Evaluation of the Industrial Strategy Challenge Fund

Process evaluation report

Sana Zakaria, Joe Francombe, Dadiso Motsi-Omoijiade, Dominic Yiangou and Andrew Leicester

RAND Europe and Frontier Economics

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Executive summary

Delivered by UK Research and Innovation (UKRI), the Industrial Strategy Challenge Fund (ISCF) seeks to leverage research and innovation (R&I) to support the development of solutions to major industrial and societal challenges facing the UK. The ISCF adopts a Challenge-led approach: under the fund, individual 'Challenges' have been established, each focused on supporting collaborative, cross-sector R&I within a specific sector or thematic area. Reflecting the ISCF's links to the 2017 Industrial Strategy, the ISCF Challenges have been designed to align to the Strategy's aims, including the four 'Grand Challenge' themes: Ageing Society; Artificial Intelligence (AI) and Data; Clean Growth; and Future of Mobility. The ISCF Challenges have been established through three sequential commissioning waves.

RAND Europe and Frontier Economics have been commissioned by UKRI to undertake a fund-level evaluation of the ISCF. The overarching aim of this evaluation is to build an evidence base with which to judge the success and overall impact of the ISCF. The fund-level evaluation seeks to complement the ongoing evaluations of the individual ISCF Challenges by focusing on the fund's delivery as a whole. The fund-level evaluation includes baseline measurement, process evaluation, and impact evaluation phases.

This report presents findings of the fund-level process evaluation of the ISCF. The process evaluation has focused on assessing the processes, drivers and evidence underpinning the design and delivery of the fund and its constituent Challenges across the three commissioning waves. The evaluation employed a mixed methods approach to data collection including interviews, a review of Challenge-level process evaluation reports, a review of secondary data and documentation, case studies and workshops.

The process evaluation has been structured around three high-level evaluation themes:

- **Strategy and set-up of the ISCF:** This theme examines the design and set-up of the ISCF with a view to considering how these processes have supported the fund's goals. Topics covered under this theme include Challenge selection, Challenge design and the role of Challenge Directors.
- **Delivery of the ISCF:** This theme focuses on how effectively and efficiently delivery mechanisms have supported the fund's goals. Topics covered under this theme include governance and fund management, fund processes (e.g. call, application and monitoring), coherence and coordination, and equality, diversity and inclusion (EDI).
- **Stakeholder engagement in the ISCF:** This cross-cutting theme reflects on how the ISCF has engaged with stakeholders across the different stages of fund set-up and delivery, while also considering the ongoing processes of engaging stakeholders in Challenge outcomes.

Key findings and recommendations for each process evaluation theme are summarised below. An important backdrop for our process evaluation findings is the evolving nature of the policies and processes underpinning ISCF throughout its duration. The establishment of UKRI, the Industrial Strategy and the ISCF within a short window of time meant that the establishment of UKRI (and Innovate UK) processes has in some cases run in parallel to the set-up and delivery of the fund. Furthermore, the evolution of processes has continued through learning and reflection facilitated by the staged nature of ISCF funding – and the establishment of the Challenges – across the three waves. The evolving nature of ISCF processes is reflected in our presentation of the findings across each of the evaluation themes. Our recommendations also reflect on what has been learned from changes in the ISCF's approach over time.

Overall, we find that ISCF processes have evolved in both an external and internal context. For instance, processes evolved to effectively support the market needs of the sectors where Challenges are operating. There have also been many processes that have created a blueprint for novel and improved way of working

internally such as improved autonomy at Challenge level, the potential of Challenge Directors as catalysts for both internal and external change, and the forging of academic, government and industry engagement to support holistic innovation. There have also been processes highlighted where further improvements are warranted, such as targeted and streamlined engagement with representative Challenge sectors to limit administrative burden and expedite implementation timelines and the need for greater consideration to EDI at the outset.

Our process evaluation findings have led to the identification of 18 cross-cutting recommendations (some of which are repeated across multiple sections given their relevance to different themes). The recommendations are forward-looking in nature; intended to inform the design and implementation of future Challenge-led R&I programmes drawing on lessons from the ISCF's approach. Where appropriate, however, we have also flagged the relevance of these recommendations to existing ISCF fund and Challenge-level processes. The primary intended audience for these recommendations is decision-makers within UKRI and Innovate UK management structures who may be involved in the design and implementation of future Challenge-led funds.[1] Below, our recommendations are summarised at a high-level in the boxes under each relevant section of the findings. The recommendations are also discussed in more detail within the relevant chapters of the report and restated in Chapter 5.

Key findings on strategy and set-up of the ISCF:

- **The approach to Challenge selection evolved across waves**. Wave 3 saw the most mature process, with more deliberative steps for Challenge selection and greater opportunities for stakeholder engagement. However, the Wave 3 process was also burdensome and time-consuming, highlighting a potential trade-off between comprehensiveness and timeliness. This warrants a change in process in stakeholder interactions to make them more targeted, which could serve as a useful model to emulate in the future as discussed in recommendations below.

- **While established to support the realisation of the Industrial Strategy, the ISCF Challenges remain highly relevant to several wider government strategies**. These include key cross-sector strategies such as the Plan for Growth, the UK Innovation Strategy and the Climate Change Strategy as well as more specific strategies and initiatives within the relevant sectors. This is likely enabled due to the very broad remit of ISCF, spanning multiple sectors and industries, making it relevant to many government agendas. Moreover, the forward-looking nature of the Challenges and their ambitious goals have likely also ensured ISCF's continued relevance.

- **Stakeholder engagement processes to support Challenge design varied across ISCF however processes were broadly deemed effective in addressing sectoral needs**. The different approaches to engagement varied from pre-launch events held to new forums established for input prior to Challenge implementation. However, in some cases engagement processes also highlight areas for improvement, including the need to ensure time for robust engagement and for outreach to all relevant stakeholder groups. Moreover, at times the engagement was perceived to be seeking to address short-term issues in a Challenge rather than long-term issues.

- **Funding instruments established by Challenges have been well-aligned to market needs and supported cross-sector R&I collaboration**. This is likely due to the wide variety of instruments deployed and stakeholder input also partly informed the instruments utilised. Evidence

[1] It would be beneficial for UKRI to look across the process recommendations from its other commissioned programme evaluations to ascertain which processes present a systemic challenge where improvement is needed, and which are unique to a programme setting.

suggests that there may be a potential trade-off between the implementation of funding instruments simultaneously and their staged implementation over time; the former creates a big bang effect accompanied by a flurry of innovation activity at once however misses out on learning from the sector and adapting the approach and offering, whilst the latter creates staged and slower change but provides the opportunity for iteration and building up products and activity across a translational pipeline.

- **ISCF took steps to promote a narrative of failure being acceptable when investing in high-risk areas of technology or high-risk sectors, and has provided opportunities to pilot investments in areas considered risky**. However, there has been no universal definition of what was meant by high-risk to inform Challenge design, which meant that there wasn't consensus nor consistency in taking a high-risk high reward approach to Challenges and projects. It could have been beneficial to define high-risk and create a more explicit narrative and mechanism to work in a high-risk and high-reward manner across ISCF to leverage benefits of a mission-oriented fund approach.
- **Challenge Directors (CD) are widely considered to have been a positive addition to the ISCF, providing both external and internal leadership to the Challenges**. Limitations on autonomy have presented an obstacle to the effective performance of the role, as have cultural frictions and recruitment challenges.

Key recommendations on strategy and setup of the ISCF:

1. Stakeholder engagement in fund and Challenge design should be comprehensive yet targeted, including a framework for how feedback is incorporated into decisions.
2. Long-term programmes should avoid retrofitting to new government strategies to prevent misalignment of core mission and outcomes and to ensure that a programme's longevity and relevance is not overly reliant on a given strategy; programmes should instead consider highlighting where programme ambitions link to specific areas within government priorities and broader strategies.
3. UKRI should be clear in communicating and defining expectations on high-risk investments whilst providing explicit mechanisms for engaging in high-risk investments so there is a consistent and proactive high-risk high-reward approach to delivering mission-oriented research.
4. UKRI should support agility in the design and implementation of funding mechanisms.
5. UKRI should clearly define the roles and expectations of key leadership positions in new programmes (e.g. CDs) within the existing governance structures to better leverage their expertise and avoid conflict.
6. UKRI should establish a recruitment strategy for key leadership positions (e.g. CDs), inclusive of EDI considerations and ensure its timely execution.

Key findings on delivery of the ISCF:

- **Fund and Challenge-level governance structures have been broadly effective**. Following an initial centralisation of processes within the Steering Board, governance structures have evolved over time to give more autonomy to the Challenge-level, thereby helping to ensure governance is more adaptive and responsive to Challenge needs. At the fund-level, greater central support for Challenges was needed to navigate change in processes such as implementing the establishment of benefits realisation plans. At the Challenge-level, opportunities for increased engagement of relevant stakeholders in boards and advisory groups are highlighted.
- **In response to the Covid-19 pandemic, fund and Challenge-level governance structures have been flexible**. This has included permitting no-cost extensions and in some cases providing additional financial support. More broadly, while some Challenges provide examples of flexible and agile delivery, other Challenges have been more limited in their agility, largely reflecting the nature of their investment (e.g. Challenges with large capital investments).

- **While Challenge call and application processes have been appropriate, leading to a good number of high-quality and relevant applications, there have been some limitations in terms of reach and accessibility of call and application processes to wider stakeholders.** Difficulties engaging newer, smaller businesses and those not previously engaged in UKRI and Innovate UK networks presents a common theme across Challenges.
- **Fund-level performance monitoring has evolved considerably over the lifespan of the ISCF but has also created issues for Challenges**. Specifically, the requirement to establish Challenge benefit realisation plans has created additional confusion regarding the reasons for collecting the additional data from projects and a perceived potential for duplication of evaluation activities.
- **Challenge-level monitoring processes have generally been fit for purpose but potential improvements have been identified**. These include strengthening bespoke programme monitoring requirements, greater centralisation and coordination of monitoring processes within Challenges, and more emphasis on active relationship-building with projects.
- **Efforts to maximise coherence and coordination both within and across Challenges should be enhanced to glean further learning on what works and to reduce the effect of known barriers**. While some channels have been established, and good practice examples exist, the lack of concerted mechanisms to support pollination and synergies across projects, within a Challenge and across Challenges can be seen as a missed opportunity.
- **At the outset of the ISCF, there were no formal processes or mechanisms to actively promote or consider gender and ethnicity**. The development of Wave 3 signalled a turning point for further development and awareness of these considerations within the ISCF, but levers for driving this agenda forward have been limited and lack formal requirements.
- **Sector and industry balance were conscious considerations at the fund level**. Evidence shows positive trends of engaging with SMEs in Waves 1 and 2. The change in co-investment requirements from industry in Wave 3, as proposed by the government, may have provided some advantages to large organisations and contributed to the dropping rates of SME engagement and funding, however this is untested and part of a suite of potential reasons highlighted by the National Audit Office (NAO) report on the ISCF.
- **The ISCF has engaged and funded across diverse regions.** Despite levelling-up and regional diversity not being a focus of the fund, the current levels of funding reflect regional diversity. Regionality was not found to be linked to success of an application and the variation across regions has been driven by Challenge specific areas of focus and existing spread of expertise.

Key recommendations on delivery of the ISCF:

1. UKRI should develop bespoke processes and governance arrangements to ensure agility and adaptability in management and delivery.
2. UKRI should recognise the potentially evolving roles of governance bodies over the course of the programme lifecycle.
3. UKRI should improve the centralised support provided for implementing and changing Challenge level processes.
4. UKRI should support agility in the design and implementation of funding mechanisms.
5. UKRI should improve the outreach and accessibility of call and application processes.
6. UKRI should establish fund-level monitoring requirements and related systems upfront.
7. UKRI should strike a better balance between bespoke Challenge-level monitoring and alignment to fund-level monitoring processes.
8. UKRI should proactively support coherence, coordination and cross-pollination within and across Challenges.
9. UKRI should establish clear scope of EDI at the outset in the business case planning stage supported by high level ambitions.
10. UKRI should create EDI monitoring requirements at the outset to drive good practices and establish clear baseline.
11. UKRI should allocate an EDI budget at business case planning stage whilst considering high level ambitions.

Key findings on stakeholder engagement in the ISCF:

- **External stakeholders have been engaged at various stages throughout the set-up and delivery of the ISCF**. Key points of engagement include Challenge selection, Challenge design, Challenge governance structures and participation in Challenge-funded competitions and strands. Assessment of engagement processes at each of these stages of the ISCF is threaded into the findings as presented above, highlighting both benefits and drawbacks of the ISCF's approach.
- **Overall, efforts to disseminate and raise awareness of Challenge and fund outcomes have been limited, with much left to individual projects.** Areas where more could have been done to engage relevant stakeholders in outcomes have included: leverage board and advisory panel member networks and connections; supporting the development of sectoral networks and establishing Challenge closure plans linked to dissemination to support a Challenge legacy.

Key recommendations on stakeholder engagement in the ISCF:

1. UKRI should ensure stakeholder engagement in fund and Challenge design is comprehensive yet targeted, including a framework for how feedback is incorporated into decisions.
2. UKRI should ensure the engagement of key government stakeholders in governance structures to influence policy change.
3. UKRI should recognise the potentially evolving roles of governance bodies over the course of the programme lifecycle.
4. UKRI should improve the outreach and accessibility of call and application processes.
5. UKRI should conduct concerted and upfront planning for dissemination activities to promote visibility and maintain the legacy of Challenge and fund outcomes.

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Abbreviations

BAME	Black, Asian and Minority Ethnic
BEIS	Department for Business, Energy and Industrial Strategy
BERD	Business Enterprise Expenditure on Research and Development
BME	Black and Minority Ethnic
CD	Challenge Director
CEO	Chief Executive Officer
CPN	Circular Plastics Network
CR&D	Collaborative Research & Development
DCMS	Department of Media, Culture and Sport
Defra	Department for Environment Food and Rural Affairs
DSIT	Department for Science, Innovation and Technology
EDI	Equality, Diversity and Inclusion
EOI	Expression of Interest
EPSRC	Engineering and Physical Sciences Research Council
ESRC	Economic and Social Research Council
EV	Electric Vehicle
FDI	Foreign Direct Investment
GCRF	Global Challenges Research Fund
GERD	Gross Domestic Expenditure on Research and Development
HCLG	Ministry of Housing, Communities and Local Government
IPA	Infrastructure and Project's Authority
IPCC	Intergovernmental Panel on Climate Change.
ISCF	Industrial Strategy Challenge Fund
IUK	Innovate UK
KTN	Knowledge Transfer Network

NAO	National Audit Office
NCNR	National Centre for Nuclear Robotics
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
PCF	Project Closeout Form
PMO	Portfolio Management Office
R&D	Research and Development
R&I	Research and Innovation
SME	Small and Medium-Sized Enterprise
TFI	Transforming Foundation Industries Challenge
TRL	Technology Readiness Level
UKRI	UK Research and Innovation
VMIC	Vaccines Manufacturing Innovation Centre
WES	Women's Engineering Society
WIM3	Women in Materials, Minerals and Mining
WRAP	Waste and Resources Action Programme

1. Introduction and methods

1.1 Overview of the Industrial Strategy Challenge Fund

Delivered by UK Research and Innovation (UKRI), the Industrial Strategy Challenge Fund (ISCF) was established to leverage research and innovation (R&I) to support the UK Government's 2017 Industrial Strategy. The Industrial Strategy identified key goals of helping businesses create better, higher-paying jobs in every part of the United Kingdom and ensuring that all citizens 'can embrace and benefit from the opportunity of technological change'.[2] It outlined four 'Grand Challenges' – Ageing Society; Artificial Intelligence (AI) and Data; Future of Mobility; and Clean Growth – in response to the rapidly evolving nature of technological innovation and society.[3]

The goal of the ISCF has been to support the development of solutions to major industrial and societal challenges facing the UK, including the Grand Challenges, through delivery of a Challenge-led R&I funding programme. Under the ISCF, UKRI has established 20 'Challenges'[4] each focused on supporting collaborative, cross-sector R&I within a specific sector or thematic area. The Challenges were established through three sequential funding waves.

All the ISCF Challenges are intended to support five fund-level objectives:

- Increase UK businesses' investment in research and development (R&D) and improve R&D capability and capacity;
- Increase multidisciplinary and interdisciplinary research around the Challenge areas;
- Increase business-academic engagement on activities relating to the Challenge areas;
- Increase collaboration between younger, smaller companies and larger, more established companies within the value chain;
- Increase overseas investment in R&D within the UK.

Table 1 and Figure 1 below provide a summary of the ISCF Challenges, their key aims, and their broad alignment to the Grand Challenges.

[2] HM Government, "Industrial Strategy: Building a Britain Fit for the Future."

[3] HM Government.

[4] We distinguish here between the 20 Challenges, the fast-start investments made under Wave 1a, and the three non-Challenge programmes established under Wave 1b.

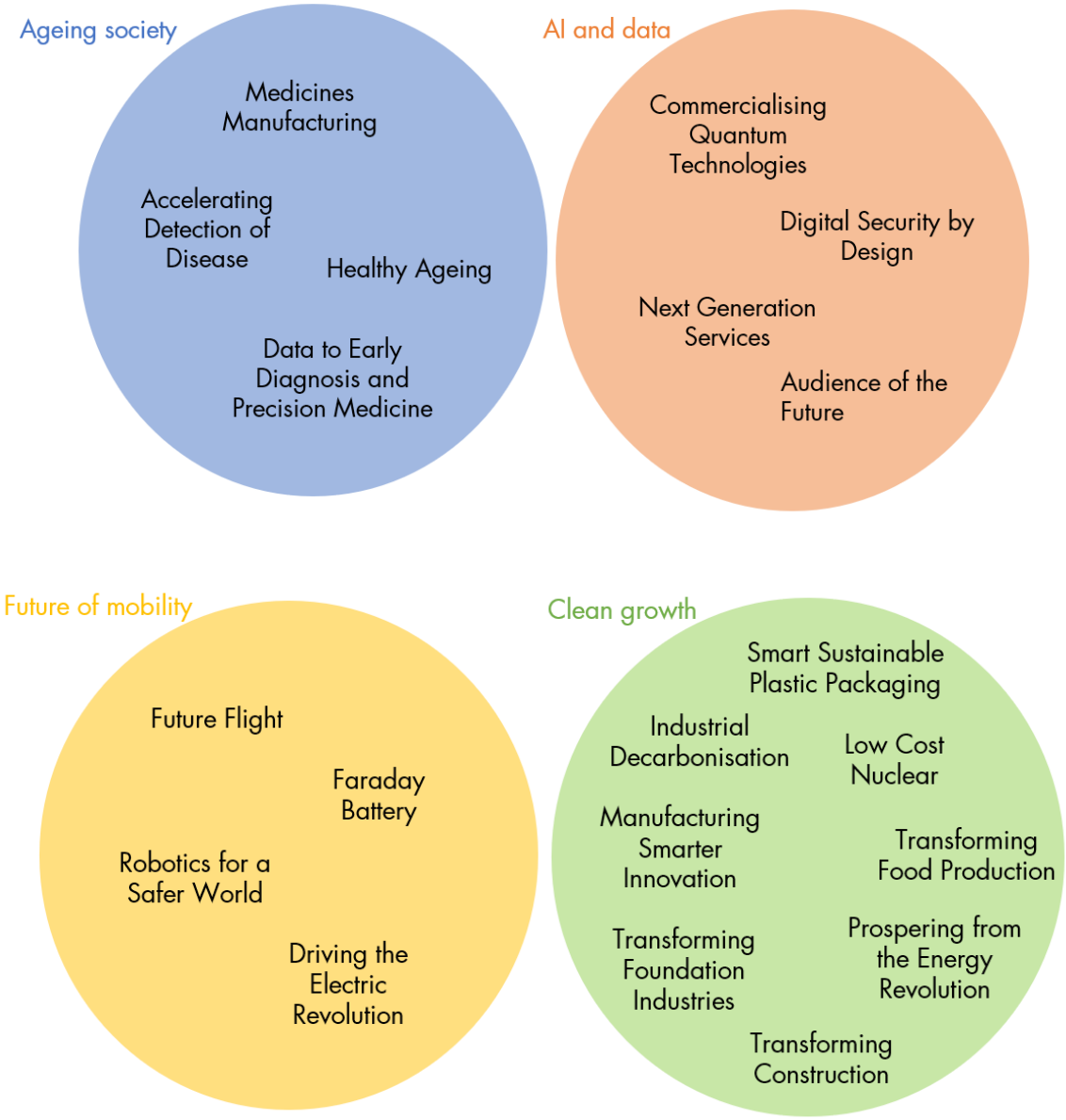
Table 1: The ISCF Challenges and their key aims[5]

Wave	Challenge	Key aims
Wave 1	Faraday Battery	To support the growth of the battery R&D ecosystem.
	Medicines Manufacturing	To support medicines manufacturing and the delivery of novel treatments.
	Robotics for a Safer World	To support the development of novel robotics and AI technologies to reduce the number of people working in extreme environments.
Wave 2	Audience of the Future	To support the development of immersive experiences and technologies.
	Data to Early Diagnosis and Precision Medicine	To support the development of precision medicine and health data for improved early diagnosis and treatment.
	Healthy Ageing	To support the development of scaled-up products, services and business models to support people as they age.
	Next Generation Services	To support the use of AI and data analytics technologies in the UK service industries.
	Prospering from the Energy Revolution	To accelerate innovation in smart local energy systems.
	Transforming Construction	To support a shift in the construction sector towards manufacturing and digital processes and a value outcome approach.
	Transforming Food Production	To support the development and adoption of new ways to produce food with a view to improving the productivity and resilience of primary food production while also reducing emissions and pollution.

[5] A more detailed version of this table is presented in Annex A.

Wave 3	Accelerating Detection of Disease	To support research into the early diagnosis, prevention and treatment of chronic disorders using biological and digital data.
	Digital Security by Design	To support the UK digital computing infrastructure to become more secure.
	Driving the Electric Revolution	To support the development of electrification technologies including power electronics, electric machines and drives.
	Future Flight	To support the development of create new modes of air travel and capability, including all-electric aircraft and deliveries by drone.
	Industrial Decarbonisation	To support the development and deployment of technologies such as carbon capture, utilisation and storage and hydrogen fuel switching.
	Low Cost Nuclear	To support development of a UK-designed Small Modular Reactor.
	Commercialising Quantum Technologies	To support the development of new products and technologies based on advances in quantum science.
	Smart Sustainable Plastic Packaging	To support the development of a more sustainable plastic packaging value chain.
	Manufacturing Smarter Innovation	To support the UK's manufacturing industry to more productive and competitive through digital innovation.
	Transforming Foundation Industries	To support the development of innovative technologies, collaborations and investment in the foundation industries in order to increase competitiveness and reduce environmental impact.

Figure 1: Broad alignment of the ISCF Challenges to the Grand Challenges



Note: This mapping of the ISCF Challenges to the Grand Challenges draws on the mapping presented in the National Audit Office (NAO) report on the management of the ISCF.[6] RAND Europe is in the process of developing its own approach to clustering the ISCF Challenges to be used as part of the fund-level impact evaluation of the ISCF.

Selected through a central, fund-level process led by the Department for Business, Energy and Industrial Strategy (BEIS)[7] and UKRI, the ISCF Challenges have been designed and implemented by Challenge-level governance structures, with these then feeding into a fund-level governance structure overseen by the ISCF

[6] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund."

[7] In February 2023 the ISCF relevant part of BEIS changed to the Department for Science, Innovation and Technology (DSIT). The report uses BEIS when referring to the past and DSIT when referring to the future.

Steering Board. Challenge-level governance structures have comprised programme boards and advisory groups, Challenge programme teams and Challenge Directors (industry leaders drawn from the relevant sectors recruited to provide strategic leadership and oversight to the Challenges). Each Challenge has distributed ISCF funds through a range of funding mechanisms and strands designed to support Challenge aims and wider fund-level objectives. Each of these aspects of the ISCF's set-up and delivery are reviewed and discussed in detail in this process evaluation report.

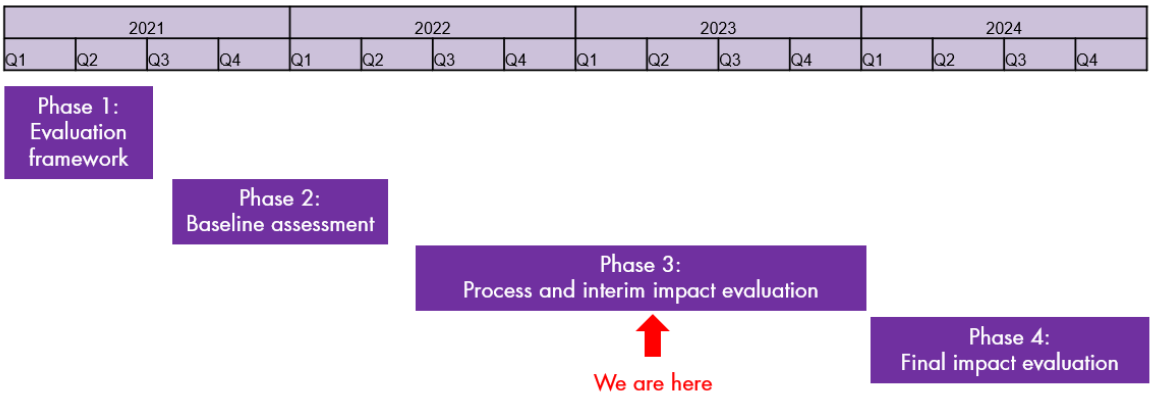
1.2 Evaluation aims and scope

In October 2020, RAND Europe and Frontier Economics were commissioned by UKRI to undertake a fund-level evaluation of the ISCF. The overarching aim of this evaluation is to build an evidence base with which to judge the success and overall impact of the ISCF to:

- inform ongoing and future improvements to the ISCF to maximise the value of public funding;
- demonstrate the return on investment to taxpayers;
- build the evidence base on the impact of mission-oriented and Challenge focused R&I support as part of UKRI's wider effort.

The fund-level evaluation is being conducted in parallel to independent evaluations of each individual ISCF Challenge. While drawing upon the findings and data collected in the Challenge-level evaluations, the fund-level evaluation will also collect additional primary and secondary data to provide an overarching assessment of the impact of the ISCF, including the overall contribution of the Challenge-led approach. The fund-level evaluation is being implemented through four phases: evaluation framework development (phase 1, completed); baseline assessment (phase 2, completed); process evaluation and interim impact evaluation (phase 3, in progress); and final impact evaluation (phase 4, to be completed).[8]

Figure 2: Structure of the ISCF evaluation

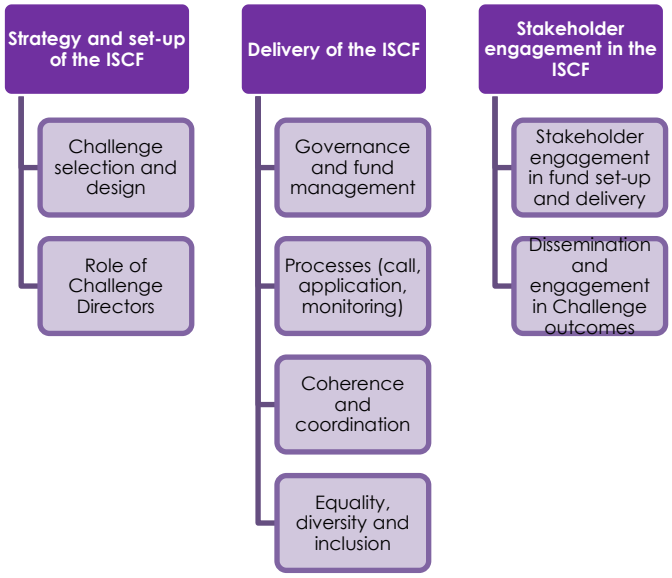


[8] The phases presented here reflect a revision to the original evaluation structure as set out in the ISCF evaluation framework report. This revision was agreed with UKRI at the inception of phase 3.

1.3 Phase 3 process evaluation: aims and approach

The fund-level process evaluation is focused on assessing the processes, drivers and evidence underpinning the design and delivery of the ISCF across the three commissioning waves. The process evaluation has interrogated evidence at the fund and the Challenge-level and also through the lens of the three commissioning waves to understand how the processes evolved over the duration of the fund. Our process evaluation is structured around a framework comprised of three high-level evaluation themes (and sub-themes) as set out in Figure 3 below. The specific evaluation questions addressed by these themes and sub-themes are listed in Annex B.

Figure 3: Process evaluation themes and sub-themes



The process evaluation is underpinned by the Organisation for Economic Co-operation and Development (OECD) evaluation principles of relevance and coherence.[9] Evaluation questions include consideration of whether the ISCF set-up and delivery have been relevant to beneficiary needs, and the extent to which the ISCF fits in with existing interventions. The assessment of evaluation questions and thus the presentation of the evidence is not against a set indicator or criteria and is presented as a nuanced qualitative narrative aimed at highlighting progress made against the original intent of the programme. Where the report draws on evidence from across ISCF Challenges, we have arrived at findings based on what we identify as common experiences across Challenges. The strength of evidence underpinning our findings is indicated through citations of the relevant sources (e.g. Challenge-level process evaluation reports and workshops with Challenge-level stakeholders) and through commentary provided throughout the narrative.

An important backdrop for our process evaluation is the evolving nature of the policies and processes underpinning ISCF throughout its duration. The establishment of UKRI, the Industrial Strategy, and the ISCF within a short window of time meant that the establishment of UKRI (and Innovate UK) processes has in some cases run in parallel to the set-up and delivery of the fund. Furthermore, the evolution of processes has continued through learning and reflection facilitated by the staged nature of the ISCF funding – and the establishment of the Challenges – across the three waves. The evolving nature of ISCF processes

[9] OECD, "Evaluation Criteria."

has been reflected in our presentation of the findings across each of the evaluation themes. Our recommendations also reflect on what has been learned from changes in the ISCF's approach over time with a view to informing future fund delivery.

To collect evidence against the process evaluation themes, we utilised a number of methodological and analytical approaches (Figure 4). A detailed description of the methodological approach is presented in Annex C.

Figure 4: Process evaluation methods

Note: Validation workshops with Challenge-level stakeholders were structure by ISCF commissioning wave. Due to difficulties securing sufficient participation for a wave 1 workshop, we conducted 2 validation interviews with relevant Challenge-level stakeholders as an alternative.

1.4 Strengths and limitations of the process evaluation

Our mixed methods approach has enabled us to develop a rounded picture of ISCF processes drawing on evidence from both the Challenge and the fund-level. A detailed review of the 14 available process evaluation reports of the ISCF Challenges is a key strength of the approach. The review has captured rich data from across the Challenges in relation to our process evaluation themes and sub-themes – with this Challenge-level data in turn having been collected through direct engagement with stakeholders in each Challenge. While drawing on this Challenge-level evidence, we have also conducted additional data collection steps focused at the fund-level, namely; interviews with fund-level stakeholders, a review of fund-level documentation and data, and the development of case studies focusing on good practice examples at different levels. This fund-level data collection has helped to fill gaps in the Challenge-level evidence, in particular relating to fund-level processes such as Challenge selection, fund-level governance, and the evolution of fund-level requirements on EDI. Findings arrived at through triangulation of this Challenge-level and fund-level data have been discussed and validated with Challenge-level stakeholders (programme managers and evaluation teams) through workshops and interviews to ensure their suitability and resonance.

Our approach is also subject to several limitations. Firstly, although Challenge-level process evaluation reports have provided a valuable source of data, six Challenge-level process evaluations had not been completed at the time of submitting this report.[10] To address this, we invited stakeholders from these Challenges to participate in our validation workshops, thereby providing an opportunity for them to review and provide input on our fund-level findings. Five of the six Challenges without completed process evaluations were represented at the validation workshops. This has given us confidence that our findings

[10] The six Challenges for which process evaluation reports had not been submitted were: Health Ageing (Wave 2) and Manufacturing Smarter Innovation, Low Cost Nuclear, Future Flight, Driving the Electric Revolution and Accelerating Detection of Disease (all Wave 3). For a list of reports included in our review see Annex D).

resonate across Challenges, but it is important to note that our evaluation relies upon a stronger evidence base for some Challenges compared to others.

The use of Challenge-level process evaluations as a key data source has also brought with it a second limitation; namely, that each of these process evaluations has collected evidence against its own bespoke Challenge-level process evaluation framework, which do not necessarily align directly with our fund-level process evaluation framework. Indeed, while our framework has been designed to reflect the key lines of enquiry of Challenge-level evaluations, there are inevitably some differences between our evaluation questions and the evaluation questions addressed at the Challenge level. In response, our approach has been to compile evidence from Challenge-level evaluations as it relates broadly to areas of our fund-level framework. We have then drawn-out 'key findings' from the compiled evidence as these relate to different areas of the framework, e.g. 'Role of Challenge Directors'. In most cases, this has resulted in findings that directly address our fund-level evaluation questions. However, there are some instances in which the alignment between Challenge-level evidence and fund-level process evaluation questions is less direct.

A third limitation of our approach relates to the use of interviews with UKRI fund-level stakeholders as a key data source for the evaluation. The engagement of such stakeholders has been necessary to gain first-hand perspectives on the delivery of the ISCF – particularly with respect to fund-level processes such as the selection of Challenges and fund-level governance structures and processes. However, there is also a potential risk of optimism bias owing to the involvement of these stakeholders in the processes being evaluated. The decision to focus our interviews on key fund-level stakeholders – taken to avoid duplication of work done by Challenge-level process evaluations – has also meant a relatively small number of interviews have been conducted. To mitigate against these issues, we have triangulated interview insights with other forms of data wherever possible, including data from Challenge-level process evaluations that have engaged a much wider range of stakeholders. Our use of validation workshops and interviews with Challenge programme managers and evaluators has also helped to compare and contrast fund-level interviewee insights with perspectives from wider stakeholder groups.

2. Strategy and set-up of the ISCF

This chapter presents findings and recommendations relating to the strategy and set-up of the ISCF. The chapter discusses findings relating to **Challenge selection**, **Challenge design** and the **role of Challenge Directors**. The final section of the chapter presents cross-cutting recommendations based upon these findings to inform the design and set-up of future programmes.

2.1 Challenge selection

2.1.1 Approach to selecting Challenges across waves

Evaluation questions:

- How, and in what ways, did Wave 1, 2 and 3 identify the Challenges? How were improvements made and learnings taken up after each wave?
- How responsive was the ISCF to a wide variety of stakeholders in establishing the Challenges?

Summary findings:

- Stakeholder engagement, transparency of decision-making and alignment to the Industrial Strategy and the ISCF objectives were among the key considerations for Challenge selection across waves.
- The approach to selecting Challenges evolved across waves:
    - In Wave 1, Challenge selection typically involved retrofitting existing investments into the Challenge model, with alignment to the Industrial Strategy being a key driver for selection. Stakeholder engagement was focused on government stakeholders.
    - Wave 2 saw a more developed process of Challenge selection involving wider stakeholder input from industry and academia, and more developed business cases.
    - Wave 3 was the most mature in its approach, with greater opportunities for engagement of different stakeholders in Challenge selection, but also faced some issues.
- The evolution of Challenge selection process across waves highlights a potential trade-off between comprehensiveness, administrative burden and timeliness. Wave 3, though most comprehensive in its engagement approach, requires changes to its processes in stakeholder interactions to make them more targeted, which could serve as a useful model to emulate in the future. See recommendations in Section 2.4.

Stakeholder engagement, transparency of decision-making, and alignment to the Industrial Strategy and the ISCF objectives were among the key considerations for Challenge selection across waves. While the process of selecting Challenges differed across waves (see below), evidence highlights a number of common considerations across waves. BEIS ministers wanted an open process with stakeholder engagement as a key part of the selection process to demonstrate that Challenges had been designed in response to sector need.[11] There was also a specific requirement from ministers to be able to evidence and articulate the manner in which stakeholders had been engaged at this stage of fund development for the

[11] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund."

purpose of transparency and to ensure that the engagement had been meaningful.[12] Interviews with UKRI stakeholders highlight other common considerations for Challenge selection including evidence of compelling need and urgency in a given sector for a Challenge led fund, the feasibility of ISCF funding to support delivery on Challenge objectives, and assessments of industry co-investment potential.[13]

The approach to identifying and selecting Challenges evolved across waves. In Wave 1, Challenge identification typically involved retrofitting existing investments into the Challenge model, with alignment to the Industrial Strategy being a key driver for selection. Programmes such as the Faraday Battery Challenge had already been in development with external partners prior to the launch of the ISCF. A factor underpinning the decision to establish Wave 1 Challenges in this way was the pressure to allocate resources within a given financial year to ensure that funding could be utilised.[14] This led to a process of allocating funding to support Challenges (and their projects) broadly aligned with the Industrial Strategy that had already been considered but not funded due to funding running out in the period preceding the ISCF. There are notable parallels here to the early practices of other large-scale R&I funding programmes, for example the Global Challenges Research Fund (GCRF).[15] While efforts were made to ensure stakeholder engagement in the Challenge selection process, in the face of such pressures, this primarily involved consultation with government stakeholders.[16]

Box 1: Note on Wave 1 non-Challenge investments

While this section of the report focuses on the process for selecting the ISCF Challenges, Wave 1 also saw investment in a series of non-Challenge investments. This included a series of Wave 1a investments selected to fit high-level objectives of the fund at the time, including programmes around agricultural innovation, industrial biotech, renewables and alternatives to fossil fuel-based processes. Wave 1a also saw the establishment of the Creative Industries Clusters Programme, an investment closely aligned with the Wave 2 Audience of the Future Challenge. Under Wave 1b, three non-Challenge programmes were also established: Self-Driving Cars, National Satellite Test Facility and Next Generation Aero Materials.

Wave 2 saw a more developed process of Challenge selection involving wider stakeholder input and more developed business cases. While there was some considerable retrofitting in the Challenge design in Wave 2[17] and the initial challenge opportunities for Wave 2 were identified internally, the development of business cases were formulated in part through engagement with relevant stakeholders, with both industry and academia engaged.[18] While selected to align with the Industrial Strategy and the high-level objectives of the ISCF, it is notable that Wave 1 and Wave 2 Challenges were selected prior to the establishment of the Grand Challenge framework linked to the Industrial Strategy. As such, the Grand Challenge framework was not a key driver in the selection process of early Challenges.[19]

Wave 3 was the most mature in its approach to Challenge selection, with greater opportunities for engagement of different stakeholders and greater scope to proactively construct Challenges. The Wave 3 approach to Challenge selection followed a ministerial request for more open engagement of

[12] National Audit Office.

[13] Int_03; Int_05; Int_02.

[14] Int_03.

[15] The Independent Commission for Aid Impact, "Global Challenges Research Fund: A Rapid Review."

[16] Int_03; Int_01.

[17] "Wave 2 Validation Workshop."

[18] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund."

[19] Int_03.

industry stakeholders in the process of Challenge selection.[20] Wave 3 used an open Expression of Interest (EOI) approach issued in February and April 2018, during which 252 applications were received. Grand Challenge Review Panel sessions were then held, which comprised 2-3 day workshops with BEIS, HM Treasury and external reviewers. During these meetings, ideas fitting with certain Grand Challenges were considered and then ranked through discussions. While these were mostly internal, each Grand Challenge had a director-level Whitehall owner who was involved in the shortlisting process.[21]

Further stakeholder involvement in Challenge selection involved shortlisting meetings with BEIS and government advisors involved in the review of EOIs and advising on which Challenges could be funded.[22] These consultations were followed by a series of Challenge deep-dive workshops which brought together industry and business leaders as well as academics to look more closely into each of the remaining Challenges, aimed at further informing the decision-making processes related to Challenge selection. The selection process concluded with a Shortlisting Review Panel featuring high-level decision makers including the Chief Executive Officer of UKRI. The Panel selected 10 Challenges out of the remaining 17 in the process. The case study below explores the Wave 3 stakeholder engagement in Challenge selection in more detail to identify key good practice learnings from this experience.

While more developed than previous waves, the Wave 3 Challenge selection process also faced issues. These included the timing of engagement activities, where there was, at times, either too short notice for some stakeholders to attend in-person, or a lack of availability in activities which took place over the summer.[23] Concerns were also raised by a small numbers of applicants over how the engagement processes led to the prioritisation of established industries and larger enterprises over small and medium-sized enterprises (SMEs).[24] A further challenge with the stakeholder engagement process had to do with the large number of EOIs submitted to Wave 3 which proved to be excessively burdensome for UKRI to manage adding to the more general problem of time constraints throughout all engagement activities.[25] Lastly, it was expressed that there were some difficult conversations which had to be resolved with industry stakeholders, for example, during the shortlisting phase, reducing the Challenge numbers led to negative feedback from senior leaders who committed a large amount of time to engage in an in-person activity only for this to result in an unsuccessful outcome.[26]

The evolution of Challenge selection processes across waves highlights a potential trade-off between comprehensiveness, administrative burden, and timeliness. While Wave 3 marked a turning point in terms of comprehensiveness of the Challenge selection process and mechanisms for stakeholder engagement, it has been described by most stakeholders as being burdensome.[27] UKRI received 252 EOIs across 17 potential Challenges in Wave 3, necessitating further iterations and discussions on the Wave 3 portfolio with the Secretary of State. This reportedly put strain on the relevant departments: it took UKRI, BEIS and HM Treasury 72 weeks to move from the EOI stage to the approval of Challenges which involved multiple iterations of analysis and planning to structure a robust business case for approval.[28] The timeliness of the selection process was further affected by the running of 2 to 3 day workshops in London

[20] Int_12.

[21] Int_01.

[22] Int_03.

[23] Int_12; Int_13.

[24] Int_03; Int_12.

[25] Int_12; Int_13.

[26] Int_13.

[27] Int_04.

[28] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund."

with BEIS, HM Treasury and external reviewers.[29] Related to this trade-off between quality and timeliness was the observed challenge of striking a balance between open engagement and creating more targeted Challenges at the EOI stage.

[29] Int_05.

Case study: Exploring good practice in stakeholder engagement in Challenge selection

The Wave 3 Challenge selection process was the most developed in its approach to stakeholder engagement. While other parts of this report discuss issues relating to the Wave 3 Challenge selection process, this case study explores four ways in which the Wave 3 processes achieved success in ensuring diverse and meaningful stakeholder engagement.

- **Ensuring diverse sectoral and multi-disciplinary engagement:** Engagement of policy, business and academic stakeholders was facilitated through each stage of the Wave 3 Challenge selection process. This included stakeholders from a wide range of disciplines and business sectors.[30] The engagement of diverse subject matter expertise aided discussions relating to Challenges where the relevant technologies had potential applications across multiple sectors, by drawing on a mix of appropriate academic, industrial and policy knowledge. For example, the multi-applicational nature of batteries in cars, materials, manufacturing and supply chains meant that drawing upon a wide range of knowledge was necessary in shaping Challenges involving the use of batteries.[31]
- **Mobilising industry knowledge and market awareness**: The Wave 3 processes allowed engagement of industry stakeholders at different stages. This ensured that Challenge selection process drew on relevant industry knowledge and was relevant to business needs in the UK.[32] For example, through discussions with industry stakeholders, an initial EOI for a Secure by Design Microchip was broadened to ultimately become the Digital Security by Design Challenge.[33]
- **Creating connections and buy-in:** The Wave 3 stakeholder engagement processes enabled industry players to come together, build new connections and establish new communities, which in turn supported buy-in to Challenges once they were established.[34] For example, the engagement of businesses of different sizes and from different regions in the UK through EOIs fed into the development of a consortium to implement the Low Cost Nuclear Challenge.[35]
- **Demonstrating the use of panels for Challenge selection:** The Grand Challenge and Shortlisting Review Panels were described by stakeholders as having worked particularly well in the stakeholder engagement process. Such panels provided an effective mechanism bringing stakeholders together to appraise options and support decision-making regarding Challenge selection.[36]

Key learnings:

- Wave 3 processes engaged industry, academic and policy stakeholders in Challenge selection, ensuring appraisal of Challenges with appropriate cross-sector and multi-disciplinary know-how.
- The engagement of industry stakeholders at various stages ensured that Challenge selection reflected business needs.
- Industry stakeholders came together through the engagement process to create new connections which in-turn supported buy-in to the Challenges.
- The use of panels provided an effective model for marshalling stakeholder engagement and supporting a prioritisation process.

2.1.2 Alignment of Challenges to government strategies and priorities

Evaluation questions:

- How has the ISCF funnelled investment into enabling technologies to support key government strategies?
- How has the ISCF adapted to evolving ministerial priorities and been agile in response to a changing policy landscape?

[30] Int_13.

[31] Int_14.

[32] Int_13.

[33] Int_14.

[34] Int_12.

[35] Int_13.

[36] Int_13.

Summary findings:

- ISCF was established to support the realisation of the UK Industrial Strategy and the Challenges can be broadly grouped against the Strategy's four Grand Challenges and ten Sector Deals. While the Industrial Strategy was discontinued in 2021, the ISCF Challenges remain highly relevant to key government strategies such as the Plan for Growth and the UK Innovation Strategy.
- While supporting key national strategies, the ISCF Challenges are also well-aligned to more specific strategies and initiatives within the relevant sectors which showcases cohesion and complementarities in activities across sectors.
- There appear to be substantive links and alignments between current government priorities and the ISCF ambitions which is crucial in illustrating how strategies are in part being operationalised through ISCF.
- There is a fine balance that should be struck between being heavily tied to a particular government strategy and in supporting and realising outcomes of multiple strategies. Moreover, retrofitting to government strategies entirely may be problematic where they don't align with programme objectives. See recommendations in Section 2.4.

ISCF was established to support the realisation of the UK Industrial Strategy. While, as noted above, Challenge selection preceded the establishment of the Grand Challenge framework to support the Industrial Strategy, Challenges established under the ISCF can be broadly mapped to the four Grand Challenges: Ageing Society, AI and Data, Future of mobility, and Clean Growth. The Challenges also align to the Industrial Strategy's ten Sector Deals. In 2021, the Industrial Strategy was discontinued and replaced by the post-pandemic Plan for Growth. Notwithstanding this change, the thematic areas supported by the ISCF Challenges remain highly relevant, not just to the Plan for Growth but also to a wider range of key national strategies, including the National Infrastructure Strategy, the Life Sciences Vision, the UK Innovation Strategy and the Climate Change Strategy. This is likely enabled due to the very broad remit of ISCF, spanning multiple sectors and industries, making it relevant to many government agendas. Moreover, the forward-looking nature of the Challenges and their ambitious goals have likely also ensured ISCF's continued relevance.

In Table 2, we have listed a purposively curated list of representative government strategies across multiple sectors and mapped these to the most relevant Challenges and their underpinning ambitions where alignment is apparent. This mapping is done at a very high-level and is underpinned by a more systematic mapping exercise presented in Annex E. The government strategies included in this mapping are by no means exhaustive but rather intended to exemplify the extent and diversity of the ISCF ambitions that are aligned to realising government priorities. Broadly, there is a clear relationship between ISCF investments and their intended contribution to realising multiple government priorities. This kind of nuanced mapping of the ISCF to parts of government strategies could be a more powerful and nuanced approach to retrofitting than a blanket approach of being tied heavily to one government strategy.

Based on the learning of the Industrial Strategy and its central ties to ISCF, it can be detrimental to the image of any given programme of ISCF's length to be heavily aligned to one government strategy in case priorities shifts and government agendas pivot. As can be seen in this mapping exercise, although ISCF remains very much relevant to current strategic ambitions outlined in multiple government strategies, the optics of aligning heavily could detract from the impact of a given programme if it is not seen as relevant to prevailing strategies and priorities.

Table 2: Mapping ISCF supported technologies to key UK government strategies

Challenge	Key technologies supported	Alignment to Industrial Strategy Grand Challenge	Alignment to key UK government strategies						
			Plan for Growth	National Infrastructure Strategy	Life Sciences Vision	UKRI Strategy	UK Innovation Strategy	25-year Environment Plan	Climate Change Strategy
Faraday Battery	• Battery R&D and manufacturing throughout the supply chain	Future of mobility	✓	✓			✓	✓	✓
Medicines Manufacturing	• Manufacturing capabilities in small-molecules pharmaceuticals, advanced therapies, vaccine • Speeding up delivery of novel treatments to patients • Digital health technologies	Ageing society	✓		✓	✓	✓		
Robotics for a Safer World	• Novel robotics and AI technologies that will reduce the number of people involved in infrastructure inspection, maintenance, and repair in extreme environments	AI and data	✓			✓	✓		
Audience of the Future	• immersive technologies and experiences (e.g. AR) for moving image, sports entertainment, visitor experience, performances	AI and data	✓			✓			
Data to Early Diagnosis and Precision Medicine	• Data and new technologies in diagnosis of disease and adoption of precision medicine • Genomics, health data diagnostics and AI • Whole genome sequencing trials	AI and data	✓		✓	✓	✓		
Healthy Ageing	• Digital technology to support social engagement and physical activity (e.g. digital platform to match local care needs with thousands of solution providers to deliver adult care)	Ageing society	✓		✓	✓			
Next Generation Services	• AI, data and digitisation in delivery of insurance, legal and accounting services	AI and data	✓			✓			
Prospering from the Energy Revolution	• Delivering cleaner, cheaper energy services (e.g. heat pumps, electric vehicle charging points)	Clean growth	✓	✓		✓	✓	✓	✓
Commercialising Quantum Technologies	• Quantum technologies (e.g. gravity sensing, miniature atomic clock, QKD for secure communications via fibre and satellite)	AI and data	✓			✓	✓		
Challenge	**Key technologies supported**		**Alignment to key UK government strategies**						

		Alignment to Industrial Strategy Grand Challenge	Plan for Growth	National Infrastructure Strategy	Life Sciences Vision	UKRI Strategy	UKRI Innovation Strategy	25-year Environmental Plan	Climate Change Strategy
Transforming Construction	• Adoption of new digital manufacturing approaches in construction • Creation of active buildings	Clean growth	✓	✓			✓	✓	
Transforming Food Production	• Data-driven precision agriculture approaches	Clean growth				✓	✓	✓	
Accelerating Detection of Disease	• Data and AI to improve and accelerate diagnosis	Ageing society	✓		✓	✓	✓		
Digital Security by Design	• Digital computing infrastructure	AI and data	✓		✓	✓	✓		
Driving the Electric Revolution	• Low carbon electrification technologies (e.g. power electronics, electric machines, drives)	Future of mobility	✓	✓		✓	✓	✓	✓
Future Flight	• Low carbon air vehicle technology (e.g. drones)	Future of mobility	✓	✓		✓	✓		✓
Industrial Decarbonisation	• Decarbonisation technologies (e.g. carbon capture and storage, carbon capture and utilisation, direct air carbon capture, bioenergy with carbon capture and storage)	Clean growth	✓	✓		✓	✓	✓	✓
Low Cost Nuclear	• Nuclear technologies (e.g. small modular reactors)	Clean growth				✓	✓	✓	
Smart Sustainable Plastic Packaging	• Smart and sustainable plastic packaging technology (materials and designs; recycling processes and infrastructure; radio-frequency identification and AI technologies to trace reusable food grade plastic packaging)	Clean growth	✓				✓	✓	✓
Manufacturing Smarter Innovation	• industrial digital technologies (AI, VR, machine learning, data analytics, additive manufacturing, robotics and automation, augmented reality, IIoT, 5G, LPWAN)	AI and data	✓	✓		✓	✓	✓	
Transforming Foundation Industries	• Decarbonisation technologies for foundational industries (e.g. carbon capture and underground storage; biofuels; recycled glass)	Clean growth	✓	✓		✓	✓	✓	✓

Source: RAND Europe analysis

While supporting key national strategies, the ISCF Challenges are also well-aligned to more specific sectoral strategies and initiatives. In some cases, this alignment has been supported by stakeholder engagement in the Challenge design process (as explored in more detail in Section 2.2.1). Box 2 below provides illustrative examples of sectoral alignment across four Challenges. This demonstrates the continued alignment and value of ISCF to realising government's national and sectoral priorities whilst also contributing to cohesiveness and complementarity across other ongoing activities to aid strategy realisation.

Box 2: Alignment of Challenges with key sectoral strategies and initiatives – illustrative examples from Challenges

- **Transforming Food Production:**

A process evaluation of the Transforming Food Production Challenge observed good alignment between the Challenge and the Department for Environment Food and Rural Affairs (Defra) Farming Innovation Programme, launched in Autumn 2021. While some initial strands of Defra's activity have been similar to those of the Challenge, the risk of duplication has been recognised and mitigated through engagement across the two programmes. Efforts have been made to maximise synergies between the two programmes, with the Transforming Food Production Challenge, which has chronologically preceded the Defra programme, being seen as 'test bed' for the latter, laying the foundations for the scale-up of interventions. Alignment and coherence between the two programmes has been underpinned by close partnership working between UKRI and Defra through the Challenge programme board and team.[37] This highlights direct operationalisation and translation of sector plans and strategies into action.

- **Transforming Construction:**

The Transforming Construction Challenge sat within a wider set of construction sector policies including the Construction Sector Deal and the Infrastructure and Project's Authority (IPA) Transforming Infrastructure Performance Strategy. A process evaluation found that the Challenge's objectives were well-aligned with these sectoral initiatives with anticipated Challenge outputs highly relevant to policymakers' current priorities. The evaluation noted particularly strong linkages to the IPA's efforts to increase the uptake of modern construction methods and found that the Challenge was complemented by other sectoral initiatives, such as the Centre for Digital Built Britain, whose focus was on skills, which was absent from the Challenge.[38] This type of alignment and engagement can be beneficial in realising sector strategies in a cohesive manner reducing duplication and ensuring complementarity.

- **Industrial Decarbonisation:**

A process evaluation of the Industrial Decarbonisation Challenge found it suitably timed to align with wider sectoral and market initiatives on industrial decarbonisation, underpinned by increasing attention placed on such technologies by the Intergovernmental Panel on Climate Change (IPCC). The Challenge also aligned with UK's adoption of the net zero target and the BEIS Industrial Decarbonisation Strategy. While noting this alignment, the evaluation also observed a lack of consistency between the Challenge's collaborative R&D approach and the more competitive model of the BEIS's Cluster Sequencing process, including some misalignment between the timing of these two processes.[39]

- **Smart Sustainable Plastic Packaging:**

The objectives of the Smart Sustainable Plastic Packaging Challenge aligned directly to the targets of the Waste and Resources Action Programme (WRAP) UK Plastics Pact. This alignment was facilitated through consultation with the plastics supply chain and key decision makers in the process of Challenge design. The alignment ensures a common focus on key issues facing the sector, such as removing problematic plastics and developing new polymers from recycled plastics or alternative materials. The Challenge objectives also align to the European and Indian Plastics Pacts thereby providing a foundation for international collaboration and cooperation.[40]

[37] SQW, "Transforming Food Production - Phase 3: Process Evaluation - Final Report." (Hereby referred to as "TFP Process Evaluation Report.")

[38] Frontier Economics and BMG Research, "Transforming Construction Challenge - Process Evaluation." (Hereby referred to as "TCC Process Evaluation Report.")

[39] Ipsos MORI, "Industrial Decarbonisation Challenge Evaluation - Process Evaluation Report." (Hereby referred to as "IDC Process Evaluation Report.")

[40] Winning Moves, "Smart Sustainable Plastic Packaging - Final Process Evaluation Report." (Hereby referred to as "SSPP Process Evaluation Report.")

2.2 Challenge design

2.2.1 Stakeholder engagement in Challenge design

Evaluation question:

- How responsive was the ISCF to a wide variety of stakeholders in establishing the Challenges?

Summary findings:

- The importance of stakeholder engagement in Challenge design was widely acknowledged, with wide-ranging examples of engagement processes across Challenges.
- Stakeholder engagement processes varied across Challenges but were deemed broadly effective in ensuring the alignment of Challenges to sectoral needs. However, some processes highlight potential areas for improvement, including the need to ensure sufficient time for robust engagement and the need to ensure outreach to all relevant stakeholder groups.
- There could be benefit in introducing centralised processes from the top-down to ensure that stakeholder engagement across all sectors and by all Challenges occurs in a comprehensive manner. See recommendations in Section 2.4.

The importance of stakeholder engagement in Challenge design was widely acknowledged, with examples of engagement processes and mechanisms across Challenges.[41] Box 3 below provides selected examples of stakeholder engagement in Challenge design.

[41] Ipsos MORI, Technopolis, and George Barrett, "Industrial Strategy Challenge Fund Medicines Manufacturing - Baseline and Process Evaluation Report (Hereby referred to as "MM Process Evaluation Report."); Ipsos MORI et al., "Industrial Strategy Challenge Fund Faraday Battery Challenge - Process Evaluation Report" (Hereby to as "FBC Process Evaluation Report."); Technopolis and Ipsos MORI, "ISCF Robotics and Artificial Intelligence in Extreme Environments - Baseline and Process Evaluation Report" (Hereby referred to as "RSW Process Evaluation Report."); Ipsos MORI and Technopolis, "ISCF Prospering from the Energy Revolution Challenge - Process Evaluation Report" (Hereby to as "PFER Process Evaluation Report."); TCC Process Evaluation Report.; Technopolis, "ISCF Next Generation Services Evaluation - [D3] Process Evaluation" (Hereby to as "NGS Process Evaluation Report."); IDC Process Evaluation Report.; SQW, "Transforming Foundation Industries - Industrial Strategy Challenge Fund Evaluation - Process and Progress Report" (Hereby referred to as "TFI Process Evaluation Report."); SSPP Process Evaluation Report.; TFP Process Evaluation Report.; CQT Process Evaluation Report. (Hereby to as "CQT Process Evaluation Report."); Technopolis and BOP Consulting, "Evaluation of the ISCF Audience of the Future - Baseline and Interim Process Evaluation Report."(Hereby referred to as "AOTF Process Evaluation Report.")

Box 3: Stakeholder engagement in Challenge design – illustrative examples from Challenges

- **Medicines Manufacturing:**

Engagement was ensured at the pre-launch stage of the Medicines Manufacturing Challenge, leading up to the launch and the post-launch stages. An example of this is the Medicines Manufacturing Industry Partnership and the Bell review, where the initial plans for the Vaccines Manufacturing Innovation Centre (VMIC) were developed from the Bell review with substantial industry input.[42]

- **Prospering from the Energy Revolution:**

The Prospering from the Energy Revolution Challenge made various adjustments in response to stakeholder needs, input and feedback on the programme's core aims of demonstrating the technical and commercial viability of smart local energy systems. These changes included requesting for additional funding for demonstration activity, requesting for specific programme support for the Energy Systems Catapult, expanding the scope of the detailed design competition from local to regional projects and modernising energy data access system to augment the sharing of and access to data.[43]

- **Next Generation Services:**

The Next Generations Services Challenge established collaborative R&D projects, bringing together complete value chains in the services ecosystem to pioneer next generation services, which laid the foundations for further stakeholder engagement. Additional stakeholder engagement in the design of the Challenge is demonstrated by the cross-UKRI collaboration between the Economic and Social Research Council (ESRC) and Innovate UK which has been described as fruitful, providing valuable complementary expertise within the programme delivery.[44]

- **Smart Sustainable Plastic Packaging:**

The Smart Sustainable Plastic Packaging Challenge programme team made use of stakeholder engagement to ensure the relevance of the Challenge to the problems it sought to address and to allow for garnering of support and relevant buy-in, through consultation with the plastics supply chain and key decision makers.[45]

Based on the Challenge level process evaluations, it appears that stakeholder engagement processes varied across Challenges but were deemed broadly effective in ensuring the alignment of Challenges to sectoral needs. However, some Challenge-level engagement processes highlight areas for improvement, including the need to ensure sufficient time is built in for robust engagement and that all relevant stakeholder groups are mapped and reached out to at the start. In some cases, the pressure to commit resources meant that some opportunities to secure greater engagement with industry may have been missed. In the Medicines Manufacturing Challenge, for example the Advisory Group, established to secure industrial input into the programme, had limited input into the design of the VMIC, leading its members to state that they would have welcomed more time to provide input into the design of the capital investment competitions.[46] This Challenge also raised some additional questions as to how far the Challenge's engagement represented a short-term response to tactical issues faced by the sector as opposed to tackling longer term challenges, exemplified by the limited SME engagement in Challenge design.[47] Improvements might therefore be found by clarifying how those 'out of the loop' can engage, which may secure greater international input to ensure the programme effectively addresses issues relating to exports and foreign direct investment (FDI).[48]

Similarly, internal stakeholders in the Faraday Battery Challenge indicated that Challenge design may have been too focused on the needs of the automotive sector, with opportunities to secure input from sectors such as aerospace, chemical and manufacturing sectors not maximised.[49] Notably, this concern was felt to

[42] MM Process Evaluation Report.

[43] PFER Process Evaluation Report.

[44] NGS Process Evaluation Report.

[45] SSPP Process Evaluation Report.

[46] MM Process Evaluation Report.

[47] MM Process Evaluation Report.

[48] MM Process Evaluation Report.

[49] FBC Process Evaluation Report.

be addressed later through activities aimed at engaging other sectors, including ensuring cross-sector participation in the Challenge Advisory Board. While the Prospering from the Energy Revolution Challenge Advisory Board provided valuable input into scoping of the programme's Detailed Designs and Innovation Accelerator competitions (such as advising on specific technology gaps to be addressed), stakeholder feedback suggested that opportunities to secure greater value from Advisory Board and other groups set out to facilitate cross-sector collaboration were not fully explored.[50] Although prescriptive and top down approaches can be seen as problematic across varied Challenges, future funds may consider the value of introducing centralised processes on how thoroughly stakeholder engagement is undertaken by Challenges in a consistent manner.

2.2.2 Risk appetite in Challenge design

Evaluation question:

- To what extent, and how, have the ISCF Challenges focused on 'high-risk' investment areas and enabled the de-risking of investment?

Summary findings:

- The ISCF took steps to promote a narrative of failure being acceptable when investing in high-risk areas of technology or high risk sectors, and has provided opportunities to pilot investments in areas considered risky. However, there was no universal definition of what was meant by high-risk.
- The extent to which Challenges have focused on high-risk investment areas is mixed and driven largely by the sectors they have engaged with.
- There could be benefit to stating the high-risk narrative more explicitly and upfront in the ISCF ambitions as well as defining high-risk and explicitly introducing or signposting to mechanisms for doing so such as by highlighting de-risking strategies. Not doing so has resulted in variation in high-risk practices in funding of projects with aversion to risk in some cases. This is counterintuitive for the fund given its ambitions. See recommendations in Section 2.4.

At the fund-level, the ISCF took steps to promote a narrative to Challenges of failure being acceptable.[51] The fund structure provided opportunities to pilot investment in risky areas and then bring in further investment over time: Quantum Technologies and Next Generation Services Challenges were deemed to be 'interesting but not exactly the right thing to do' in Wave 1, but were subsequently funded as pioneer Challenges in Wave 2 to gauge the extent to which there was a case to further invest in these areas in the future.[52] Other investments deemed to be high-risk were the Audience of the Future Challenge and associated Creative Industries Clusters Programme, both of which were considered to be working in highly innovative, and, as such, relatively high-risk areas.[53] Although the narrative on failure being acceptable was communicated from UKRI, the definition of what high-risk meant was unclear based on data from Challenge-reports and ISCF validation workshops. High risk appears to be equated to investment in sectors that were underdeveloped, volatile or not commercially mature as well as technologies that were innovative/commercially immature or embryonic from a technical viewpoint. However, there are many potential ways in which high-risk can be interpreted. Defining high-risk, introducing parameters as well as mechanisms for pursuing high-risk investments and improved mechanisms to support de-risking whilst promoting the narrative of high risk upfront could have benefitted the fund and catalysed further high-risk

[50] PFER Process Evaluation Report.

[51] Int_05.

[52] Int_01.

[53] AOTF Process Evaluation Report.; "Wave 2 Validation Workshop."

approaches across the board. This is important to ensure that Challenges are operating on the principle of high-risk high-reward rather than a standard grant funding model approach.

The extent to which Challenges have focused on high-risk investment areas is mixed and driven largely by the sectors they have engaged with. On one hand, it is evident that some Challenge investments have been consciously high-risk, capitalising on the opportunity presented by the ISCF to invest in areas where risk had previously been considered too high due to the novelty of the technology or volatile nature of the sector and the market. Examples of this include the Data to Early Diagnostics Challenge where there was acknowledgement by various stakeholders that even though elements of the programme were high-risk, the Challenge should still go ahead as it would put the UK at the forefront of the field internationally.[54] Similarly, the Prospering from the Energy Revolution Challenge was viewed as an ambitious demonstrator programme for industry despite the high level of risk involved in the energy sector at the time.[55]

Challenge leadership and management had varying degrees of risk appetite. A process evaluation of the Smart Sustainable Plastic Packaging Challenge found evidence of a 'risk tolerance' in Challenge set-up and delivery, balancing exploratory research with the need to ensuring delivery and contribution to targets from larger-scale demonstrators. As part of this, the Challenge team accepted that projects may fail but were clear on the reasons why projects should fail.[56]

On the other hand, stakeholder feedback suggests that for some Challenges risk was not necessarily a key consideration in Challenge design, with potential risk averse behaviour in some areas. For example, a process evaluation of the Robotics for a Safer World Challenge observed an aversion to high levels of technical risk and investment uncertainty associated with R&D projects.[57] Although there is insufficient evidence from across the Challenge evaluations, evidence from interviews and workshops with Challenge-level stakeholders has indeed indicated the variation in risk appetite ranging from pro-risk to risk aversion. Based on circumstantial evidence, this could reflect the sectors the Challenges were operating in.

[54] "Wave 2 Validation Workshop."

[55] "Wave 2 Validation Workshop."

[56] SSPP Process Evaluation Report.

[57] RSW Process Evaluation Report.

2.2.3 Funding instruments

Evaluation question:

- To what extent, and how, have the various funding instruments (e.g. CR&D, Hubs/centres) helped develop an ecosystem within Challenges that enables collaboration across different domains (government, academia and businesses)?

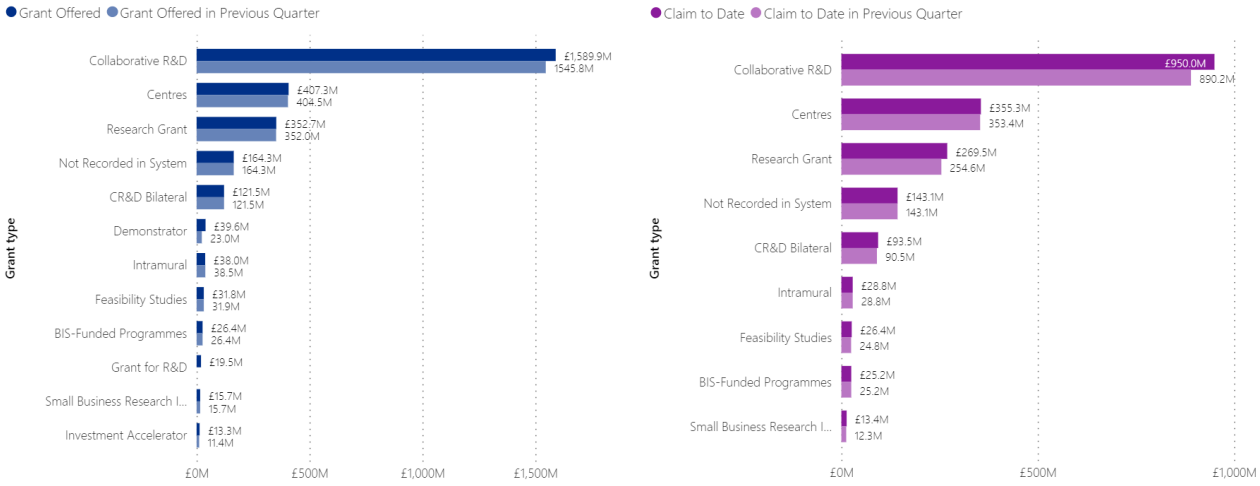
Summary findings:

- Across all Challenges, funding has comprised a diverse mix of instruments, including 'tried and tested' mechanisms such as Collaborative Research & Development (CR&D) grants and demonstrators, alongside more novel approaches.
- The variety of funding instruments and mechanisms used have generally suited to prevailing market needs.
- There are signs that the mix of funding instruments employed by Challenges have supported the development of cross-sector R&I collaboration.
- There is potential trade-off between the implementation of funding strands simultaneously and their staged implementation over time. While the former may help to create a 'big bang' of funding, thereby drawing in stakeholders from across sectors, a staged approach offers opportunities to incorporate sector feedback, programme learning, and to support progression of beneficiaries through programme strands.
- Although the funding instrument approach may require nuancing for a given sector, a staged approach to implementation of funding instruments could be beneficial. This could be supported through assessing stakeholder and market needs at the Challenge design stage when undertaking stakeholder engagement. See recommendations in Section 2.4

Across all Challenges, funding has comprised a diverse mix of instruments, including 'tried and tested' mechanisms such as Collaborative Research & Development (CR&D) grants and demonstrators, alongside more novel approaches designed to address existing market failures and support underdeveloped investment ecosystems. The latter has included investment accelerators and funding for new centres to promote coordination in addressing key sectoral needs. Box 4 below provides illustrative examples of funding instruments across Challenges. Fund-level analysis shows that CR&D and Centres have been the most prominent ISCF grant types in terms of funding offered and claimed, with Centres ahead in percentage claimed compared to CR&D owing to higher proportional investment in Centres in Wave 1b (see Figure 5).[58]

[58] UKRI, "Industrial Strategy Challenge Fund - Q3 FY22/23 - Portfolio Performance Report."

Figure 5: ISCF funding offered and claimed by grant type (as of Q3, 2023)



Source: UKRI, Industrial Strategy Challenge Fund - Q3 FY22/23 - Portfolio Performance Report.

Box 4: Funding instruments – illustrative examples from Challenges

❖ **Audience of the Future:**

The Audience of the Future Challenge has comprised five main programme components, each with a different but complementary purpose:

- **Design Foundations grants** to generate ideas and to create and test low-cost prototypes
- **Production Innovation in Immersive Content grants** that allow industry and academia to work together on narrower, proprietary solutions
- **An Investment Accelerator**, a unique and novel instrument within the portfolio of UKRI, designed to decrease the risk of investment through both grant funding and venture capital investment, and boost the finance and investment ecosystem within the immersive content sector
- **Demonstrators** bringing in end users and supply chains to build awareness and secure feedback to tailor solutions
- **A National Centre** supporting skills development through experimental labs, workshops, placements, and higher education courses

The funding mechanisms combine well-established mechanisms such as CR&D and Demonstrators with newer, more novel interventions such as the Investment Accelerator with the latter focused on incentivising fund managers and building connections with wider industries with applications for the immersive sector. The addition of a National Centre seeks to address the longer-term training and skills needs of the sector. Together, the various funding mechanisms seek to establish a 'lifecycle' of interventions relevant to the level of maturity of the sector.[59]

❖ **Next Generation Services:**

The Next Generation Services Challenge has also centred around five core programme strands, with each strand intended to support different activities to facilitate AI adoption in the Challenge's three focus sectors: accounting, insurance, and legal services. Again, the strands comprise a mixture of well-established and more innovative instruments comprising:

- **CR&D projects** bringing together complete value chains in the services ecosystem to pioneer next generation services. This includes both large and small CR&D projects
- **Research projects** in partnership with businesses focussed on the opportunities and evidence needed to augment human expertise with Specialised Artificial Intelligence in the professional services
- **Data Access projects** focussed on developing data access methods to enable the application of AI and data technology in the accountancy, insurance and legal services

[59] AOTF Process Evaluation Report.

sectors. As part of this strand, the Challenge also undertook an 'innovation lab' succeeded by a follow-on CR&D competition

- **AI for Services network** to support community development by bringing together organisations funded under the NGS Challenge and data and artificial intelligence businesses and academics with professionals working in relevant sectors
- **International activities** to explore international opportunities to understand the landscape of NGS sectors in other regions

Notably, the Challenge strands have evolved over the course of the programme delivery. As the first two strands of the programme, CR&D projects and Research projects were designed to be complementary in addressing research at various stages of development. Subsequently, additional strands have been added as the programme team adapted and responded to the needs of the sector and learnings.[60]

❖ **Commercialising Quantum Technologies:**

The Commercialising Quantum Technologies Challenge has been designed to address a range of market failures and challenges in the quantum technologies sector. The Challenge's five core strands are designed to support activities relevant to different stages of technology development and different segments of the supply-chain:

- **CR&D grants** supporting industry-led projects aimed at creating game-changing quantum technology products and services with a requirement for demonstrable end-user involvement.
- **Feasibility Studies grants** supporting shorter-term studies focused on innovative components and supply chain elements
- **Technology Project grants** supporting industry-led R&D projects developing key underpinning quantum technologies with widespread potential applications
- **Germinator grants** providing a small number of grants for high risk/high reward practical projects, led by industry or academia, seeking to develop new paradigms and concepts to build a pipeline of new quantum technologies for the longer-term.
- **An Investment Accelerator** aimed to de-risk private sector investment in early-stage QT companies by matching venture capital investment with ISCF grant funding.

The Challenge employs a mix of 'classic' Innovate UK funding instruments and novel mechanisms. In addition to being complementary, the programme strands have also been timed to allow for progression across strands, for example from the smaller-scale Feasibility Studies and Germinator Projects to larger-scale CR&D activities which suited the needs of the sector.[61]

The variety of funding instruments and mechanisms have supported market needs.[62] In many cases, this has been supported by the engagement of relevant stakeholders in the process of Challenge design (Section 2.2.1). There is also evidence that across Challenges funding instruments have been designed with a view to complementarity, with different programme strands addressing different market needs in support of a 'systems approach'.[63] Notwithstanding this broad complementarity of instruments, there have also been some limits to the extent of coordination and cross-fertilisation between Challenge strands, as explored later in this report (Section 3.3).

There is strong evidence from across multiple Challenges that the mix of funding instruments employed by Challenges has supported the development of cross-sector R&I collaboration within

[60] NGS Process Evaluation Report.

[61] CQT Process Evaluation Report.

[62] AOTF Process Evaluation Report.; NGS Process Evaluation Report.; CQT Process Evaluation Report.; TFP Process Evaluation Report.; SSPP Process Evaluation Report.; TCC Process Evaluation Report.; RSW Process Evaluation Report.

[63] NGS Process Evaluation Report.; CQT Process Evaluation Report.; TFP Process Evaluation Report.; RSW Process Evaluation Report.; TFI Process Evaluation Report.; SSPP Process Evaluation Report.

the Challenge areas. Many Challenge funding instruments either require cross-sector collaboration (including industry co-investment) as a condition of participation, or encourage cross-sector collaboration in other ways, for example events. One source of evidence for cross-sector collaboration comes from fund-level monitoring of progress against the four ISCF objectives on 'business R&D investment', 'multi-disciplinary collaboration', 'business-academic collaboration' and 'diverse business collaboration'. A snapshot view of Q3 2022-2023 ISCF portfolio performance and monitoring report shows that:

- 45% of business participants were directly involved in an ISCF grant from a Research Council
- 32% of ISCF grants involved more than one Level 2 Dimensions Fields of Research
- 41% of ISCF grants involved at least one business and one academic partner
- 33% of ISCF grants involved at least one micro/small/medium business and at least one large business.

Challenge-level process evaluation reports provide more direct evidence that funding instruments have enabled R&I collaboration within the Challenge areas. Box 5 provides illustrative examples from Challenges.

Box 5: Role of Challenge funding instruments in supporting cross-sector collaboration – illustrative examples from Challenges

- **Robotics for a Safer World:**

In the case of the Robotics for a Safer World Challenge, for example, process evaluation findings highlighted the role of the Challenge in attracting actors from across the robotics and AI supply chain. The evaluation also indicated that the Challenge has broadly doubled the annual volume of public research funding in the robotics and AI in extreme environments field. Together with other initiatives and sector strategies, the funding opportunities created by the Challenge has made an important contribution to widening activity within the sector and the engagement of new players.[64]

- **Commercialising Quantum Technologies:**

The Commercialising Quantum Technologies Challenge process evaluation also found that Challenge funding has supported a wide range of collaborations across the quantum sector encompassing different parts of the supply-chain from component developers to system integrators to end-users.[65]

- **Smart Sustainable Plastic Packaging:**

The Smart Sustainable Plastic Packaging process evaluation found widespread agreement among Challenge stakeholders that the Challenge has been effective in building relationships within and between academic institutions and between academic institutions and businesses. New cross-sector collaborations supported by the Challenge have helped to leverage the financial resources and personnel to help progress new products, materials, technologies and designs to market.[66]

- **Transforming Food Production:**

The Transforming Food Production process evaluation highlights how the Challenge funding strands have helped provided strategic 'direction' on what innovation priorities should be within the sector and 'spurred interest' in new technologies.[67]

There is potential trade-off between the implementation of all funding instruments simultaneously and their staged implementation over time. In some cases, Challenges have adopted a staged approach

[64] RSW Process Evaluation Report.

[65] CQT Process Evaluation Report.

[66] SSPP Process Evaluation Report.

[67] TFP Process Evaluation Report.

to the establishment of funding strands, thereby building in opportunities for adaptation to emerging needs of the sector and programme learning. Such staging has also provided opportunities for Challenge beneficiaries to progress through different funding strands (see Section 3.3). The Next Generation Services Challenge and Commercialising Quantum Technologies Challenge are good examples of this approach (see Box 4).[68] The Transforming Construction Challenge provides a contrast case, with all strands of the Challenge being established simultaneously. According to the Challenge process evaluation, the concurrence of strands helped to create a 'big bang' of funding, thereby drawing-in academic and industry stakeholders in ways that might not otherwise have been possible. At the same time, however, it also found that the lack of staging between strands may have led to missed opportunities to incorporate learnings from one activity to next – for example, the use of findings from lower technology readiness level (TRL)-focused strands for higher TRL activities – as well as fewer opportunities for progression across Challenge stands.[69] Although the approach taken may need to be nuanced for a given sector, there might be value in having a staged approach to funding instruments being implemented with eventual access to all types of fundings instruments and stages suited to market needs. The stakeholder engagement processes underpinning Challenge design should ensure that funding instruments are also discussed and assessed for a given sector.

[68] NGS Process Evaluation Report.; CQT Process Evaluation Report.

[69] TCC Process Evaluation Report.

2.3 Role of the Challenge Directors

Evaluation questions:

- To what extent have the Challenge Directors maximised R&I opportunities across sectors (government, academia, businesses) for the benefit of the programme in a coherent and directed way?
- To what extent have the Challenge Directors led appropriate investment decisions that focus on the industrial Challenges assigned to each programme?
- How much autonomy have Challenge Directors had in designing and delivering their programmes? How would increased autonomy for Challenge Directors regarding preferred timelines, scope and activities for the Challenge have changed the likely benefits and costs?
- What additional value have Challenge Directors provided compared to standard grants in UKRI?

Summary findings:

- CDs are widely considered by UKRI management and Challenge-level stakeholders to have been a positive addition to the ISCF, with CDs providing coherent and directed external and internal leadership to the Challenges, and playing an instrumental role in ensuring the success of Challenges.
- Limitations on autonomy have presented a key obstacle to CD's leadership of Challenges, especially for earlier Challenges which impacted CDs' ability to shape and govern the Challenges as intended.
- Other issues pertaining to CD leadership have included recruitment challenges and cultural frictions.
- It may have been beneficial to consider a more adaptive and open governance style to assimilate CDs into ISCF. While this appears to have eventually occurred by Waves 2 and 3, future programmes may benefit from a clearer delineation of the role of the CD within the governance structure to better leverage their expertise. Issues relating to recruitment also highlight the need for design and timely execution of a recruitment strategy for CDs). See recommendations in Section 2.4.

Challenge Directors (CDs) represent a unique design feature of the ISCF. CDs were individually selected from a pool of highly qualified industry experts, with years of experience in their respective fields. They were brought on board to 'bring fresh ideas and dynamism' to Innovate UK and UKRI and to 'act as catalysts for the creation of truly disruptive collaborations and solutions to meet challenges'.[70]

A predominant view across the ISCF is that CDs have been a positive addition to the ISCF, with CDs providing coherent and directed external and internal leadership to the Challenges and playing an instrumental role in ensuring the success of Challenges.[71] CDs are described as having high credibility because of their industry knowledge, which facilitates effective engagement.[72] In addition to being well-connected to the target sectors, they are also seen to understand their respective sectors and bring their networks to the Challenges. For instance, CDs' external leadership has included engaging with external industry stakeholders on further investment and co-investment with evidence of new contacts being brought into Challenges by CDs highlighted in workshops with Challenge-level stakeholders.[73]

The CD role has also been credited with bringing in an array of different working cultures and perspectives that were not present in UKRI beforehand.[74] One example of this is seen in the Data to Early Diagnosis Challenge which has been able to get stakeholder buy-in more effectively when CD was in post. In this

[70] Innovate UK, "Example Job Advert for Challenge Director."

[71] Int_03; Int_06; "Wave 3 Validation Workshop," .

[72] Int_03.

[73] "Wave 3 Validation Workshop."

[74] Int_06.

instance, the CD played a key role in ensuring that the work done on the Challenge is communicated to the wider NHS community, which helped to help facilitate adoption of the new technology and products being developed through the Challenge.[75] Similarly, during the Wave 1 Robotics for a Safer World Challenge, the CD joined the steering group for the Lawtech UK Sandbox activity, allowing the programme team to have

[75] "Wave 2 Validation Workshop."

regular interaction with the Ministry of Justice.[76] The CD role has thus been lauded for distinguishing the ISCF from previous R&I investments through providing multiple, alternative perspectives and through evolving UKRI and Innovate UK's working culture. The corollary of this shift has been a more focused

[76] RSW Process Evaluation Report.

approach to Challenges, facilitating the formation of consortia of large and small companies and shaping the portfolio to deliver tailored approaches to Challenges.[77]

CDs have helped to provide effective internal management of Challenges, advocated for change within UKRI pushing reflection on current processes, and created more visibility for Challenges within the ISCF

[77] Int_04.

governance structures.[78] There is also evidence that in some cases CDs have played a role in Challenge portfolio management. In the case of the Smart Sustainable Plastic Packaging Challenge, for example, the CD was viewed as integral to selecting a balanced portfolio of projects, exercising discretion to select projects when many were addressing similar issues in ways that would not have been possible if the selection

[78] "Wave 2 Validation Workshop."

process relied solely on standard proposal review processes.[79] The Audience of the Future also provides an example of effective CD involvement in project selection. While this initially raised potential tensions between the CD's role and standard Innovate UK proposal review processes, the CD was able to effectively resolve these tensions and devise a briefing programme that sought to engage more deeply with the sector at pre-application stage, and took more executive control over the selection process, which was well-received by the sector and resulted in a high-level of participants. The CD's involvement was described as being integral given the large size and strategic importance of the Challenge Demonstrator projects.[80]

Overall, CDs have been described as fundamental to the ISCF's success[81] and as 'fairly critical in shaping Challenges'[82] in the specific ways highlighted in the CD case study. This is supported by the observation that the extent to which Challenges succeeded depended on having the right CD from early on.[83] It is also noted that CDs' ability to do their role effectively has also depended on the role of the Deputy CD, which has been extremely valuable in shouldering responsibilities and allowing CDs to deputise effectively.[84] The case study below provides a more detailed exploration of factors that have underpinned the successful performance of the CD role across Challenges.

Case study: Exploring good practice in the role of the Challenge Director

CDs have constituted a unique design feature of the ISCF. While our report surfaces various issues and barriers faced by CDs (see below), the evidence also highlights the many positive contributions of the CD role. This case study explores three factors that may have helped CDs perform their role successfully:

- **Adapting at pace to set the strategic direction of Challenges:** A key task that CDs had to accomplish was to set the strategic direction for their respective Challenges. In many cases, CDs faced obstacles to this in that they were brought on board later in the process, after Challenge businesses cases and governance mechanisms had been set up. Notwithstanding these constraints, in some cases CDs were able to successfully exercise strategic leadership and ensure that the Challenge scope was fit for purpose, both in terms of alignment to the ISCF objectives and relevance to the realities of the respective industries. As explained by one CD, despite being pulled into the process after some key decisions had already been made, they were able to adapt at pace to strategically retrofit the Challenge's logic model to make it more fit for purpose at the local level.[85] Another CD reported how they were able to re-direct the course of the Challenge to a more fitting direction after the pre-existing business case had shortcomings in understanding the most current and contemporary developments of the target industry.[86]
- **Navigating UKRI structures to address Challenge-specific obstacles:** CDs faced various Challenge-specific obstacles in carrying out their duties. In the face of such obstacles, CDs' ability to effectively navigate UKRI structures was key in enabling them to arrive at optimal outcomes. In one instance, a CD successfully made use of internal UKRI structures and key individuals, including the deputy CD, who had in-depth knowledge of Innovate UK and was able to provide guidance on the internal processes and procedures of the organisation to assess where and how to influence processes to suit Challenge needs.[87] A common challenge that CDs successfully navigated had to do with the level of autonomy of CDs. Here, CDs were able to identify relevant internal stakeholders within the UKRI who would allow them to still achieve their goals within the pre-existing parameters. This included strategically engaging with more senior UKRI staff and working with them to engage more junior staff in better understanding and supporting the Challenge's objectives.[88] In some cases, CD's ability to navigate UKRI structures was supported by their professional experience. One CD reported how advanced communication skills allowed them to 'force through' their recommendations despite some levels of misgivings on recommendations made to

[79] SSPP Process Evaluation Report.

[80] AOTF Process Evaluation Report

[81] Int_05.

[82] Int_04.

[83] Int_04.

[84] "Wave 3 Validation Workshop"; "Wave 2 Validation Workshop."

[85] Int_09.

[86] Int_10.

[87] Int_09.

[88] Int_11.

senior management.[89] Another reported that channelling decades of industry experience helped him to effectively negotiate a change in approach and reach a consensus on how to proceed with all relevant stakeholders.[90]

- **Leveraging industry knowledge, connections, and credibility to ensure stakeholder engagement:** There is strong evidence of the effectiveness of CDs in ensuring stakeholder engagement in Challenges. These examples also highlight that CDs' industry knowledge and connections have been key to success in this aspect of the role. One CD reported that they were able to assemble the right members of the advisory panel to enable them to 'tap into' a wide and diverse knowledge base to supplement and plug any existing gaps in expertise.[91] Similarly, another CD was able to bring in a high-level public-sector expert to guide the Challenge stakeholders through politically-relevant interactions.[92] Alongside ensuring stakeholder engagement in advisory boards, CDs also helped to ensure that the Challenge calls were widely distributed to the right stakeholders, and that the findings of Challenge projects were widely communicated.[93] The ability to bring stakeholders was also due to the high level of credibility that CDs held within their respective industries. As explained by one CD, the highly specialised nature of the industry they worked in meant that 'everyone knows each other' and being held in high standing and esteem as someone who has held an executive position in an industry-leading company allowed them to 'have the right conversations'.[94]

Key learnings:

- CD's ability to adapt at pace enabled them to influence strategic direction despite structural constraints.
- CD's ability to navigate UKRI structures, aided by their industry experience, enabled them to address Challenge obstacles.
- Industry knowledge, connections, and credibility helped CDs to ensure engagement of the right stakeholders.

Limitations on autonomy have presented a key obstacle to CD's leadership of Challenges, which has, in some cases, impacted CDs in being able to shape and govern the Challenges as they would have wanted to. However, the downstream impact of this on Challenges performing and delivering impact is uncertain. In many cases, CDs had to work within constrained parameters due to Challenge scope and governance already being established before CD onboarding. This was especially the case for Wave 1 Challenges where the HM Treasury business cases were prescriptive. More specifically, there was an observed underlying tension in that the governance structures for the Challenges had to be set out in the business cases, which naturally predated the recruitment of CDs. This meant that when CDs were recruited, they had to operate within structures that had in large part already been established (rather than being able to design those structures themselves).[95]

Owing to the above, CDs of Wave 1 Challenges had very little authority to shape Challenges or to grant financial approvals,[96] making business cases additionally restrictive on financial autonomy which meant Challenge-level decisions could not be taken in a responsive manner based on sector findings. Financial autonomy for CDs was difficult to achieve due to changing budgets, particularly due to the outcome of spending reviews which reflected the short-term nature of budgeting cycles.[97] This was compounded by the fact that spending had to be approved through various other internal governance structures and processes within the UKRI which some CDs found frustrating.[98] The length of time that these and other decision making processes within UKRI/BEIS took was relatively longer than the time taken in business environments for comparable processes. This meant that there were more observable tensions and

[89] Int_10.

[90] Int_11.

[91] Int_11.

[92] Int_09.

[93] Int_09.

[94] Int_11.

[95] Int_15.

[96] Int_05.

[97] "Wave 3 Validation Workshop."

[98] "Wave 3 Validation Workshop."

adjustment needed for CDs coming from an industry background, who expressed frustration with the strictures of working within government departments.[99]

Recruitment challenges compounded the issue of restrictive parameters and lack of autonomy for Wave 1 Challenges. CDs joined the process when the significant parameters of the Challenges were already established, leaving limited ability and scope to influence the direction of the Challenges. An illustrative case in point is the Medicine Manufacturing Challenge in Wave 1 where the requirement for speed of implementation resulted in some compromises being made in the planning of the programme. The short scoping and setup phase meant that the CD could not shape the strategic direction of the programme from the outset and the governance arrangements had also already been established before a permanent CD could be recruited into post.[100]

Over time, the governance structures as set in the Challenge business cases became more flexible with, for example, more decision-making power down to CDs and programme boards which could have been a result of learning from Wave 1 as well as the influence of CDs in roles. This subsequent approach taken in Waves 2 and 3 gave CDs more autonomy to select their focus areas for particular Challenges. Changes were made across waves to allow for more flexibility on CDs making decisions to the portfolio.[101] Whilst this was marginally improved across Wave 2 and 3, with improved governance control, the calls for more autonomy to CDs in other Challenges have persisted.[102] For one, it has been noted that CDs are running things which are already 'set in stone' with a pre-determined delivery plan. Calls for more autonomy for CDs have persisted in Wave 3 where there have continued to be limits on CDs in terms of shaping the Challenges.[103]

Other issues affecting CD leadership have included recruitment challenges and cultural frictions. CD recruitment was challenging on a few fronts. The first challenge was to find CDs with the right credentials and experience to lead, compounded by the ISCF not being very well known.[104] As CDs have often been senior industry leaders, it has been challenging to attract and retain people within these constraints for enough time to deliver Challenges. Recruiting the right candidates was further curtailed by the fact that CD recruitment packages were offered within public sector constraints (£150k limit) with BEIS approval needed for packages over £100k. This issue is exemplified by the fact that two CDs were successfully head-hunted with better packages.[105] Delays recruiting CDs have also meant onboarding at points where Challenges were already well underway, meaning considerable time needed to be taken to familiarise CDs with Challenge governance structures and processes.[106]

The CD role has also presented challenges around integration into existing organisational culture and structures. Whilst CDs bring a much-needed broadening in perspective within the UKRI, there have also been tensions between CDs and UKRI and Innovate UK processes.[107] Broadly, as most CDs were more accustomed to the pace, cultures and processes of industry, there were some tensions with the relatively slower pace of UKRI and Innovate UK.[108] As noted above, for example the role of CDs in the application

[99] "Wave 3 Validation Workshop."

[100] MM Process Evaluation Report.

[101] Int_02; Int_04.

[102] Int_01.

[103] Int_05.

[104] Int_04.

[105] Int_03.

[106] "Wave 3 Validation Workshop."

[107] Int_06.

[108] Int_09.

process highlighted potential tensions between the role of the CD in portfolio management and standard Innovate UK proposal review processes.

The CDs were deemed an important asset to the ISCF. Adopting a more adaptive governance style upfront may have eased their transition and assimilation into the ISCF. This appears to have eventually occurred by Wave 2 and 3 in an organic fashion based on learning, feedback, and influencing, leading to more autonomy and decentralised control of Challenges. However, the issues that remain within Wave 3 on CD autonomy could pertain to cultural and process differences that exist between government and private sectors.

2.4 Recommendations

This section draws on the above findings relating to strategy and set-up of the ISCF and presents recommendations to inform the design and set-up of future R&I programmes adopting the ISCF's Challenge-led approach. These recommendations are not something that can be incorporated into the ISCF but are rather built on the learning from ISCF and some of the process changes that have already occurred in the programme.

1. **Stakeholder engagement in fund and Challenge design should be comprehensive yet targeted, including a framework for how feedback is incorporated into decisions**

In earlier waves, the ISCF did not engage enough with the external community and had a heavy government focus. Wave 3 processes provide an example of a more comprehensive approach to engagement bringing in industry, academic and policy stakeholders ad demonstrating the use of panels as an effective mode of engagement. However, the Wave 3 process also created issues in terms of the volume of engagement and the resource intensity involved. The extensive process took a lot of time and created a significant administrative burden. There is scope to consider process changes that might streamline this. For instance, stakeholder engagement at Challenge design stage could focus on targeted mapping of all relevant sectors and engaging with representatives in the sector instead of engaging with a large volume of stakeholders. Moreover, engagement at Challenge selection should be different from the design stage where the input from stakeholders at the design stage could feed into targeting the EOI more tightly. The EOI itself could be shortened to reduce burden all around and be invited from multiple sectors and representatives but refrain from being completely open by introducing relevant eligibility criteria. 'Guardrails' defining the expected nature of stakeholder input and how this will be utilised at different stages of the programme could also help create more transparency and support more targeted engagement with stakeholders. This would still be a step change from the type of engagement undertaken in Waves 1 and 2 whilst being more streamlined than what occurred in Wave 3. As per the NAO recommendation, we also propose considering a parallel review and approvals process rather than a sequential process through UKRI, BEIS, and HM Treasury.[109]

2. **Long-term programmes should avoid retrofitting to new government strategies to prevent misalignment of core mission and outcomes and to ensure that a programme's longevity and relevance is not overly reliant on a given strategy; programmes should instead consider highlighting where programme ambitions link to specific areas within government priorities and broader strategies.**

A challenging example of retrofitting is that of the government levelling-up agenda which became a priority after the ISCF was established, and there was a drive to showcase the alignment between the fund and

[109] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund."

levelling-up. There was a dissonance between this government priority and the core ambition of ISCF and its criteria for award. However, the mapping of ISCF Challenges and projects to multiple government and sector specific strategies (Table 2) highlights that the ISCF value could be better demonstrated by communicating how the ambitions and objectives of the Challenges are catalysing the delivery of various government agendas. As can be seen in the exercise, not all Challenges map to all the areas within a given strategy. A blanket retrofitting approach can be problematic, however a more nuanced retrofitting and alignment can be achieved to strike a middle ground. Tying a programme too closely to one given strategy could be risky as seen in the case of ISCF and the Industrial Strategy. Although ISCF remains very much relevant to current strategic ambitions as outlined in multiple government strategies, aligning heavily to the Industrial Strategy could detract from ISCF's relevance from an optics viewpoint.

3. **UKRI should be clear in communicating and defining expectations on high-risk investments whilst providing explicit mechanisms for engaging in high-risk investments so that there is a consistent and proactive high-risk, high-reward approach to delivering mission-oriented research.**

Evidence suggests that while the UKRI and Innovate UK took steps to promote a narrative of failure being acceptable, high-risk investment was not necessarily a key consideration of Challenges nor was there a consistent understanding of what was meant by high risk. The dissonance between fund and Challenge-level approaches to risk highlight the potential for better communication and more clarity regarding expectations for high-risk investment as well as support in signposting to mechanisms for de-risking. A more persistent rhetoric surrounding risk would help to keep it at the forefront of Challenge governance and delivery. This is important for future funds to ensure that a high-risk, high-reward approach is built in to avoid turning challenge-based funding into a standard grant funding model.

4. **UKRI should support agility in the design and implementation of funding mechanisms.**

The funding instruments and mechanisms at the ISCF's disposal were an important enabler in operationalising Challenge ambitions and supported the establishment of bespoke funding mechanisms suited to different market needs. This also created a testbed for learning and experimentation, including between the simultaneous launch of programme strands and their staged implementation over time. While the suitability of an agile approach to the implementation of funding mechanisms will depend on the programme, examples from across Challenges indicate that the agile design and implementation of funding mechanisms can improve the relevance of instruments to specific sectors, while also opening up further opportunities for coherence and cross-pollination between funding strands. Ensuring that Challenges have scope and support to adopt agile approaches, where appropriate, would help to ensure that these opportunities are not missed. Furthermore, it may be beneficial to utilise the staged approach of funding instrument implementation in the first instance to build in learning cycles and gauge industry reaction, though it may need to be sensitive to the demands of a given sector. This could be supported through the stakeholder engagement undertaken at the Challenge design stage.

5. **UKRI should clearly define the roles and expectations of key leadership positions in new programmes (e.g. CDs) within the existing governance structures to better leverage their expertise and avoid conflict.**

Evidence suggests that the CD role has been constrained in some cases by a lack of autonomy, particularly in the case of earlier Challenges which at times impacted the CDs' ability to shape and govern the Challenges in the manner they would have liked to. At times, it was unclear what the CD was able to do within the confines of UKRI and Innovate UK processes and structures, with existing processes cited as a barrier and a point of cultural friction. More careful planning and deliberation on how key leadership roles such as CDs

can fit into the existing governance structure system – and also how they are expected to change the system – will enable more flexibility and agility upfront. At the same time, more emphasis on familiarising CDs (or equivalents) with UKRI and Innovate UK structures and processes will also enhance their capacity to navigate and influence these effectively during Challenge delivery. Whilst establishing future funds, there may be more thought given to business-as-usual processes and how far they can deviate to allow innovative processes to underpin innovative programmes.

6. **UKRI should establish a recruitment strategy for key leadership positions (e.g. CDs) that isinclusive of EDI considerations and ensure its timely execution.**

Some of the issues experienced by the CD role were linked to the recruitment issues and timeliness. Many CDs joined the process late, when the parameters of the Challenges were already established, leaving only limited ability and scope to influence their direction. A lack of a clear recruitment strategy was a factor here, making it challenging to find the most relevant individuals whilst ensuring diversity and inclusion in CD make-up. The establishment and timely execution of a clear recruitment strategy for CDs (or equivalent) soon after business case approval or drafting of a recruitment plan (inclusive of EDI) in parallel would help to ensure recruitment of the most suitable individuals. Moreover, where possible business cases should introduce a narrative of flexibility and change at the discretion of UKRI/government bodies to provide some ability for CDs to co-create or influence programme strategy and governance post-approval.

3. Delivery of the ISCF

This chapter presents findings and recommendations relating to the delivery of the ISCF. The chapter discusses findings to **governance and fund management**, **call, application and monitoring processes** and **coherence and coordination** within and across Challenges. The chapter further considers evidence on **equality, diversity and inclusion (EDI)** within the ISCF at both the fund and Challenge-level. The final section of the chapter presents cross-cutting recommendations drawing upon these findings to inform the delivery of future programmes.

3.1 Governance and fund management

3.1.1 Role of key governance bodies

Evaluation questions:

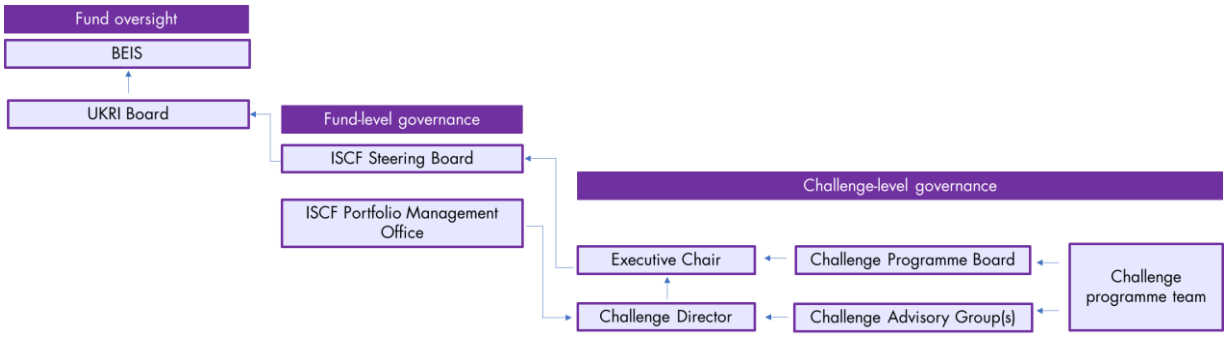
- How effectively has the ISCF been managed?
- How has the ISCF governance and set up supported and enabled delivery of the ISCF? (e.g. how effective has the ISCF Steering Board been in decision-making?
- How, if at all, has the ISCF PMO enabled a centralised, coordinated, and consistent approach to delivering ISCF Challenges?

Summary findings:

- The ISCF Steering Board has provided strategic oversight of the fund but initially faced some governance challenges. Over time, Steering Board processes have adapted to address these issues, including increased autonomy to Challenge-level governance structures.
- The ISCF Portfolio Management Office (PMO) has played an important role in the standardisation and coordination of processes across Challenges, particularly in the early stages of the Challenge lifespan. PMO support to Challenges could have been greater in relation to change management across the ISCF.
- Challenge programme boards, advisory groups, and programme teams have generally provided effective oversight of Challenges. Nevertheless, Challenge-level governance structures have faced some issues, most notably:
    - A lack of autonomy from fund-level governance structures, though autonomy has increased over time.
    - Opportunities for increased engagement of relevant stakeholders in programme boards/advisory groups.
    - Resource and capacity constraints faced by programme teams.
- These findings underscore the need for bespoke processes and governance arrangements to ensure agility and adaptability in management and delivery, to recognise the evolving roles of fund and Challenge-level governance bodies over the course of the programme lifecycle, to improve change management support provided by central fund bodies, and to ensure the engagement of relevant stakeholders in governance structures at all levels. See recommendations in Section 3.5.

Governance of the ISCF spans fund and Challenge-level structures. Figure 6 provides a simplified overview of the governance structure across these levels, with fund oversight provided by the UKRI Board and BEIS. The remainder of this section considers evidence regarding the role of the following key bodies within the structure: the ISCF Steering Board, the ISCF PMO, Challenge programme boards and advisory groups, and Challenge programme teams.

Figure 6: ISCF governance structure (simplified)[110]



Source: RAND Europe analysis based on ISCF programme documentation

Notes: The ISCF Steering Board is chaired by the ISCF Senior Responsible Officer. An Executive Chair (typically a member of the ISCF Steering Board) chairs the Challenge programme board and is accountable to the ISCF SRO. Challenge Directors typically chair Challenge advisory groups. Challenge programme teams include Challenge programme managers, project managers, innovation leads, performance and monitoring /impact and performance officers/managers. Challenge programme teams may also engage with BEIS sector teams.

The ISCF Steering Board has provided strategic oversight of the fund but initially faced some governance challenges. The Steering Board comprises key UKRI personnel, including the executive chairs of the research councils and Innovate UK, and senior officials from BEIS and HM Treasury. The Board's responsibilities have included review of the performance of ISCF Challenges, review of overall progress against the ISCF objectives, taking strategic decisions on Challenge delivery, and approval of changes to the ISCF budget. Consultation with UKRI and Challenge-level stakeholders suggests a degree of over-governance associated with early Steering Board processes, including an over-concentration of decision-making, a tendency to adopt a 'management' rather than 'stewardship' approach, and a focus on operational over strategic issues.[111] Changing roles and the engagement of BEIS and Treasury within the Steering Board were also cited as creating a difficult environment for a consistent governance mechanism.[112] In addition, a lack of clarity regarding the information required to inform Steering Board decisions created difficulties for both Challenge programme teams[113] and fund-level monitoring staff.[114] Over time, Steering Board processes have adapted to address each of these issues.

Notably, the Steering Board has provided greater autonomy to Challenge-level governance structures over time. In the context of Wave 3 of ISCF, work was undertaken to develop decision thresholds for what needs to be escalated to the Steering Board, allowing more decisions to be pushed

[110] A more detailed governance structure is presented in the ISCF Wave 1-3 business cases.

[111] Int_04; Int_06.

[112] Int_06.

[113] FBC Process Evaluation Report.

[114] Int_03; Int_08.

down to Challenge Directors and programme boards.[115] In addition to increased autonomy for Challenges, this has improved the speed of decision-making allowing Challenge teams to work at pace, while also freeing-up more time for the Steering Board to focus on strategic oversight.[116] The clarity of Steering Board information requests has also improved over time, in part influenced by the evolution of fund-level monitoring mechanisms and the Board's improved understanding of these.[117]

The ISCF PMO has played an important role in the standardisation and coordination of processes across Challenges, particularly in the early stages of the Challenge lifespan. Key functions of the PMO have been to communicate information from the Steering Board to the Challenges and to promote common frameworks and standards across Challenges including Challenge governance structures and risk management processes.[118] The PMO has also established role-based peer groups to share experiences and learning across Challenges, including for Challenge Directors, programme managers, project managers and impact and performance managers.[119] Workshops with Challenge-level stakeholders highlight the important role of the PMO in early stages of the Challenges.[120]

In some areas, PMO support to Challenges could have been greater. Workshops with Challenge-level stakeholders highlighted some areas in which the PMO's governance support offering could have been improved. In particular, the need for a more effective role in change management across the fund was raised, with the need for clearer communication and support to Challenges during the establishment of Challenge-level benefits management plans highlighted as a specific example.[121]

Challenge programme boards, advisory groups, and teams have generally provided effective oversight of Challenges. Challenge-level process evaluation reports highlight various examples of the leadership role programme boards and advisory panels have played in Challenge governance, including: providing strategic direction to Challenges, providing feedback and assurance for funding and management decisions taken by programme teams, providing insights and guidance from other funds, and engaging across UKRI and wider government.[122] There is also good evidence from across Challenges that relations between programme boards, advisory panels and programme teams have been effective, with roles and responsibilities well-defined, transparent, and due processes followed.[123]

While broadly fit-for-purpose, Challenge-level governance structures have also faced some issues. As noted above, during the early stages of the ISCF, an over-centralisation of decision-making within the Steering Board served to restrict the autonomy of Challenge boards, advisory groups and teams to make decisions regarding strategy and delivery (e.g. budget changes). Over time, however, there has been greater

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[115] Int_03; "Wave 3 Validation Workshop."

[116] Int_03.

[117] Int_08.

[118] Int_05.

[119] Int_02.

[120] "Wave 2 Validation Workshop."

[121] "Wave 3 Validation Workshop." Int_15.

[122] RSW Process Evaluation Report.; NGS Process Evaluation Report.; AOTF Process Evaluation Report.; SQW, "Data to Early Diagnosis and Precision Medicine ISCF Challenge Evaluation - Progress and Process Evaluation Report" (Hereby referred to as " D2EDPM Process Evaluation Report."); TFP Process Evaluation Report.; RSM, "Evaluation of Digital Security by Design - Phase 3a: Process Evaluation" (Hereby referred to as "DSBD Process Evaluation Report."); IDC Process Evaluation Report.; TFI Process Evaluation Report.; SSPP Process Evaluation Report.

[123] DSBD Process Evaluation Report.; AOTF Process Evaluation Report.; D2EDPM Process Evaluation Report; TFP Process Evaluation Report.; IDC Process Evaluation Report.; TFI Process Evaluation Report.; SSPP Process Evaluation Report.

delegation of decision-making to the Challenge-level governance structures, with autonomy not considered an issue for many Wave 3 Challenges.[124] Workshops with Challenge-level stakeholders underscored how increased autonomy has given Challenge programme boards and teams more scope to adapt and be responsive to specific Challenge-level developments, without needing to seek approval at the fund level.[125]

While most process evaluations found that Challenges had been broadly effective in engaging relevant stakeholders in programme boards and advisory groups, including a balance of government and industry representatives, in some cases, opportunities for increased engagement of key stakeholders was highlighted.[126] A common theme across several Challenge-level process evaluations was the need for further engagement of representatives from key government departments relevant to the Challenge sector in order to aid effective influencing and transacting policy changes in a given sector. Box 6 below provides examples across Challenges. In the case of the Commercialising Quantum Technologies Challenge, the need for an increased role of industry stakeholders in boards was highlighted.[127]

Box 6: Opportunities for increased engagement of key stakeholders in Challenge programme boards and advisory panels – illustrative examples from Challenges

- **Faraday Battery Challenge:**

A process evaluation of the Faraday Battery Challenge recommended extending programme board membership to Defra and/or Ministry of Housing, Communities and Local Government (HCLG) with a view to ensuring the identification and mitigation of risks associated with the long-term impacts of mass adoption of battery technology in the UK.[128]

- **Robotics for a Safer World:**

A process evaluation of the Robotics for a Safer World Challenge recommended broadening the membership of the programme board and the advisory group to include representatives from the Ministry of Justice, HM Treasury, the Department of Media, Culture and Sport (DCMS) and/or Office for AI to ensure relevant insight on the range of issues that may impact upon the programme. The evaluation also identified the need for more inclusion of experts on regulation and technical standards within the programme's Advisory Group.[129]

- **Prospering from the Energy Revolution:**

A process evaluation of the Prospering from the Energy Revolution Challenge found that further work was needed to coordinate more effectively with regulatory bodies, including BEIS, Ofgem, the Competition and Markets Authority, the Environment Agency and the Information Commissioner's Office.[130]

- **Next Generation Services:**

A process evaluation of the Next Generation Services Challenge recommended that future interventions could improve connections with relevant governments departments and agencies, for example the AI Sector Deal, DCMS, Ministry of Justice, HM Treasury by expanding the membership of the programme board and/or the advisory group.[131]

In some cases, Challenge programme teams have faced resource and capacity constraints. The Faraday Battery Challenge and the Next Generation Services Challenge provide two examples of this. In the case of the Faraday Battery Challenge, the Challenge process evaluation observed how reduced staffing levels in the programme team following the outcome of the 2015 Comprehensive Spending review created

[124] Int_03; "Wave 3 Validation Workshop."

[125] "Wave 2 Validation Workshop"; "Wave 3 Validation Workshop."

[126] PFER Process Evaluation Report.; RSW Process Evaluation Report.; CQT Process Evaluation Report.; FBC Process Evaluation Report.; TFP Process Evaluation Report.; NGS Process Evaluation Report.

[127] CQT Process Evaluation Report.

[128] FBC Process Evaluation Report.

[129] RSW Process Evaluation Report.

[130] PFER Process Evaluation Report.

[131] NGS Process Evaluation Report.

a challenging context for programme delivery, with ambitious timescales and the ongoing establishment of UKRI adding to these pressures.[132] The process evaluation of the Next Generation Services also observed constraints on programme team resources and capacities, with limited time for support and engagement with programme participants. In response, the programme team has emphasised partnership working with other organisations, most notably the Knowledge Transfer Network (KTN).[133]

3.1.2 Agility of governance

Evaluation question:

- How well has the ISCF governance allowed for an effective response to disruption (e.g. Covid-19) and guided the Challenges to adjust and adapt appropriately?

Summary findings:

- The most significant disruption caused by the Covid-19 pandemic was at the Challenge level, in response to which Challenges have been adaptable, permitting no-cost extensions and in some cases providing financial support. In response, the ISCF governance structures have shown flexibility and understanding through the granting of extensions.
- There were also some positive impacts of the Covid-19 pandemic for Challenges, including increased capacities within the relevant sector (e.g. genomic sequencing) and increased reach of activities conducted through virtual means.
- While certain Challenges provide examples of flexible and agile programme governance, in some cases fund structures have served to restrict agile governance.
- Although the feasibility of an agile approach may be influenced by the nature of the investment – e.g. being more difficult for programmes comprised of large capital investments – where feasible, adaptable approaches such as holding back funds have the benefit of allowing programme delivery to respond to emerging insights and opportunities as identified through programme monitoring and feedback loops. See recommendations in Section 3.5.

The most significant disruption caused by the Covid-19 pandemic was at the Challenge level. While creating some issues for fund and Challenge governance processes – e.g. switching to remote ways of working – the most notable impact of the pandemic was on the projects supported by the Challenges. Impacts of the pandemic on projects have included restrictions on access to necessary infrastructure to conduct research, disruption to data collection and decreased project engagement from project participants as they focused energies on broader aspects of pandemic response.[134] Notably, the pandemic created substantial disruption for the Data to Early Diagnosis and Precision Medicine Challenge, with issues faced including reallocation of participating NHS teams, restricted access to labs and supplies, lack of patient recruitment.[135] In response, the ISCF governance structures have shown flexibility and understanding through the granting of extensions. While in most cases this took the form of no-cost extensions,[136] in some cases, such as the Data to Early Diagnosis and Precision Medicine Challenge, costed extension were

[132] FBC Process Evaluation Report.

[133] NGS Process Evaluation Report.

[134] NGS Process Evaluation Report.; CQT Process Evaluation Report.; DSBD Process Evaluation Report.; TFP Process Evaluation Report.; D2EDPM Process Evaluation Report.

[135] D2EDPM Process Evaluation Report.; "Wave 2 Validation Workshop."

[136] NGS Process Evaluation Report.; CQT Process Evaluation Report.; DSBD Process Evaluation Report.; SSPP Process Evaluation Report.

provided.[137] In the case of the Digital Security by Design Challenge, the Challenge itself was given a 9 month extension (and additional funds) was granted to the Challenge to mitigate the impacts of the pandemic.[138] Box 7 provides examples of Covid-19-related extensions across Challenges.

Box 7: Granting of extensions in response to Covid-19 – illustrative examples from Challenges

- **Data to Early Diagnosis and Precision Medicine:**

The Data to Early Diagnosis and Precision Medicine Challenged acknowledged delays caused by Covid-19, with the DigiPath strand and provided costed extensions. A further £9m has been provided in costed extensions for the Centres of Excellence and an extra £2m for the Integrated Diagnostic CR&D projects.[139]

- **Smart Sustainable Plastic Packaging:**

Where Covid-19-related delays and postponements impacted significantly on delivery timetables, the Smart Sustainable Plastic Packaging Challenge extended delivery schedules and were flexible and supportive during performance monitoring meetings.[140]

- **Next Generation Services:**

As of February 2021, 60% of Next Generation Services Challenge CR&D projects had received no-cost extensions with many of these linked to impacts of the COVID-19 pandemic. These extensions ranged between 1 and 9 months, with most projects receiving a 3-month extension (median).[141]

- **Commercialising Quantum Technologies:**

Due to the Covid-19 pandemic, most projects under Wave 2 of the Commercialising Quantum Technologies Challenge were granted no-cost extensions of 3-6 months.[142]

- **Digital Security by Design:**

The Digital Security by Design Challenge was given a 9-month extension to mitigate the impacts of the Covid-19 pandemic on working practices and supply chains or over- or under-spends. Additional funds were allocated and spent to schedule (with a six-month extension arranged at an early stage due to Covid-19) and the Challenge has made use of new funds made available by DCMS and MoD (via DSTL) to support delivery, reallocated funds between workstreams and redesigned programme. Arm and Innovate UK also received a 3-month Covid-related extension related to Covid-19.[143]

There were also some positive effects of the Covid-19 pandemic for Challenges. For example, while the Data to Early Diagnosis and Precision Medicine Challenge faced considerable disruption as described above, a process evaluation of the Challenge also reported positive wider effects in the form of increased capacity and profile for whole genome sequencing; new tools developed by some of the Digital Innovation Hubs to support the pandemic response; and the use of more virtual and flexible diagnostic services.[144] The Commercialising Quantum Technologies Challenge also saw process improvements during the Covid-19 pandemic by pivoting to virtual environments. For example, the 2020 UK National Quantum Technologies Showcase, which was delivered online due to Covid-19 related restrictions, was attended by over 1,200 people.[145]

Some Challenges provide examples of flexible and agile programme governance. Evidence from Challenge-level process evaluation reports highlights the Next Generation Services Challenge and the Transforming Food Production Challenge as notable examples in this respect (see Box 8).

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[137] D2EDPM Process Evaluation Report.; DSBD Process Evaluation Report.; "Wave 2 Validation Workshop"; "Wave 3 Validation Workshop."

[138] DSBD Process Evaluation Report.

[139] D2EDPM Process Evaluation Report.

[140] SSPP Process Evaluation Report.

[141] NGS Process Evaluation Report.

[142] CQT Process Evaluation Report.

[143] DSBD Process Evaluation Report.

[144] D2EDPM Process Evaluation Report.

[145] CQT Process Evaluation Report.

Box 8: Agile governance – illustrative examples from Challenges

- **Next Generation Services:**

In the case of the Next Generation Services Challenge, flexibility was built-into the programme through a decision to hold back programme funding to support waves of activity based on the emerging insights and opportunities as identified through project monitoring and feedback loops embedded throughout the programme's governance. For example, in response to the low number of data access related applications to the Challenge's CR&D competition, the second wave of Challenge funding included a strand specifically designed to encourage data access projects, thereby addressing the stated need within the business case for activity to support data access activities.[146]

- **Transforming Food Production:**

The Transforming Food Production Challenge was also highlighted as an example of an agile and evolving programme. Here, the Challenge has been implemented in two overarching phases, providing opportunities to incorporate learning from phase one into phase two. This enabled phase two to develop a better focused and more impactful programme focusing on three areas: targeting the barriers that hinder R&D progression within project activity, embedding knowledge exchange practices and mechanisms within project activity, and prioritising practitioner engagement explicitly in projects. The Challenge has also demonstrated flexibility in reallocating funding between strands of the programme in response to emerging learnings, needs and priorities.[147]

In some ways, however, funding structures have served to restrict agile governance. For example, process evaluations of the Faraday Battery Challenge and the Medicines Manufacturing Challenge found that the degree to which funds could be moved or reallocated across funding strands within these programmes was limited due to the timing and nature of the different strands and the fact that funding had already been committed.[148] The fact that both these Challenges involved significant capital investment elements is worth noting here; such programmes being less suited to agile or flexible approaches. More broadly, the practice of recovering underspent funds from the Challenges was also seen by some Challenge-level stakeholders to have reduced scope for flexibility and 'testing and learning' approaches.[149]

[146] NGS Process Evaluation Report.

[147] TFP Process Evaluation Report.

[148] FBC Process Evaluation Report.; MM Process Evaluation Report.

[149] "Wave 3 Validation Workshop."

3.2 Processes

3.2.1 Call and application processes

Evaluation question:

- To what extent are processes such as the application processes and post-award monitoring processes appropriate and proportionate?

Summary findings:

- Challenge call and application processes have generally been appropriate and led to a good number of high-quality and relevant applications.
- There have been some limitations in terms of engagement of wider stakeholders, including newer, smaller businesses and those not previously engaged in UKRI and Innovate UK networks.
- Measures aimed at overcoming such limitations in the future may include leveraging of existing sectoral networks and associations to raise awareness of Challenge competitions, the future provision of bid support to help more inexperienced stakeholders through the application process and longer application timeframes. See recommendations in Section 3.5.

Challenge call and application processes have generally been appropriate, leading to a good number of high-quality and relevant applications. Challenges have employed a wide range of call and outreach activities to promote funding competitions. Across Challenges, this has included briefing events, webinars, promotion through Innovate UK and the KTN, attendance at external industry and academic conferences and advertisements in recognised trade publications.[150] Several Challenge process evaluations highlight the role of existing sectoral networks and associations as an important factor in raising awareness of Challenge funding opportunities to relevant stakeholders (see Box 9 for illustrative examples).[151] Challenge application processes have typically used well-established Research Council or Innovate UK processes, with most Challenges also incorporating additional features to ensure the relevance of applications.[152] Most Challenges-level evaluation reports provide evidence of these processes leading to a good number of high-quality and relevant applications. [153] In some cases, there are also examples of outreach to new audiences.[154] In the case of the Audience of the Future Challenge, for example, a survey of Production Innovation in Immersive Content, Design Foundations, and Investment Accelerator applicants found that around 35% of successful and unsuccessful businesses had not previously sought Innovate UK funding (though, it was also noted, this may reflect the high proportion of creative sector applicants, this being a sector not generally targeted by previous Innovate UK competitions).[155]

[150] AOTF Process Evaluation Report.; CQT Process Evaluation Report.; D2EDPM Process Evaluation Report.; DSBD Process Evaluation Report.; FBC Process Evaluation Report.; IDC Process Evaluation Report.; MM Process Evaluation Report.; NGS Process Evaluation Report.; PFER Process Evaluation Report.; RSW Process Evaluation Report.; SSPP Process Evaluation Report.; TCC Process Evaluation Report.; TFP Process Evaluation Report.; TFI Process Evaluation Report.

[151] AOTF Process Evaluation Report.; DSBD Process Evaluation Report.; SSPP Process Evaluation Report.

[152] RSW Process Evaluation Report.; FBC Process Evaluation Report.; PFER Process Evaluation Report.; AOTF Process Evaluation Report.

[153] MM Process Evaluation Report.; FBC Process Evaluation Report.; CQT Process Evaluation Report.; DSBD Process Evaluation Report.; AOTF Process Evaluation Report.; IDC Process Evaluation Report.

[154] AOTF Process Evaluation Report.; TFI Process Evaluation Report.; "Wave 2 Validation Workshop,".

[155] AOTF Process Evaluation Report.

Box 9: Challenge marketing and outreach activities – illustrative examples from Challenges

- **Faraday Battery:**

Faraday Battery Challenge CR&D competitions were promoted through regional briefing events supported by the Knowledge Transfer Network (KTN). The Round 3 funding competition was also announced by the Prime Minister at the Zero Emissions Vehicle Conference in 2018. The Challenge's Faraday Institution, which provided funding opportunities to higher education institutions with battery R&D capabilities, also undertook a range of promotional activities, including regional workshops, targeted communications at both academic and industrial communities, and engaging with the Engineering and Physical Sciences Research Council (EPSRC) to publicise research calls.[156]

- **Audience of the Future:**

The Audience of the Future Challenge drew on existing networks such as the Knowledge Transfer Network and Immerse UK to engage potential applicants to the programme. The outreach included webinars delivered to support further engagement with interested potential participants. The Challenge was also active in promoting the programme across the UK, with in-person briefing events held in Northern Ireland, Scotland, and across multiple cities in England.[157]

- **Digital Security by Design:**

The Digital Security by Design's outreach activities included: scoping and launch workshops to present the Challenge rationale and vision to businesses, academics and wider stakeholders, use of KTN channels, production of webinars and recordings, marketing emails and participation in conferences relevant to digital security.[158]

However, there have been some limitations in terms of engagement of wider stakeholders, including newer, smaller businesses and those not previously engaged in UKRI and Innovate UK networks. A tendency for call and application processes to favour well-disposed applicants – and barriers to wider stakeholder engagement – is a theme surfaced across many Challenge process evaluations, and reinforced by consultations with fund and Challenge-level stakeholders. Specific issues highlighted include:

- Limited exposure of Challenges to audiences not previously engaged in UKRI and Innovate UK networks.[159] For example, while the Smart Sustainable Plastic Packaging Challenge made use of existing networks and membership organisations to promote funding competitions, these events were generally found to attract organisations that had a relationship with UKRI, Innovate UK, the KTN or the UK Circular Plastics Network (CPN).[160]

- A tendency for application processes to favour larger, more well-resourced organisations and/or previous recipients of Innovate UK funding.[161] For example, the process of applying to the Transforming Construction Challenge's CR&D competitions was found to be resource intensive, with this having the potential to disincentivise engagement. Stakeholders also highlighted an over-reliance on standardised application templates, with the language used not necessarily appropriate to projects. This was felt to create an uneven playing field that benefited larger and more experienced organisations and those that could afford professional support (e.g. grant application

[156] FBC Process Evaluation Report.

[157] AOTF Process Evaluation Report.

[158] DSBD Process Evaluation Report.

[159] MM Process Evaluation Report.; FBC Process Evaluation Report.; SSPP Process Evaluation Report.

[160] SSPP Process Evaluation Report.

[161] FBC Process Evaluation Report.; RSW Process Evaluation Report.; TCC Process Evaluation Report.; TFP Process Evaluation Report.; TFI Process Evaluation Report.; SSPP Process Evaluation Report.; "Wave 2 Validation Workshop"; "Wave 3 Validation Workshop."

support). Feedback also suggested that a clearly signposted 'bid support' function would have been helpful for those new to grant applications, including small business. [162]

- An orientation towards certain sectors.[163] For example, consultations with applicants to the Faraday Battery Challenge suggested that the language used in competition documents was oriented towards the automotive and chemicals sector, which may have created a barrier to engagement of wider stakeholders.[164]

Application timeframes have also created some issues. Issues highlighted by individual Challenge process evaluations include: a lack of alignment between application timelines academic calendars (with some competitions run at busy periods)[165] and tight timeframes in view of application requirements.[166] In some cases, Challenge process evaluations suggested that tight timeframes may have impacted on the number of applications compared to expectations[167] and even lower-than-expected quality of applications.[168]

3.2.2 Monitoring processes

Evaluation question:

- To what extent are processes, such as the application processes and post-award monitoring processes appropriate and proportionate?

Summary findings:

- Fund-level performance monitoring processes have evolved over the lifespan of the ISCF.
- The fund-level requirement for Challenge benefits realisation plans has improved tracking of Challenge impacts but its post-hoc implementation has created issues for Challenge programme teams and Challenge evaluators.
- Challenge monitoring processes have generally been fit for purpose, enabling Challenge boards and programme teams to track progress against programme milestones, ensure delivery to budget, and respond to delivery or performance issues.
- Across Challenges, various areas for improvement of monitoring processes have been highlighted, including strengthening bespoke programme monitoring requirements, greater centralisation and coordination of Challenge monitoring processes, and more emphasis on active relationship-building with projects.
- More consideration to fund-level monitoring processes during the design stage would help to avoid issues related to the implementation of monitoring systems in parallel to delivery. The appropriate balance between standard fund-level processes and more bespoke Challenge processes should be considered as part of upfront planning. See recommendations in Section 3.5.

Fund-level performance monitoring processes have evolved considerably over the lifespan of the ISCF. From the inception of Fund through to late 2019, fund-level performance monitoring comprised basic monitoring information with limited linkage to decision-making.[169] During this early period, performance monitoring was largely input-focused and relied heavily on systems inherited from Innovate

[162] TCC Process Evaluation Report.

[163] FBC Process Evaluation Report.

[164] FBC Process Evaluation Report.

[165] TCC Process Evaluation Report.

[166] MM Process Evaluation Report.; FBC Process Evaluation Report.; RSW Process Evaluation Report.; TFP Process Evaluation Report.; TFI Process Evaluation Report.; SSPP Process Evaluation Report.

[167] MM Process Evaluation Report.; RSW Process Evaluation Report.

[168] FBC Process Evaluation Report.

[169] Int_08; Int_01.

UK and the Research Councils for which the relevant data needed to be compiled manually by Challenge teams, at times resulting in incomplete and untimely management information.[170] In its 2020 review of UKRI's management of the ISCF, the National Audit Office (NAO) identified a need to refocus performance monitoring processes to better account for impact.[171]

From late 2019 onwards, a series of initiatives have contributed to the development of the performance monitoring system, with some of these having commenced prior to the NAO's report. Key initiatives have included:

- **Establishment of Challenge-level benefits management documentation**: Led by the ISCF Portfolio Benefits Lead, UKRI have worked with Challenges to establish Challenge benefits realisation plans. The aim of this exercise is to articulate the specific anticipated impacts of each Challenge, with the accompanying plans specifying the data that will be collected to evidence these impacts. As well as encouraging Challenges to be clear about what they are expecting to achieve, this has provided a basis for fund-level monitoring of Challenges progress over time, going beyond existing reporting mechanisms such as Innovate UK project monitoring data and project completion forms (PCFs).[172]
- **Improved performance monitoring against ISCF objectives**: UKRI has also developed new methodologies for monitoring progress against the ISCF fund-level objectives. This has focused on metrics for objectives 1-4 (business R&D investment, multidisciplinary collaboration, business-academic collaboration, and diverse business collaboration), with objective 5 (overseas investment) considered not yet suitable for measurement.[173]
- **Development of data infrastructure**: UKRI has also invested in the establishment of the 'Delphi' engine. Delphi is a data infrastructure drawing together disparate data sources – including grant data, Innovate UK project monitoring data, PCF data, co-investment data, Challenge-level benefits data and wider sectoral data – into a suite of dashboards providing an overarching view on the performance of the ISCF.[174]

Underpinned by these initiatives, fund-level performance monitoring has developed into an increasingly sophisticated function capable of producing dynamic portfolio-level analysis. Performance monitoring data is relayed to ISCF and broader UKRI governance structures through regular reporting such as the quarterly portfolio performance and monitoring reports, annual co-investment reporting and balanced scorecard and annual reports. [175] More specific analysis of monitoring data has also been conducted in response to one-off requests from the Steering Board and other BEIS and HM Treasury stakeholders.[176] Interviews with fund-level stakeholders highlight several factors that have supported the evolution of the fund-level monitoring system, including trust, autonomy to develop the necessary infrastructure (and to pilot different approaches) and fund leadership buy-in for monitoring functions.[177]

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[170] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund"; "Wave 2 Validation Workshop."

[171] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund."

[172] Int_08.

[173] UKRI, "Industrial Strategy Challenge Fund Q1 FY22/23 - Portfolio Performance Report."

[174] Int_08.

[175] Int_08.

[176] Int_01; Int_08.

[177] Int_08.

While improving the ability of the fund to monitor Challenge impacts, the post-hoc establishment of Challenge benefits realisation plans has also created some issues for Challenge programme teams and Challenge evaluators. Issues highlighted by Challenge process reports and Challenge-level workshops include the limited support to Challenges for the development of benefits plans,[178] a lack of clarity regarding the reasons for collecting the additional data, and a perceived potential for duplication of evaluation activities.[179] For earlier Challenges (i.e. Wave 1 and Wave 2 Challenges), there were also some difficulties in terms of the timing of the introduction of benefits realisation plans – this being done at a time when projects had already started, making it difficult to baseline benefit metrics, and at a time when Challenge evaluation teams were already in the process of reaching out to projects for information.[180]

Challenge monitoring processes have generally been fit for purpose. At the Challenge-level, monitoring has typically employed standard Innovate UK and Research Council) monitoring processes**.** Standard features of monitoring across Challenges have included Innovate UK financial monitoring, the assignment of Innovate UK monitoring officers to projects and submission of PCFs.[181] Designated impact and performance managers within programme teams have played a key role in co-ordinating Challenge-level monitoring activities, as well as the implementation of benefits plans. Evidence from across Challenge-level process evaluation reports indicates that monitoring processes have been robust and effective, enabling Challenge boards and programme teams to track progress against programme milestones, ensure delivery to budget, and respond to delivery or performance issues.[182] The key role of Innovate UK monitoring officers in relationship building with projects was highlighted by several Challenge-level process reports and in workshops with Challenge-level stakeholders.[183] Moreover, some Challenges have demonstrated the value of 'active management' of projects – going beyond the role of the Innovate UK monitoring officer – with a view to understanding progress and identifying potential support needs.[184] Across Challenges, this function has been performed variously by designated relationship managers, innovation leads and impact and performance managers. Box 10 provides examples from Challenges.

[178] Int_15; "Wave 2 Validation Workshop."

[179] "Wave 3 Validation Workshop"; IDC Process Evaluation Report.

[180] "Wave 2 Validation Workshop."

[181] MM Process Evaluation Report.; TFP Process Evaluation Report.; FBC Process Evaluation Report.; PFER Process Evaluation Report.

[182] TFP Process Evaluation Report.; NGS Process Evaluation Report.; D2EDPM Process Evaluation Report.; TFP Process Evaluation Report.; PFER Process Evaluation Report.; CQT Process Evaluation Report.; DSBD Process Evaluation Report.; MM Process Evaluation Report.; IDC Process Evaluation Report.; TFI Process Evaluation Report.; SSPP Process Evaluation Report.

[183] TCC Process Evaluation Report.; CQT Process Evaluation Report.; SSPP Process Evaluation Report.; NGS Process Evaluation Report.; "Wave 2 Validation Workshop."; "Wave 3 Validation Workshop."

[184] AOTF Process Evaluation Report.; CQT Process Evaluation Report.; SSPP Process Evaluation Report.; "Wave 2 Validation Workshop."

Box 10: Monitoring through active management – illustrative examples from Challenges

- **Audience of the Future:**

For its Investment Accelerator strand, the Audience of the Future Challenge established 'relationship managers' to provide a direct link between the programme and the projects. Relationship managers had regular meetings with projects covering all aspects of projects including progress against objectives, operational challenges and mitigating strategies. Relationship managers also took a lead in the collection of data from their projects to feed into Challenge-level benefits monitoring and maintained a dialogue with Innovate UK monitoring officers regarding the status of projects.[185]

- **Commercialising Quantum Technologies:**

The Commercialising Quantum Technologies Challenge established strong relationships between Innovation Leads and projects which proved beneficial for project monitoring, providing an additional layer of reflection and insight on project performance. Such relationships helped programme team to identify and respond to delivery or performance issues affecting the projects in a prompt and effective manner.[186]

- **Smart Sustainable Plastic Packaging:**

The Smart Sustainable Plastic Packaging Challenge adopted a proactive approach to project management focusing on the cultivation of relationships between monitoring officers, Innovation Leads and project leads. This 'relationship management' helped to establish a deeper understanding of individual projects and enabled earlier identification of delivery issues or concerns with underperformance.[187]

Across Challenges, process evaluation reports highlight various areas for improvement of monitoring processes. These include:

- **Strengthening bespoke monitoring requirements**: While examples of bespoke monitoring exist, several Challenge-level process evaluation reports highlight the potential for strengthened monitoring requirements to better suit specific Challenge objectives and provide more oversight of emerging project impacts.[188] For example, a process evaluation of the Commercialising Quantum Technologies Challenge found that existing monitoring arrangements provided limited structured data on the extent to which the programme is on track to deliver its intended impacts.[189] Notably, the requirement to establish and monitor progress against benefits realisation plans has encouraged the collection of more tailored monitoring data by Challenge programme teams.
- **Greater centralisation and coordination of Challenge monitoring processes**: in several cases, Challenge-level process evaluation reports observe that monitoring processes have remained siloed – for example by funder (i.e. separate Innovate UK and Research Council monitoring platforms) or by programme strand – with limited mechanisms in place to facilitate a holistic programme-level view. In the case of the Faraday Battery Challenge, for example, project monitoring officers had only limited awareness of activities in other programme strands.[190] Greater alignment and coordination of monitoring processes would help to identify opportunities and risks across Challenge strands while also improving the consistency and efficiency of monitoring processes.[191]

[185] AOTF Process Evaluation Report.; "Wave 2 Validation Workshop,"

[186] CQT Process Evaluation Report.

[187] SSPP Process Evaluation Report.

[188] FBC Process Evaluation Report.; CQT Process Evaluation Report.; MM Process Evaluation Report.; RSW Process Evaluation Report.; IDC Process Evaluation Report.; TFI Process Evaluation Report.; SSPP Process Evaluation Report.

[189] CQT Process Evaluation Report.

[190] FBC Process Evaluation Report.

[191] NGS Process Evaluation Report.; FBC Process Evaluation Report.; MM Process Evaluation Report.

- **More emphasis on relationship-building with projects**: in recognition of the importance of relationships between programme team and projects (and as demonstrated by good practice examples (see Box 10), Challenge-level process evaluation reports highlight the need to ensure sufficient resources to support more direct relationship-building between programme and project teams, with this being reinforced by workshops with Challenge-level stakeholders.[192] For Challenges with a large number of projects, such relationship-building may be focused on specific strands projects deemed to benefit most from more active support and engagement.

The roll-out of Innovate UK's broader impact management framework may have implications for fund and Challenge-level monitoring moving forward. According to fund-level stakeholders, the need to ensure alignment between ISCF monitoring and the broader Innovate UK impact management framework (currently being established) has at times slowed down the development of the fund-level monitoring system.[193] Moreover, Challenge-level stakeholders highlight that consultation on the framework has thus far provided limited opportunities for input from Challenge teams, creating a risk that the framework (and associated metrics) will be of limited relevance to the Challenges. [194]

[192] NGS Process Evaluation Report.; CQT Process Evaluation Report.; TCC Process Evaluation Report.; "Wave 2 Validation Workshop,".

[193] Int_08.

[194] Int_15; "Wave 2 Validation Workshop."

3.3 Coherence and coordination

3.3.1 Intra-Challenge coherence and coordination

Evaluation questions:

- How has the ISCF ensured that projects within the Challenges complement each other and do not come into conflict?

Summary findings:

- Within Challenges, funding strands have been designed with a view to complementarity and coherence. There are also some examples where coordination and cross-fertilisation has been facilitated.
- Overall, however, efforts to maximise intra-Challenge coordination and synergies have been limited.
- Challenge-level process evaluation reports highlight various approaches through which cross-strand fertilisation might have been strengthened, including calls for proposals directed at past participants, weighting proposal evaluation criteria to consider alignment to other funding strands, and a greater emphasis on cross-strand networking. See recommendations in Section 3.5.

Within Challenges, funding strands have been designed with a view to complementarity and coherence (see Section 2.2.3). **There are also several examples where coordination and cross-fertilisation between Challenge strands has been facilitated.**[195] One notable way in which this has been achieved has been through staged competitions providing opportunities for the progression of participants between different strands. Box 11 provides examples of intra-Challenge coordination and cross-pollination.

[195] NGS Process Evaluation Report.; PFER Process Evaluation Report.; CQT Process Evaluation Report.; TCC Process Evaluation Report.; TFP Process Evaluation Report.; IDC Process Evaluation Report.; TFI Process Evaluation Report.

Box 11: Coordination and cross-fertilisation across funding strands – illustrative examples from Challenges

- **Next Generation Services:**

As well as being complimentary in their areas of focus, the timing of the strands of the Next Generation Services was set-up to facilitate potential progression of participants from the smaller-scale feasibility studies germinator projects to larger-scale CR&D activities. The approach has led to some overlap in programme participants. There is also evidence of broader coordination between programme strands, with Data Access projects also drawing on participants from a separate innovation lab and the AI for Services network playing a role in connecting participants across different Challenge strands.[196]

- **Prospering from the Energy Revolution:**

The set-up and timing of funding strands for the Prospering from the Energy Revolution Challenge has also facilitated cross-pollination and coordination across strands. For example, several participants within its Concepts and Future Designs strand subsequently received follow-on funding under the Detailed Designs strand. Detailed Designs projects were also selected in part for being complementary to four demonstrator projects funded under the Challenge. The Challenge's Innovation Accelerator has provided funding to projects to support development of the technology components and enhancing the commercialisation of projects developed under other programme strands.[197]

- **Transforming Construction:**

In addition to good formal links between the core programme governance structures and its Active Building Centre and Construction Innovation Hub strands, the Transforming Construction Challenge also saw the development of informal engagements between specific projects and workstreams across strands where synergies existed. Indeed, in response to a survey, **m**ore than half of respondents reported engaging with more than one strand of the Challenge.[198]

- **Commercialising Quantum Technologies:**

The funding strands of the Commercialising Quantum Technologies Challenge have been set up in a staged manner to facilitate progression of participants across strands. This has allowed for progression of projects from small-scale Feasibility Studies and Germinator Projects to larger-scale CR&D activities. There has also been some evidence of wider cross-pollination between the strands. However, this has in large part been driven by the small size of the sector and the subsequent overlap in participants across projects.[199]

Notwithstanding these examples, several Challenge-level process evaluations identified the potential for more concerted efforts to maximise coordination within Challenges, highlighting potential benefits in terms of cross-project learning, knowledge exchange and building synergies across projects.[200]Challenge-level reports also highlight various approaches through which cross-strand fertilisation might have been strengthened**.** In addition to the sequential staging of funding strands to support progression of participants (see Section 2.2.3), these include issuing of specific calls for proposals directed at past participants, weighting proposal evaluation criteria to consider alignment to other funding strands, and, a greater emphasis on events and networking to bring participants from different strands together.[201] In some cases, opportunities for cross-strand collaboration has been limited by wider factors. For example, engagement and collaboration between Industrial Decarbonisation Challenge clusters and projects has been negatively impacted by the ongoing implementation of the BEIS Cluster Sequencing process, to which many projects have also submitted bids. The latter includes stipulations relating to

[196] NGS Process Evaluation Report.

[197] PFER Process Evaluation Report.

[198] TCC Process Evaluation Report.

[199] CQT Process Evaluation Report.

[200] RSW Process Evaluation Report.; MM Process Evaluation Report.; AOTF Process Evaluation Report.; PFER Process Evaluation Report.; TFP Process Evaluation Report.; IDC Process Evaluation Report.; TFI Process Evaluation Report.; TCC Process Evaluation Report.; CQT Process Evaluation Report.

[201] AOTF Process Evaluation Report.; CQT Process Evaluation Report.; RSW Process Evaluation Report.

confidentiality and restrictions on the sharing of commercially sensitive information, thereby limiting the capacity of projects to engage with each other.[202]

3.3.1 Cross-Challenge coherence and coordination

Evaluation questions:

- How has the ISCF ensured that projects within the Challenges complement each other and do not come into conflict?

Summary findings:

- Formal and informal channels have been used to share learning and facilitate cross-fertilisation across Challenges, with CDs playing a key role.
- Additional mechanisms, for example learning platforms or groups centred around specific clusters of Challenges could be beneficial in further maximising opportunities for cross-Challenge learning and identifying opportunities for synergy.

Formal and informal channels have been used to share learning and facilitate cross-fertilisation across Challenges, with CDs playing a key role. The formal channels for cross-Challenge exchange and learning were the monthly meeting held by CDs, with deputy CDs playing an important supporting role in this process.[203] Beyond these formal cross-Challenge learning activities, the more impactful and fruitful cross-Challenge fertilisation opportunities took place through informal and ad-hoc channels.[204] There are several examples of informal interactions generating learning and cross-fertilisation opportunities. One is the National Centre for Nuclear Robotics (NCNR) Hub, funded under the Robotics for a Safer World Challenge. The Hub's Principal Investigator was involved in a funded project on the recycling of batteries through the Faraday Institute within the ISCF Faraday Battery Challenge. The project demonstrated how their approach to manipulation capabilities for nuclear decommissioning could be transferred to robotic disassembly of electric vehicle (EV) Lithium-ion batteries, illustrating how new cross-Challenge learning opportunities can generate new impact pathways, and highlighting the key role that Challenge and research group leaders can play in generating and facilitating these learning opportunities.[205] Another example of cross-Challenge pollination and learning is the innovation accelerator which was run by Audience of the Future Challenge which was subsequently also adopted by the Healthy Ageing Challenge after CD-facilitated cross-Challenge learning.[206]

While cross-fertilisation across Challenges has not been a stated objective of ISCF or of individual Challenges, additional mechanisms for supporting cross-Challenge learning, such as learning groups and platforms, would be beneficial in maximising opportunities for cross-Challenge learning and identifying opportunities for synergy. Indeed, while examples of cross-fertilisation between Challenges exist (as described above), in general, formal mechanisms to support cross-Challenge exchange have been mostly restricted to process learnings, e.g. exchanges between CDs regarding how to navigate ISCF processes. The lack of wider formal opportunities for cross-Challenge exchange have been described as a 'missed opportunity' to maximise synergies between and across projects and Challenges, with these shortcomings largely attributed to time and resource constraints (reflecting the lack of emphasis on

[202] IDC Process Evaluation Report.

[203] "Wave 2 Validation Workshop,"; "Wave 3 Validation Workshop."

[204] "Wave 2 Validation Workshop."

[205] RSW Process Evaluation Report.

[206] "Wave 2 Validation Workshop."

cross-Challenge exchange within ISCF).[207] Suggestions to increase cross-Challenge learning include the establishment of learning platforms or groups centred around specific clusters of Challenges working in similar fields.[208]

3.4 Equality, diversity and inclusion (EDI)

EDI has been an organisational priority for UKRI since its inception in 2018 and has culminated in the development of an EDI strategy in September 2020, which is part of its People, Culture and Talent portfolio. Preceding the strategy are various practices and processes across the research councils and Innovate UK to promote EDI.

The ISCF, which is a significant investment of public funds, is especially concerned with ensuring that its processes enable and embed cultural awareness and better EDI processes across the Challenges and projects. The ISCF aims to not only further research, innovation and contribute to a strong economy, but also aspires to ensure that its funding supports EDI in the broadest sense. For the context of this report, we consider EDI to encompass regional/geographic parity, gender and ethnicity, and size of the organisations involved in ISCF given the focus of ISCF, its EDI strategy, and the monitoring metrics set out.

The sections below reflect on the establishment and evolution of processes for EDI focus and data capture within ISCF against the backdrop of broader organisational change across Innovate UK and UKRI. In addition, the sections detail some of the relevant findings from the EDI reports commissioned by UKRI to capture the diversity of the broader sectors within which the Challenges are situated.

[207] "Wave 3 Validation Workshop."

[208] Int_15.

3.4.1 Approach to ensuring diversity in terms of gender and ethnicity

Evaluation question:

- How did the ISCF ensure diversity among participants, especially in regard to gender and ethnicity?

Summary findings:

- At the inception of the ISCF, there were no formal processes nor mechanisms to actively promote or consider gender and ethnicity at the business case, application and award stage or during implementation and delivery of Challenges and projects.
- The development of Wave 3 signalled a turning point for further development and awareness of EDI within the ISCF, with various external factors like the political will, civil unrest and increasing scrutiny by the government and the public, playing a role.
- Levers for driving the strategy forward were limited and required alignment of the ISCF and Innovate UK approaches to get leadership buy in, however the pandemic created a lack of appetite to formalise any asks of the Challenges. Thus, operationalisation of the EDI is being driven through creating buy in through PMO rather than formal requirements.
- Data collection has been problematic due to lack of upfront processes and levers in place and internal data collection efforts have focussed on capturing internal ISCF staff make up through quarterly reporting, making it challenging to assess EDI progress across the Challenges.
- ISCF has commissioned external data collection on EDI to provide a lay of the land of the ISCF sectors and Challenges which have raised further challenges that need to be overcome. Having EDI considered at the start in business cases with a budget to support activities, and developing clear benefits and monitoring metrics linked to it could mitigate against the challenges experienced in data capture and slim resources associated. See recommendations in Section 3.5.

At the inception of the ISCF, there were no formal processes nor mechanisms to actively promote or consider gender and ethnicity at the business case, application and award stage or during implementation and delivery of Challenges and projects. The only requirement for EDI was the inclusion of the Public Sector Equality section in the BEIS business cases which was populated using boilerplate text. This requirement was non-committal and was maintained as a feature across the three waves. Although there was no top-down mandate or strategy for EDI, EDI activities, such as hosting events and talks acknowledging EDI challenges in respective sectors and creative inclusive solutions, etc., did occur in Wave 1 and 2 Challenges in an ad-hoc manner, driven primarily by Challenge teams and by the nature of projects supported by certain Challenges.[209]

The development of Wave 3 signalled a turning point for further development and awareness of EDI within the ISCF, with various external factors playing a role. Drivers of the change included increasing political awareness of EDI and an inclination to address gender parity and other diversity measures across the public funded functions; internal reflection in Innovate UK and ISCF on the gender balance of the Challenge Directors was another factor that propelled the agenda forward. In addition, external events such as Black Lives Matter, increasing public and government scrutiny and awareness of equity created an acute awareness around EDI. Lastly, the increase in personnel from tens to hundreds, marking an influx of diverse perspectives, created the critical mix of factors to catalyse the EDI agenda from a conversation to a formalised strategy, which was launched in September 2020.[210] The changes within the ISCF structures were initiated through training on EDI for programme management for all Challenge teams (programme managers, administrative staff, and CDs) as well as other governance roles in the PMO,

[209] Int_07; D2EDPM Process Evaluation Report.; "Wave 3 Validation Workshop."

[210] Int_07.

in late 2019. The training was the start of a range of EDI measures pursued by senior management. Following the training there was an emphasis on moving beyond learning to delivering activity within the ISCF Challenges that could contribute to diversity.[211]

Levers for driving EDI forward were limited and required alignment of ISCF and Innovate UK approaches to get leadership buy in. Teams in place across Innovate UK and ISCF Challenges responsible for EDI, had not engaged on their respective EDI ambitions and plans. This eventually occurred and connecting these opportunities presented a stronger case for the ISCF leadership to agree on the formalisation of an EDI strategy. Although CDs were largely supportive of this, there was some resistance on the ask of the Challenges and the timings of the ask, due to it being a challenging time for the fund and the Challenges, primarily caused by the pandemic as well as the asks coming too late and seeming like a retrofit.[212] Therefore, although approved with buy in from all Challenges, the strategy was not accompanied by a formulaic or rigid operationalisation and monitoring plan given the lack of appetite to create too many asks of the Challenges.

Operationalisation of EDI is therefore being driven through creating buy in rather than formal requirements. Wave 1 and 2 of the fund preceded the ISCF EDI strategy, however Wave 3 business cases were at various stages of development. This presented an opportunity for the strategy to be fed into some of the business cases and delivery plans. However, for the majority of the Challenges, the only requirement was for an equality impact assessment to be carried out. The strategy was not operationalised in a manner that mirrored the ambitions outlined and had to be driven forward by light touch and engaging measures by providing support, training, and conducting impact assessments. This was due to multiple reasons such as lack of resourcing, recruitment freeze, and pandemic response as a priority. The delivery of the EDI vision and embedding of the culture is being driven by leadership and managers who are naturally invested in EDI.[213] For instance, those interested in EDI were recruited onto an advocates programme, meeting every month to support the strategy objectives.

A new EDI governance structure is also being developed across the organisation; a steering board and an advisory group, catalysed through an IUK restructure where their EDI remit is broader than ISCF.[214] ISCF Challenges have been implementing EDI champions to look at equality and impact assessments. It was felt that mechanisms like conducting equality impact assessment are sufficient to bring about change and to engage in a broader conversation without forcing measures in place. Moreover, there is limited capacity and bandwidth in the ISCF and Innovate UK EDI teams to support, facilitate and deliver a multitude of activities hence the onus of engagement and delivery of EDI plans is on the Challenges through creating buy-in for the agenda. However, for some this felt challenging given the lack of guidance on practical aspects of EDI delivery as well as the limited external communication on internal ISCF considerations around EDI.[215]

Data collection has been problematic due to the lack of upfront processes and levers in place and internal data collection efforts have focused on capturing internal ISCF staff make up, meaning it has been challenging to assess EDI progress across the Challenges. Given the lack of a leadership driven mandate, not having EDI considered upfront in the business case and in monitoring plans, EDI data collection from Challenges has been problematic and riddled with gaps and inconsistencies. However,

[211] Int_07.

[212] Int_07; "Wave 2 Validation Workshop."

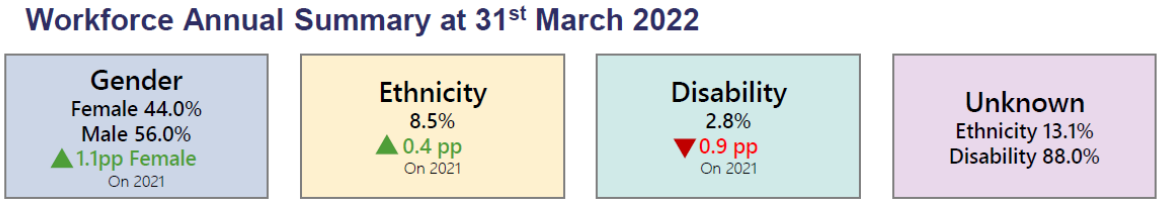
[213] Int_07.

[214] UKRI, "Industrial Strategy Challenge Fund Q1 FY22/23 - Portfolio Performance Report."

[215] "Wave 3 Validation Workshop,"

ISCF has established the precedence for focussing EDI data collection on the internal UKRI ISCF workforce through the quarterly monitoring reports, which has not been seen in any other part of UKRI before. A snapshot view provided by these reports in March 2022 indicated that the number of female employees has increased since 2021, a 1.1 % increase, and is closely aligned with UKRI staff levels at 44.7%. Ethnicity figures have had a slight increase at 8.5% which compares favourably to general UKRI which is at 7%, although not representative of the UK. Disclosure for ethnicity is higher in the fund with 13.1% unknowns compared to 23% at UKRI , however disclosure for disability is lower in ISCF with 88% unknowns compared to 70% at UKRI. Efforts are being made to encourage more employees to voluntarily self-declare their ethnicity/disability. Having an accurate picture of workforce ethnicity/disability will support an assessment of whether improvements in organisational processes bias are translating to an inclusive workforce.

Figure 7: ISCF annual workforce summary (as of March 2022)



Source: UKRI, "Industrial Strategy Challenge Fund Q1 FY22/23 - Portfolio Performance Report."

For some of the Challenges, activities to foster more inclusive EDI practices were more easily incorporated than others. For instance, Challenges like Data to Early Diagnosis and Precision Medicine developed projects to engage with a diverse range of participants and patients and set up their own engagement and involvement processes to facilitate the diversity.[216] There was a drive to do this and collect EDI data for these Challenges given their scope and ambition whereas this was not the case for the majority of the Challenges where data collection and activity generation was done on an ad-hoc or goodwill basis. This was further compounded by a lack of centrally communicated/mandated targets and focus areas.[217]

ISCF has commissioned external data collection on EDI for a lay of the land of ISCF sectors and Challenges which have raised further challenges that need to be overcome. External data collection efforts have been voluntary and ad-hoc through Survey Monkey, which have provided a partial view of Challenge workforce diversity. To generate a fuller view, three research reports were independently commissioned by ISCF highlighting the diversity of the sectors within which Challenges are situated and providing an overview of the Challenges in whether they publish and emphasise EDI in external facing communications. Following receipt of the EDI report on the diversity of the funded projects, an insights paper is currently being developed to be shared with Challenges and the Performance and Monitoring Board.[218]

The externally commissioned reports highlighted the challenges of creating a comprehensive view of the diversity of Challenge sectors due to lack of data capture practices, difficulty in engaging with industries and accessing data, and differences in terminology used. For the desk research capturing publicly available data and data captured through surveys of Challenges, the information was categorised across broad

[216] Int_07.

[217] "Wave 2 Validation Workshop,"; "Wave 3 Validation Workshop,"

[218] UKRI, "Industrial Strategy Challenge Fund Q1 FY22/23 - Portfolio Performance Report."

innovation areas being supported by the ISCF to support broad generalisations and create a more complete view of sectors. The broad categories were:

- STEM Overview
- Health and Biosciences
- Materials and Manufacturing
- Digital and Technology
- Infrastructure
- Creative Industries

It was noted that data for the characteristics of gender and race were more densely collected and reported on across all the sector categories listed above compared to data on gender reassignment, religion and belief, pregnancy and maternity, socioeconomics and sexual orientation.[219] It was felt that more efforts need to be made for sectors across all industries, beyond the statutory requirements, to collect more robust and complete data with regards to gender, ethnicity and other protected characteristics to anticipate workforce trends and to make adequate and appropriate provisions.

The key challenges for ISCF in particular to respond to have been around the wage gaps identified in the sectors by both ethnicity and gender, however UKRI itself has reported a substantive gender pay gap making it potentially challenging to influence external practices in this regard. Standardising EDI terminology (e.g. not using 'BAME'/'BME' or 'non-white') across all industries has also been recommended to reflect national legislation and inform consistency on EDI data capture efforts. It is suggested that ISCF could support this through training and awareness. [220]

[219] "UKRI Commissioned Desk Research on Industry EDI Project Report 1."

[220] "UKRI Commissioned Survey on Challenges EDI Project Report 2." Int_07.

Case study: Exploring good practice in EDI at the Challenge level

While the ISCF aimed to promote EDI practice across Challenges, there was a lack of strategy which was developed in September 2020 through an iterative and organic process, driven primarily through individuals at the Challenge level who have acted as 'agents of change' for EDI. Other sections of this report have documented how EDI awareness and activities have evolved over the course of ISCF. In this case study, we focus specifically on one Challenge – Transforming Foundation Industries (TFI) – that has exemplified good practice with regards to EDI. The case study demonstrates the potential for proactive EDI measures taken at the Challenge level while also illustrating the impact of the fund-level EDI as it has permeated through Challenges.

- **Processes:** TFI EDI processes were formalised, standardised and put into practice in response to ISCF introducing their Wave 3 EDI strategy.[221] Within the Challenge business case, TFI integrated a number of processes to ensure EDI was a priority consideration. For example, rather than having one specific EDI objective, the Challenge had three equality analysis team meetings to make sure that EDI was embedded into all of TFI objectives.[222] This commitment to supporting EDI and its implementation across the Challenge's activities was implemented with the support of the ISCF EDI lead. In response to the ISCF EDI strategy, TFI has also developed a delivery plan, which aims to undertake a number of actions to support the following themes: encouraging talent, developing skillsets, highlighting successes, tackling culture and ensuring inclusive Challenge activities.[223]
- **Activities:** TFI hosts a variety of EDI activities, including a Future Leaders Group Fellowship, supporting the development of under-represented groups with the potential to lead industry in the future.[224] TFI has also implemented a number of support networks aimed at career development and networking for under-represented groups, for example, Women in Materials, Minerals and Mining (WIM3) and Women's Engineering Society (WES). TFI also conducted a 'Women's Leadership Development' programme to fund 80 women in the sector to reach senior and technical positions.[225] The Challenge also takes a targeted approach to recruitment, whereby specific goals are set to on-board from diverse backgrounds. This process, however, did not require a high degree of affirmative influence, due to the fact that the recruitment advertisement was inclusive to diverse backgrounds leading to a highly diverse applicant pool.[226] Importantly, many EDI activities in the TFI Challenge are budgeted, and so create an additional incentive for buy-in.[227]
- **People:** In addition to processes and activities, the people associated with the TFI Challenge are highly informed and fundamentally committed to engaging with EDI.[228] This can be seen throughout all levels of TFI governance, from leadership & governance positions (including their Challenge Director) through to administration personnel.[229] The buy-in from all levels of the Challenge has been key to ensuring that processes and activities do not become 'tick box exercises'.[230]

Key learnings:

- Formalising processes and earmarking a budget to undertake relevant activities and create crucial buy-in for EDI was key to TFI's practice.
- The implementation of an inclusive recruitment advertisement helped to ensure a diverse applicant pool, which in turn increased diversity of the funded projects.
- Integrating EDI as a core, cross-cutting component of the programme as opposed to a separate/standalone workstream.
- The TFI Challenge underscores the importance of ensuring buy-in at all levels of staff from leadership to management, with an innate understanding of what EDI entails and how to represent these considerations across all facets of the work (i.e. from application writing, to event planning, to recruitment strategy).

[221] TFI Process Evaluation Report.

[222] Int_07.

[223] Int_07.

[224] Int_07.

[225] Int_07.

[226] TFI Process Evaluation Report.

[227] Int_07.

[228] Int_07.

[229] Int_07.

[230] Int_07.

3.4.2 Approach to ensuring diversity in terms of range of organisation types

Evaluation question:

- What was the extent of diversity in ISCF awardees and participants in terms of sectors and disciplines involved (e.g. industry, businesses, academia, multidisciplinary etc.)?
- To what extent, and how, has the ISCF reached business, academia, and broader stakeholders across sectors and across disciplines?
- How balanced was the ISCF in selecting the industry it targets (e.g. achieving the balance between selecting small and micro companies and larger companies)?

Summary findings:

- Diversity was viewed by ISCF stakeholders and leadership through varying lenses, and this led to a lack of clarity in scope in terms of what diversity entails. For some this was limited to gender-based characteristics however to some this was also about regional and business sector parity. Considering and defining scope of EDI could be beneficial in maintaining clarity and consistency when developing programmes and setting up monitoring. See Section 3.5 for Recommendations.
- Sector and industry balance was a conscious consideration at the fund-level, in contrast to gender, showing positive trends of engaging with SMEs in Waves 1 and 2.
- The change is co-investment requirements form industry in Wave 3 may have provided some advantage to large organisations and contributed to the dropping rates of SME engagement and funding, however SMEs remained a core recipient of Wave 3 funding.

Diversity was viewed by ISCF stakeholders and leadership through varying lenses, and this led to a lack of clarity in scope in terms of what diversity entails. It appears that the conversations leading up to the development of the EDI strategy and post strategy support has been largely centred on parity of gender, ethnicity and other protected characteristics. It was largely the perception that aspects of diversity such as the size of the business engaged and funded, and geographic location were already addressed in the business cases and well considered in the delivery plans. For instance, there were targeted calls and competitions as well as requirements set out for co-investments that were focused around regions and business size and sectors.[231] Many members of staff at UKRI and Innovate UK felt that regional spread and business size did not really reflect diversity as such because it was already considered in the ISCF funding model.[232] It appears that everyone had their own lens and experience when engaging with the EDI agenda. Given that diversity can mean many things to people, it would be beneficial to consider what it entails for a given programme of work, bearing in mind the public sector equalities duty, to maintain clarity and consistency in the way programmes are funded, implemented and monitored.

Sector and industry balance was a conscious consideration at the fund level. There was an effort to represent a balance of all sectors in most industries, to take advantage of the unique opportunities and challenges within them; collaboration with diverse business is in fact one of the key objectives of ISCF.[233] In selecting certain Challenges for instance, there was a need to make sure that evidence was available to show the market value and need for that given Challenge. This was important to the funding process, as it made sure that industries had evidence to support their narratives when applying for funding.[234]

In terms of achieving a balance of businesses and organisations based on size, the figure below provides a snapshot view from the Q3 2022/2023 portfolio performance and monitoring report, showing the investment in participants with a micro or small sized organisation as a trend over time across the three

[231] Int_07.

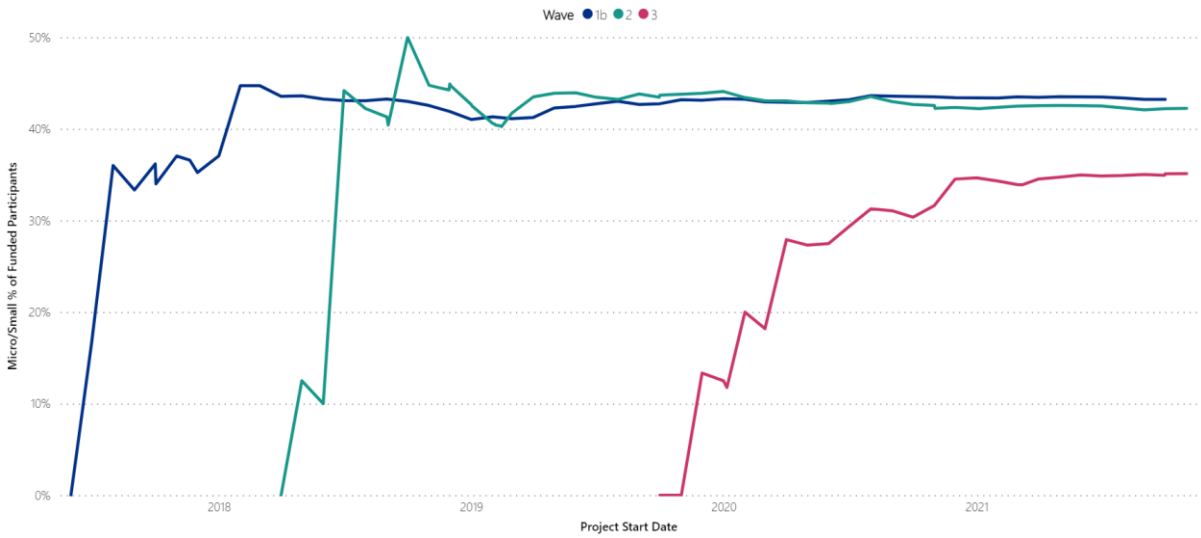
[232] Int_07.

[233] Int_02.

[234] Int_05.

waves. A balanced mix at around 43% was achieved for Waves 1b and 2, whereas the rate of investment in Wave 3 has been slower and is now beginning to plateau at 35%.[235]

Figure 8: ISCF investment in projects with a micro or small sized organisation over time



Source: UKRI, Industrial Strategy Challenge Fund - Q3 FY22/23 - Portfolio Performance Report.

The Q3 2022/2023 portfolio performance and monitoring also presents data collected to evidence the fund-level objectives on multidisciplinary collaboration, business-academic collaboration and diverse business collaboration, which shows that:

- 32%[236] of ISCF grants involved more than one Level 2 Fields of Research under Dimensions;
- 41% of ISCF grants involved at least one business and one academic partner; and
- 33% of ISCF grants involved at least one micro/small/medium business and at least one large business.[237]

Wave 3 requirements for match funding may have proved challenging for SMEs. Small and micro companies accounted for more than 40% of the project awards in the first two Waves. The third funding Wave saw a rapid increase in the proportion of projects awarded to large companies (from 20% to 29%).[238] UKRI compared the size of companies making applications with those receiving funding and found no difference in the distribution.[239] It concluded that there was no evidence of an in-built bias in favour of larger companies during the selection process and that differences are likely due to incentives associated with the funding requirements themselves. The NAO's report on the ISCF proposed several reasons for why smaller companies may have had disincentives to applying. For example, based on a requirement from the Secretary of State for BEIS, UKRI increased the ratio of public to private co-investment from 1:0.45 in

[235] UKRI, "Industrial Strategy Challenge Fund Q1 FY22/23 - Portfolio Performance Report."

[236] Prior to a change in Dimensions field classifications, the proportion of ISCF grants meeting this criterion was 43%. UKRI, "Industrial Strategy Challenge Fund - Q3 FY22/23 - Portfolio Performance Report."

[237] UKRI.

[238] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund."

[239] National Audit Office.

Wave 1 to 1:1.5 in Wave 3. This would have made it more challenging for smaller organisations with smaller budgets to be involved.[240] A couple of other factors were the lengthy application processes which would have been resource intensive for small organisations and the potential lack of awareness of the funding offer from UKRI.[241] However, this is conjecture and has not been tested through engagement with SMEs that didn't apply.

Although there is circumstantial evidence to suggest that the change in match funding requirements may have impacted engagement from smaller organisations, there are examples of UKRI engaging broadly with various sectors and organisations to achieve parity. For instance, the 'deep mining' sector – which featured as one of four main sectors in early programme documentation, is not well represented in the current project portfolio, however consultees suggested that the sector was engaged, but that there either was not the same level of interest, or the quality of bids was not as high as in other sectors.[242] Analysis undertaken by the ISCF study team showed that actors from across Robotics and AI supply chains have also been attracted to the programme and this includes technology and component providers, systems integrators, intermediate companies, and public & private end-users. Further systematic efforts were also made by the programme to involve more end-users to help frame research challenges and to take up project results.[243]

It appears that due to multiple barriers, fewer SMEs applied in Wave 3 compared to Waves 1 and 2, however a large proportion of Wave 3 awardees are SMEs as most SMEs that applied in Wave 3 got funded.[244]

[240] National Audit Office.

[241] National Audit Office; "Wave 3 Validation Workshop."

[242] RSW Process Evaluation Report.

[243] RSW Process Evaluation Report.

[244] "Wave 3 Validation Workshop."

3.4.3 Approach to ensuring diversity in terms of regional spread

Evaluation question:

- How, if at all, did the ISCF contribute to tackling regional inequalities?

Summary findings:

- Despite levelling-up and regional diversity not being the focus of ISCF, funding reflected regional diversity
- The current levels of funding highlight variation across regions driven by Challenge specific areas of focus and existing spread of expertise. All NUTS2 regions have received ISCF funding and some have benefitted from higher amounts of funding relative to their population density.
- Region was not found to be a predictor of success of an application and as such no measures have been put in place to tackle any existing regional inequalities in a targeted or deliberate manner.

Levelling up and regional diversity was not the focus of ISCF, nonetheless funding reflected regional diversity. As with business size and type, regional distribution of funds became more considered within the EDI agenda driven by multiple political agendas such as 'levelling up'. However, regional diversity, or levelling-up was not an explicit ambition of the ISCF when it was established, nevertheless the fund has engaged and funded across diverse regions.[245, 246]

Some of the regional diversity was driven by the nature of the Challenges themselves, for instance, the Creative Cluster Challenge purposively sought out a diverse regional footprint in their nod to the levelling up agenda[247], whilst Driving the Electric Revolution Challenge has targeted different regions due to the various expertise in areas and to capitalise on supply chains.[248] The overall distribution of committed funding at present is shown in the figure below, taken from the Q3 2022/23 portfolio performance and monitoring report, showing that the South-East was funded at 27.3% of the total funds.[249]

[245] "UKRI Commissioned Desk Research on Industry EDI Project Report 1."

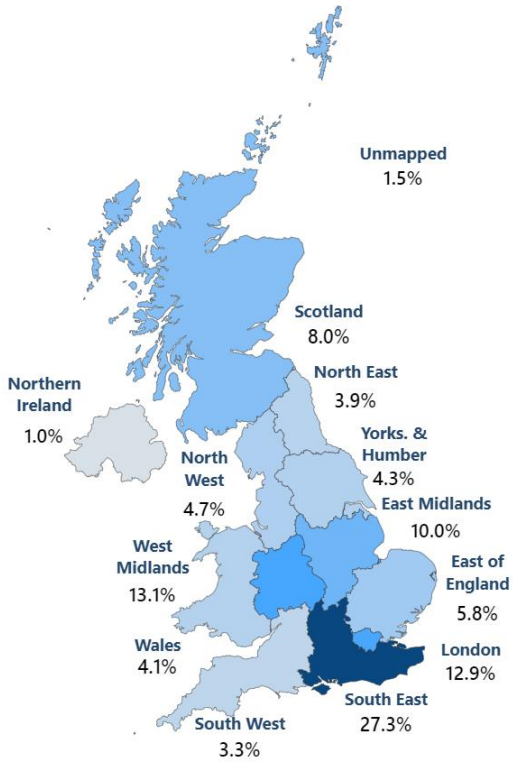
[246] Int_15.

[247] "Wave 2 Validation Workshop."

[248] "Wave 3 Validation Workshop."

[249] UKRI, "Industrial Strategy Challenge Fund Q1 FY22/23 - Portfolio Performance Report."

Figure 9: Overall distribution of ISCF committed funding by region



Source: UKRI, Industrial Strategy Challenge Fund - Q3 FY22/23 - Portfolio Performance Report.

Across all three waves of the ISCF, funding has been allocated within every NUTS 2 region with the highest proportion of funding going to the South East at 27%. Several NUTS 2 regions feature in the top 10 in terms of grant offer / gross value added (GVA) and several NUTS 2 regions with relatively low populations have benefitted from proportionally large amounts of funding.[250]

In comparison to gross domestic expenditure on R&D (GERD), the ISCF has invested a relatively small amount in East England. As the ISCF is an industry-led programme, it is useful to draw comparison against business enterprise expenditure on research and development (BERD): East England accounts for an even greater percentage of business enterprise expenditure on R&D, which ISCF funding under-indexes against.[251] Relative to the number of businesses claiming R&D tax credits, funding has been proportionally large for Scotland, North-East and Wales.[252]

Region is not a factor in predicting success of an application. To analyse the influence of region on an application's success (up until June 2021), Innovate UK analysed its application data. This was a partial analysis based on a sample of the IUK applicants (53%), which accounts for ~85% of all ISCF applications. Direct awards were removed from the data, due to all of these applications being successful. The regional distribution of 2,065 successful participants is aligned with the distribution of 5,650 applicants.[253] The majority of regions' success rates are between 30% and 40%, meaning that generally, an individual participant's region is not a determining factor in terms of whether the application was successful or not. The two exceptions are North East England and Northern Ireland. Statistical tests prove that the higher

[250] UKRI, "ISCF Places Analysis."

[251] UKRI.

[252] UKRI.

[253] UKRI.

North East England success rate is statistically significant but targeted applications building upon the region's strengths in battery technology and robotics is likely the cause.[254] Largely, it appears that region is not a predictor of success of an application and as such no measures have been put in place to tackle any existing regional inequalities in a targeted or deliberate manner.

Box 12: ISCF Places analysis[255] – key findings

- Almost half of Wave 1b funding has been offered in Berkshire, Buckinghamshire and Oxfordshire.
- The top three regions are as follows: Berkshire, Buckinghamshire and Oxfordshire: £431m (48% of Wave 1b); West Midlands: £171m (19% of Wave 1b); Inner London – West: £35m (4% of Wave 1b).[256]
- Compared to Wave 1b, Wave 2 funding has been much more evenly distributed throughout the UK based on the more disperse locations of relevant centres/applicants pertaining to the Challenges.
- The top three regions are as follows: Herefordshire, Worcestershire and Warwickshire: £80m (12% of Wave 2); Inner London - West: £73m (11% of Wave 2); West Wales: £66m (10% of Wave 2).[257]
- Of the Wave 3 funding offered so far, it has also been more evenly distributed throughout the UK, compared to Wave 1, however as mentioned above, this is primarily a reflection of where applicants and relevant centres are located for a given Challenge area.[258] Regional analysis at the IUK and ISCF levels suggests that region is not a factor of application success, the diversity is a by-product of where applicants are located.
- The top three regions are as follows: Surrey, East and West Sussex: £60m (12% of Wave 3); Inner London - West: £54m (11% of Wave 3); East Anglia: £46m (9% of Wave 3).[259]

3.4.4 Broader EDI awareness in the Challenge organisations and issues to overcome

Summary findings:

- Disparate EDI practices are evident across the ISCF Challenge partners with less than 50% explicitly mentioning EDI in their external communications.
- ISCF has generated broader impact on EDI practices across UKRI and BEIS with EDI built into many processes upfront such as business case development.
- Various issues have been surfaced during the evolution of the EDI agenda and strategy development pertaining to upfront planning, resourcing and considering benefits and monitoring, which should be considered at the outset at business planning stage. See recommendations in Section 3.5.

Disparate EDI practices are evident across the ISCF Challenge partners with scope for improvement. Based on the UKRI commissioned work on capture EDI data from the sector and ISCF funded organisations, only 17 organisations of the 50 randomly sampled organisations funded by ISCF explicitly mentioned EDI in their external communications with another 9 having inclusive language (e.g., we support people with disabilities).[260] Given the small number of organisations that externally published their EDI work, further targeted enquiries were made to surface what organisations had not publicly stated

[254] UKRI.

[255] UKRI, "ISCF Places Analysis."

[256] UKRI.

[257] UKRI, "ISCF Places Analysis."

[258] UKRI, "ISCF Places Analysis."

[259] UKRI.

[260] "UKRI Commissioned Report on EDI across ISCF Industry Partners."

or communicated. Some examples include the Academy of Robotics which had no mention of EDI activity on their website, however, their driver-less car project has been used to help deliver medication to older adults isolated from COVID-19, demonstrating a keen interest in creating social value. Similarly, onHand focuses on improving the lives of older people, with the founder winning an Entrepreneur for Good award.[261] The research proposed a number of areas for UKRI to progress with regards to supporting EDI activities in the ISCF funded landscape, which are underpinning some of the EDI recommendations in Chapter 5.

ISCF has generated broader impact on EDI practices across UKRI and BEIS. ISCF practices on EDI, though slow to start, have been paving the way for broader process changes and generating impact across UKRI and BEIS. For instance, a new UKRI technology fund worth £250 million[262] had to undergo the BEIS business case process and because of the reflection of ISCF development and the lessons learned from Wave 3, equality impact assessments are mandatory in the business case development for any new money. This requirement has been made for both Innovate UK and BEIS business case processes. There's also been an introduction of equality analysis in the public sector equality duty section of the BEIS business case template.[263]

Various issues have been surfaced during the evolution of the EDI agenda. Although EDI development has been largely positive across ISCF and has seen buy in at all levels of leadership and management, there are challenges that remain to be overcome. It appears that various organic practices have emerged across UKRI and IUK for EDI without a sense of cohesion in resulting processes, that is now being addressed. IUK is said to be undergoing a transformative change based on which EDI processes are being streamlined so that there is a single voice for EDI consolidating Innovate UK and ISCF efforts. Another challenge is that EDI activity is not budgeted nor earmarked in the ISCF thus limiting the scope of what can be achieved off the back of the strategy. For instance, the Innovate UK EDI team has a business advice function for diversity and inclusion that is entirely directed at supporting IUK funded organisations to embed diversity within their organisations, however this has not translated across into ISCF. Similarly, the commissioning of the external work for EDI data collection was a last-minute development due to left over funds being allocated.[264] Some of the challenges in delivery of EDI support and interventions have also stemmed from leadership queries on what the role of ISCF and UKRI should be and whether they are best placed to advise people on EDI when their own practices are sub-optimal. The less-than-optimal practices were exemplified by the recruitment approach to Challenge Director roles, which wasn't underpinned by a coherent strategy nor EDI considerations.[265]

3.5 Recommendations

This section draws on the above findings relating to delivery of the ISCF to present recommendations to inform the delivery of future R&I programmes adopting the ISCF's Challenge-led approach. While these recommendations are forward looking in nature, where appropriate, their relevance to existing ISCF processes has also been highlighted.

[261] "UKRI Commissioned Report on EDI across ISCF Industry Partners."

[262] "UKRI Technology Fund."

[263] Int_07.

[264] Int_07.

[265] Int_07.

1. **UKRI should develop bespoke processes and governance arrangements to ensure agility and adaptability in management and delivery.**

Defaulting to UKRI/Innovate UK business as usual processes was cited as a barrier across many facets of the ISCF design and delivery such as its budget management approach, risk management, limited delegated authority etc. Creating processes (especially with those hired to run the programmes i.e. CDs) tailored to facilitate Challenge and fund objectives could prove more efficient in the future, with Innovate UK and UKRI processes serving as a loose reference template.

2. **UKRI should recognise the potentially evolving roles of governance bodies over the course of the programme lifecycle.**

Evidence suggests that the Steering Board initially played an in-depth role in ISCF processes and decision-making with limited delegation. This organically shifted over time with more authority delegated to CDs and Challenge programme boards, leading to improved efficiency of decision-making. There is also evidence of evolving governance structures at the Challenge level, with programme boards gradually shifting from decision making, to advisory, and finally to public ambassadors supporting with Challenge outcomes visibility and legacy building. While there are indications these changes have happened naturally, a more formal recognition of the evolving role of governance bodies throughout the programme life cycle would be beneficial in creating consistent practices and expectations across different levels of the fund. For future funds, this could potentially be incorporated as a more formal requirement within board terms of reference. More generally, this recommendation may also be relevant to ongoing ISCF fund and Challenge-level governance, where board members at different levels could well be shifting towards more outward-facing roles as the Challenges (and the fund as a whole) near completion.

3. **UKRI should ensure the engagement of key government stakeholders in governance structures.**

Evidence suggests that while Challenge programme boards and advisory panels have generally provided effective governance, across several Challenges there has been a need for further engagement of representatives from key government departments relevant to the Challenge sector in order to effectively influence and transact relevant policy changes in a given sector. At the fund-level, changing roles and engagement of BEIS and Treasury within the ISCF Steering Board also appear to have created some governance challenges. These findings highlight the need for more concerted efforts to engage the relevant government stakeholders in governance structures at different levels.

4. **UKRI should improve the centralised support provided for implementing and changing Challenge level processes.**

Evidence suggests that additional central support would have been beneficial in supporting Challenges cope with changes in processes. For example, processes like the development of benefits realisation plans, which were centrally driven, created some confusion for Challenges in relation to the collection of data for benefits monitoring, in part due to the implementation of this requirement after many Challenges had been established. Challenge-level stakeholders highlighted the potential to draw learning from the Innovate UK change management team in how this type of support could be provided. This recommendation may still be relevant to ongoing fund management processes, in particular in relation to the ongoing implementation of Innovate UK's impact management framework and its application to across the ISCF.

5. **Support agility in the design and implementation of funding mechanisms.**

This recommendation was also presented above in relation to strategy and set-up of the ISCF (see Section 2.4). While the agile funding mechanisms will depend on the nature of the funding programme – e.g.

programmes comprised of large-scale capital investments being perhaps less suited to agile approaches – examples from some Challenges highlight the potential benefits of flexible approaches to programme delivery. The holding back funds of funds, for example, had the benefit of allowing a staged approach to programme delivery to respond to emerging insights and opportunities as identified through programme monitoring and feedback loops. Evidence suggests that more could have been done to ensure the ISCF processes supported agility and experimentation in the design and implementation of funding instruments where it was appropriate – for example, the practice of recovering underspent funds were felt to have reduced scope for flexibility and 'testing and learning' approaches. As noted earlier, this could be supported through the stakeholder engagement undertaken to ensure the suitability of funding mechanisms to stakeholder needs.

6. **Improve the outreach and accessibility of call and application processes.**

Notwithstanding concerted efforts to reach new audiences, evidence highlights that in many cases Challenges have faced limitations in terms of reach to wider stakeholders, including newer, smaller businesses and those not previously engaged in UKRI and Innovate UK networks. These findings highlight the need for further efforts to improve the outreach and accessibility of Challenge funding competitions. This might include further efforts to engage relevant sectoral associations and communities (with several Challenges highlighting this as an important enabler), considering the potential burden of application processes on applicants, and providing bid support to help more inexperienced stakeholders through the application process. Related considerations may include longer application timeframes and considering the optimal time for running competitions within academic and business calendars.

7. **UKRI should establish fund-level monitoring requirements and related systems upfront.**

Fund-level performance monitoring infrastructure and systems have been developed in parallel to the implementation of the ISCF. This led to several issues, including a lack of clarity for fund-level monitoring staff and a reliance on manually-compiled and untimely monitoring data during the early stages of the fund. The post-hoc establishment of benefits realisation plans added to these issues, with the requirement to monitor against these plans proving difficult for Challenges where projects had already been established, and also raising questions about the respective roles of evaluators and Challenge programme teams. Many of these issues have been resolved over time, as new waves have been established and the monitoring and benefits realisation functions have evolved. In future, however, more consideration to such processes during the fund design stage would help to avoid such issues and improve the ability of the monitoring and related systems to inform decision-making during the delivery phase.

8. **UKRI should strike a better balance between bespoke Challenge-level monitoring and alignment to fund-level monitoring processes.**

Challenge-level monitoring has typically employed standard Innovate UK and Research Council monitoring processes and requirements. However, evidence from Challenge-level process evaluations has highlighted the potential for strengthened bespoke monitoring requirements to better suit specific Challenge objectives and provide more oversight of emerging project impacts. At the same time, there has also been a need to ensure alignment of Challenge-level monitoring to fund-level frameworks such as benefits realisation plans. As part of upfront planning for a fund-level monitoring system, the appropriate balance between standard fund-level processes and more bespoke Challenge processes should be considered. This should include consideration of division of responsibility between fund-level monitoring staff, Challenge programme teams and evaluators.

9. **UKRI should proactively support coherence, coordination and cross-pollination within and across Challenges.**

Mechanisms to support cross-project coherence and coordination have been established both within and across Challenges. At both levels, however, the evidence indicates space for more concerted efforts to maximise these opportunities. Within Challenges, such efforts could include calls for proposals targeted towards past participants, weighting proposal evaluation criteria to consider alignment to other funding strands, and a greater emphasis on cross-strand networking. Further initiatives to support cross-Challenge exchanges could include the establishment of platforms centred around specific clusters of Challenges working in similar fields. In addition to maximising the potential impact of projects, a greater emphasis on intra- and cross-Challenge coordination would also support broader learning opportunities across the fund.

10. **UKRI should establish clear scope of EDI at the outset in the business case planning stage supported by high level ambitions.**

Evidence points to varying interpretations of EDI. For some, EDI only centred on gender and ethnicity while for others this also meant regional diversity and diversity in business types and sizes. Establishing a clear scope for EDI at the outset of a programme could help in maintaining clarity, focus and establishing activities and monitoring requirements accordingly. This needs to be considered at the business case stage to reflect on the most important and appropriate aspects of EDI for a given programme. High level objectives for EDI should also be defined at this stage which could drive budget and activity considerations as a follow on. Evidence from the TFI Challenge supports the value of this process, which enabled them to integrate EDI into the core project delivery work, and also underpinned their recruitment strategy.

11. **UKRI should create EDI monitoring requirements at the outset to drive good practices and establish clear baseline.**

Inconsistencies and gaps in EDI datasets speak to the need for improved balance of soft and hard requirements for EDI from Challenges. More upfront clarity and formalised requirements to monitor EDI activities and outputs is pertinent to creating systemic change and being able to evidence the change through data. EDI requirements should be specified and built into fund and Challenge design and recruitment strategies; this needs to flow from the high-level objectives specified in the business case.

12. **UKRI should allocate an EDI budget at business case planning stage whilst considering high level ambitions.**

Although the ISCF EDI strategy has not officially been operationalised through a set of hard requirements and deliverables, there is a concerted effort to drive change and create a more inclusive culture through all stages and facets of the fund. However, lack of upfront requirements and planning has meant that there is no formal budget allocated to EDI activities unless driven by CDs or programme teams. This has often resulted in a lack of resources and capacity to carry out EDI activities or collect meaningful data. Instances where there is an underspend which would need to be returned are when EDI activities take centre stage. In order to operationalise and instil good EDI practices, budget allocation should be considered upfront in business planning against the high-level objectives for EDI, which should lead to the development of an operationalisation plan detailing activities and monitoring requirements for EDI.

4. Stakeholder engagement in the ISCF

This chapter presents findings and recommendations relating to stakeholder engagement in ISCF. The first part of the chapter reflects on findings relating to stakeholder engagement across the set-up and delivery of the ISCF, as surfaced in the preceding two chapters. The chapter then considers evidence on **stakeholder engagement for the purpose of communicating Challenge outcomes and impacts.** The final section of the chapter presents recommendations drawing upon these findings to inform stakeholder engagement in future programmes.

4.1 Stakeholder engagement across fund set-up and delivery

Evaluation questions:

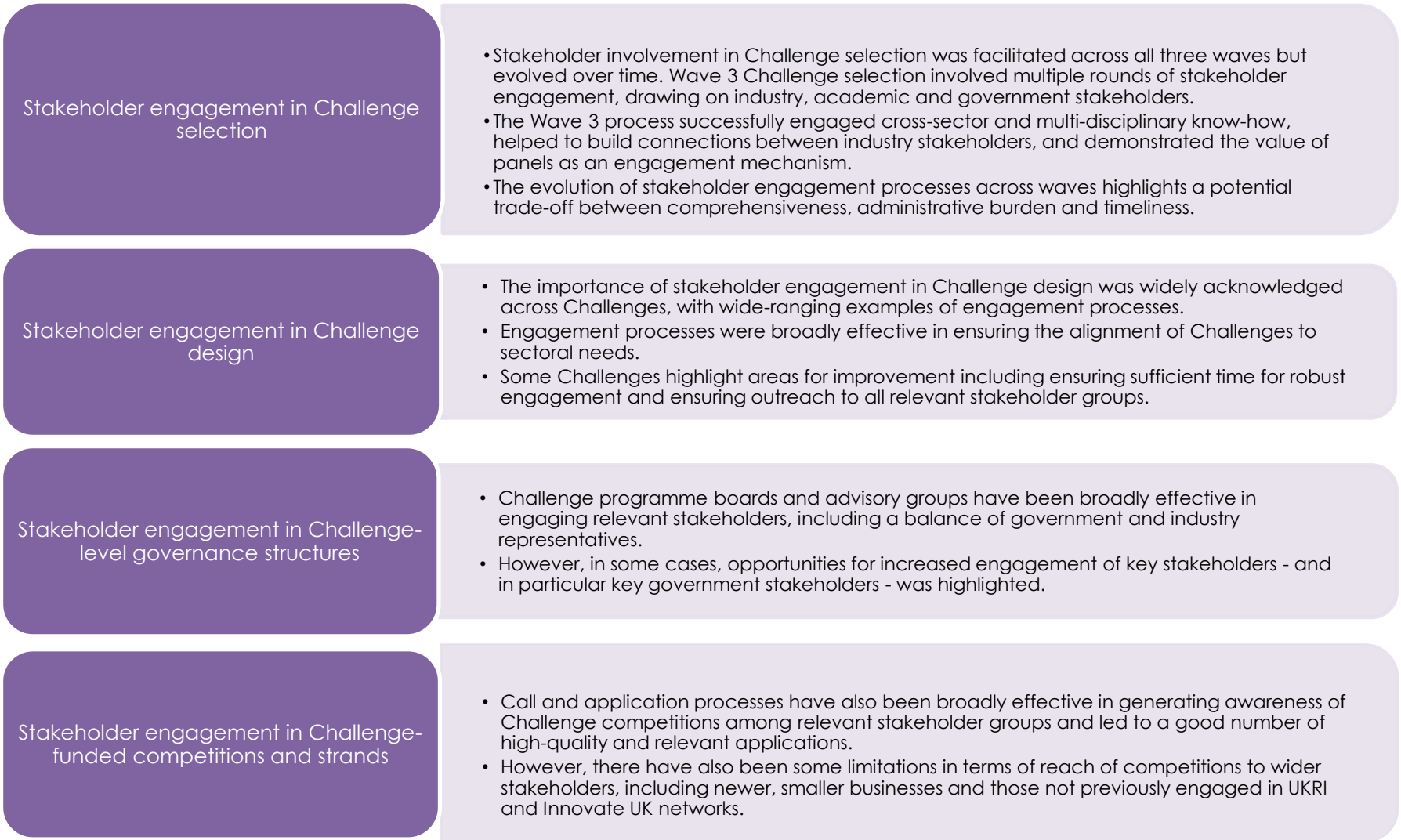
- How effective has the ISCF been in obtaining industry commitment and investment?
- How effectively have wider stakeholder groups been involved in programme and Challenge activities? Which activities have been most effective in engaging different stakeholders?

Summary findings:

- External stakeholders have been engaged at various stages throughout the set-up and delivery of the ISCF, with key points of engagement being Challenge selection, Challenge design, Challenge-level governance structures and Challenge-funded competitions.
- Relevant findings, which have been presented throughout the preceding sections of this report, highlight both benefits and drawbacks of the ISCF's approach.
- Related recommendations as presented earlier in this report, include ensuring stakeholder engagement in fund and Challenge design is comprehensive yet targeted, ensuring the engagement of key government stakeholders in governance structures and further improving the outreach and accessibility of call and application processes. See recommendations in Section 4.2.

External stakeholders have been engaged at various stages throughout the set-up and delivery of the ISCF. Key points of engagement, as highlighted in the preceding chapters, have been: engagement of stakeholders in Challenge selection, engagement of stakeholders in Challenge design, engagement of stakeholders in Challenge-level governance structures, and; and engagement of stakeholders in Challenge-funded competitions and strands. Assessment of the effectiveness of engagement processes at each of these stages, as presented in earlier chapters of the report, highlights both benefits and drawbacks of the ISCF's approach. In Figure 10 below we summarise the key process evaluation findings relevant to each stage.

Figure 10: Key stages of stakeholder engagement in ISCF set-up and delivery, with key process evaluation findings for each stage



The focus of the remainder of this chapter is on understanding the processes underpinning engagement with stakeholders for the purpose of communicating Challenge and project progress and outcomes.

4.1.1 Dissemination of Challenge outcomes

Summary findings:

- Overall, efforts to disseminate and raise awareness of Challenge outcomes have been limited, with much left to individual projects.
- Alongside more concerted planning and resourcing for dissemination activities, there may also be benefit to increased leveraging of Board member networks and connections to relevant stakeholder groups, support for the development of sectoral networks, drawing on best practice examples and development of Challenge closure plans focused on Challenge legacy. See recommendations in Section 4.2.

Across many Challenges, efforts to disseminate emerging Challenge outcomes to relevant stakeholders have been limited, with much left to individual projects. The dissemination of outcomes and achievements can play an important role in ensuring Challenges engage and influence relevant audiences, including policymakers, investors and wider industry. However, a common finding across many Challenge-level process evaluation reports is that such activity has been limited.[266] While this may to an extent reflect the timing of Challenge-level process evaluations while Challenges were in progress (with dissemination activities planned to take place later, once more evidence on outcomes had emerged), in some cases these evaluations also pointed to limited planning for structured communication campaigns/strategies,[267] limited resource allocation for 'outward-facing' activities,[268] limitations of Innovate UK processes and webpage management[269], and limited support to projects for dissemination and engagement activities.[270] Discussions in workshops with Challenge-level stakeholders also highlighted that dissemination could have been considered more systematically, as part of Challenge closure planning, to generate a self-sustaining momentum in maintaining the legacy of the work.[271]

Alongside more concerted planning and resourcing for dissemination activities, Challenge-level process evaluations also highlight further specific areas where more could have been done. Firstly, while a number of Challenge-level reports highlight the potential role of programme board and advisory group members in supporting the dissemination and translation of Challenge outputs and outcomes through their networks, there is limited evidence that such mechanisms have been leveraged in practice.[272] A greater focus on the diffusion role of board and panel members represents a potential point of emphasis when planning future programmes (in addition to the role of these individuals in advising on programme implementation). Here, there are also links to the finding discussed earlier in this report, that in some cases further diversification of Challenge boards/advisory panels members would have been desirable (see Section 3.1.1)Workshops with Challenge-level stakeholders indicated that it is likely that the role of board members will naturally evolve and shift towards dissemination as Challenges progress.[273] However the lack

[266] D2EDPM Process Evaluation Report.; TFP Process Evaluation Report.; SSPP Process Evaluation Report.; TCC Process Evaluation Report.; DSBD Process Evaluation Report.

[267] D2EDPM Process Evaluation Report.; SSPP Process Evaluation Report.

[268] TFP Process Evaluation Report.

[269] "Wave 3 Validation Workshop."

[270] TCC Process Evaluation Report.; D2EDPM Process Evaluation Report.

[271] "Wave 3 Validation Workshop."

[272] DSBD Process Evaluation Report.; D2EDPM Process Evaluation Report. ; NGS Process Evaluation Report.; TCC Process Evaluation Report.

[273] "Wave 3 Validation Workshop."

of requirements means this could be ad-hoc. There is therefore potential for a more formal recognition of the shifting roles of board and panel members towards diffusion and dissemination over time.

Secondly, several Challenge-level process evaluations also highlight the potential to support the establishment of Challenge/sector-based communities or networks bringing together funded organisations with wider stakeholders.[274] Such networks may play a multi-dimensional role, including: a dissemination route for Challenge outputs; a platform for awareness raising regarding future funding opportunities; opportunities for networking and relationship building between organisations, fora through which consultations may be conducted within specific sectors Challenge-areas (e.g. on future R&I funding needs). In fact, workshops with Challenge-level stakeholders highlighted that dissemination needs evolve over the course of the projects (and in turn over the course of Challenges) and niche sectors and communities may need to be engaged with, therefore bringing together these networks and platforms could be value added.[275] The potential role of such communities has been demonstrated in the context of the Medicines Manufacturing and Next Generation Services Challenges (see Box 13).

Box 13: Building sectoral networks and communities – illustrative examples from Challenges

- **Medicines Manufacturing**

The Medicines Manufacturing Challenge Community was established to accelerate the outcomes from the Medicines Manufacturing Challenge. The KTN, a key enabling and facilitation forum, played an important convening role in the Community. The Challenge Community brought together industry and government stakeholders and grew the cohesion of the sector through bringing disparate voices together. They hosted workshops, developed white papers and case studies to further the outcomes generated from the Challenge investment.[276]

- **Next Generation Services:**

Under the Next Generation Services Challenge, Innovate UK partnered with the KTN to establish the 'AI for Services' network. The network brings together data and artificial intelligence businesses and academics with professionals working in law, accountancy, insurance and finance and serves as a platform for coordinating events, promoting collaboration and showcasing outcomes and learning from NGS-funded projects.[277]

- **Audience of the Future:**

Within the Audience of the Future Challenge, cross-network and cross-sector events have been developed such as the Audience of the Future Live, bringing together businesses, researchers, technology experts to discuss ground-breaking projects and outcomes from the Challenge in collaboration with the Creative Industries Cluster Programme.[278] The Demonstrator programmes have been visible in mainstream media and generated a lot of engagement with project outcomes. Immerse UK network[279] (predating the ISCF) has also provided an important linking up and commercially focussed platform for the relevant stakeholders of this Challenge, through a suite of networking events and seminars.

4.2 Recommendations

This section draws on the above findings relating to stakeholder engagement in the ISCF to present recommendations to inform stakeholder engagement approaches of future R&I programmes adopting the ISCF's Challenge-led approach. While these recommendations are forward looking in nature, their relevance to existing ISCF processes has also been highlighted where appropriate.

[274] NGS Process Evaluation Report.; D2EDPM Process Evaluation Report.; CQT Process Evaluation Report.

[275] "Wave 2 Validation Workshop."

[276] Innovate UK/KTN, "Medicines Manufacturing Challenge Community."

[277] NGS Process Evaluation Report.

[278] "Audience of the Future Live."

[279] "Immerse UK."

1. **UKRI should ensure stakeholder engagement in fund and Challenge design is comprehensive yet targeted, including a framework for how feedback is incorporated into decisions.**

This recommendation was also presented above in relation to strategy and set-up of the ISCF (see Section 2.4). In earlier waves, the ISCF did not engage enough with the external community and had a heavy government focus. Wave 3 processes provide an example of a more comprehensive approach to stakeholder engagement however that also created issues in terms of the volume of engagement and the resource intensity involved. The extensive process of stakeholder engagement took a lot of time and created significant administrative burden. As has already been highlighted by the NAO's report on the management of the ISCF, there is scope to consider process changes that might streamline this: For example, a parallel review and approvals process rather than a sequential process through UKRI, BEIS, and HM Treasury.[280] Similarly, a more systematic mapping of key target stakeholders, focusing on comprehensive representation rather than quantity could be a more efficient use of resources and to ensure diverse stakeholder input. 'Guardrails' defining the expected nature of stakeholder input and how will be utilised at different stages of the programme could also help create more transparency and support more targeted engagement with stakeholders.

2. **UKRI should ensure the engagement of key government stakeholders in governance structures.**

This recommendation was also presented above in relation to delivery of the ISCF (see Section 3.5). Evidence suggests that while fund and Challenge boards and advisory panels have generally provided effective governance, across several Challenges there has been a need for further engagement of representatives from key government departments relevant to the Challenge sector in order to effectively influence and transact relevant policy changes for a given sector. At the fund-level, changing roles and engagement of BEIS and Treasury within the ISCF Steering Board also appear to have created some governance challenges. These finding highlight the need for more concerted efforts to engage the relevant government stakeholders in governance structures at different levels.

3. **UKRI should recognise the potentially evolving roles of governance bodies over the course of the programme lifecycle.**

This recommendation was also presented above in relation to delivery of the ISCF (see Section 3.5). There is evidence of evolving governance structures at the fund and the Challenge-level, with Challenge programme boards gradually shifting from decision making, to advisory, and finally to public ambassadors supporting with Challenge outcomes visibility and legacy building based on evidence from ISCF validation workshops. While there are indications these changes have happened naturally, a more formal recognition of the evolving role of governance bodies throughout the programme life cycle would be beneficial in creating consistent practices and expectations across different levels of the fund. For future funds, this could potentially be incorporated as a more formal requirement within board terms of reference. More generally, this recommendation may also be relevant to ongoing ISCF fund and Challenge-level governance, where board members at different levels could well be shifting towards more outward-facing roles as the Challenges (and the fund as a whole) near completion.

4. **UKRI should improve the outreach and accessibility of call and application processes.**

[280] National Audit Office, "UK Research and Innovation's Management of the Industrial Strategy Challenge Fund."

This recommendation was also presented above in relation to delivery of the ISCF (see Section 3.5). Notwithstanding concerted efforts to reach new audiences, evidence highlights that in many cases Challenges have faced limitations in terms of reach to wider stakeholders, including newer, smaller businesses and those not previously engaged in UKRI and Innovate UK networks. This finding highlights the need for further efforts to expand the outreach of funding competitions, including use of even wider channels for communicating calls, considering the potential burden of application processes on applicants, and the provision of bid support to help more inexperienced stakeholders through the application process. Related considerations may include longer application timeframes and considering the optimal time for running competitions within academic and business calendars.

5. **UKRI should conduct concerted and upfront planning for dissemination activities to promote visibility and maintain the legacy of Challenge and fund outcomes.**

Although many Challenges are still realising their benefits and outcomes, dissemination activity has largely been ad-hoc and post-hoc rather than planned strategically. More emphasis could also be placed on leveraging Board member networks and connections to engage with relevant stakeholder groups on outcomes of Challenges. This could have the added benefit of supporting the development of sectoral networks and drawing on best practice examples and creating a visible legacy of the fund's outcomes. A greater emphasis on Challenge closure planning to generate a self-sustaining momentum in maintaining the legacy of the work should also be considered. Finally, planned dissemination could also benefit from framing Challenge outcomes against realisation of government priorities and strategies to showcase synergies in policy and R&D investment and benefits. In addition to informing the planning of future funds, this recommendation may also be relevant to ongoing (and recently completed) Challenges where a more concerted approach to dissemination and storytelling may help to maintain the legacy of the ISCF.

5. Recommendations

In discussing findings relating to strategy and set-up, delivery and stakeholder engagement, the preceding chapters have also presented a series of recommendations. As has been highlighted throughout, these recommendations are forward-looking; intended to inform the design and implementation of future R&I programmes adopting the ISCF's Challenge-led approach. In some cases, however, these recommendations may also have relevance to the ongoing delivery of ISCF and the Challenges that are still being implemented. In Table 3 below, we recap on the report's 18 key recommendations. The table delineates the relevance of each recommendation to our three process evaluation themes, and also where these recommendations may still be relevant to ongoing ISCF fund and Challenge processes.

Evaluation questions:

- What were the unexpected facilitators or barriers to implementing and delivering the ISCF, if any?
- Overall, what are the lessons learned from the ISCF's Challenge-led approach to funding R&I?

Table 3: Summary of recommendations

Recommendation	**Strategy and set-up**	**Delivery**	**Stakeholder engagement**	**Relevant to ongoing ISCF fund and Challenges processes**
Stakeholder engagement in fund and Challenge design should be comprehensive yet targeted, including a framework for how feedback is incorporated into decisions	✓		✓	
Long-term programmes should avoid retrofitting to new government strategies where their core purposes differ but consider highlighting where programme ambitions link to specific areas within government priorities and broader strategies.	✓			
UKRI should clear in communicating and defining expectations on high-risk investments whilst providing explicit mechanism for engaging in high-risk investments	✓			
UKRI should support agility in the design and implementation of funding mechanisms	✓	✓		

UKRI should clearly define the roles and expectations of key leadership positions in new programmes (e.g. CDs) within the existing governance structures to better leverage their expertise and avoid conflict	✓			
UKRI should establish a recruitment strategy for key leadership positions (e.g. CDs), inclusive of EDI considerations and ensure its timely execution	✓			
UKRI should develop bespoke processes and governance arrangements to ensure agility and adaptability in management and delivery		✓		
UKRI should recognise the potentially evolving roles of governance bodies over the course of the programme lifecycle		✓	✓	✓
UKRI should ensure the engagement of key government stakeholders in governance structures to influence policy change		✓	✓	
UKRI should improve the centralised support provided for implementing and changing Challenge level processes		✓		✓
Improve the outreach and accessibility of call and application processes		✓	✓	
UKRI should establish fund-level monitoring requirements and related systems upfront		✓		
UKRI should strike a better balance between bespoke Challenge-level monitoring and alignment to fund-level monitoring processes		✓		
UKRI should support coherence, coordination and cross-pollination within and across Challenges		✓		✓
UKRI should establish clear scope of EDI at the outset in the business case planning stage supported by high level ambitions		✓		
UKRI should create EDI monitoring requirements at the outset to drive good practices and establish clear baseline		✓		
UKRI should allocate an EDI budget at business case planning stage whilst considering high level ambitions		✓		
UKRI should conduct concerted and upfront planning for dissemination activities to promote visibility and maintain the legacy of Challenge and fund outcomes			✓	✓

5.1. Next steps for process assessment

It is anticipated that some processes could act as enablers for Challenge delivery and impact whilst others could impede progress. In order to test this assumption, the next phases of the ISCF impact evaluation will consist of stakeholder workshops that will unpack enablers and barriers of impact and conduct an assessment of whether any of the enablers and barriers surfaced are linked to ISCF processes. If we find any connections at this stage, bespoke interviews will be conducted in the next phase to delve into the links between process and impact and potentially develop relevant case studies to highlight such instances for future learning and offer relevant recommendations.

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Annex A.Summary of the ISCF Challenges

This annex presents a more detailed version of the Table 1 in the report, summarising the ISCF Challenges and their key aims.

Table 4: ISCF Challenges and their key aims

ISCF Challenge	Key aims
Wave 1	
Faraday Battery	The Faraday Battery Challenge aims to drive the growth of a strong battery business in the UK through the development of battery technologies that are cost-effective, high-performing, longer-range, faster-charging, long-lasting, safe and recyclable. The Challenge aims to support the UK automotive supply chain meet deadlines for zero emission vehicles.
Medicines Manufacturing	The Medicines Manufacturing Challenge aims to promote the UK as a world leader in medicines manufacturing and the delivery of novel treatments. Subcomponent aims: • Digital Health Technology Catalyst (DHTC) programme – supports R&D projects aiming to accelerate the development and commercialisation of digital health technologies. • Medicines Manufacturing Programme – developing next generation medicines, increasing technology opportunities within the medicines supply chain, improving vaccine manufacture and innovation, promoting advanced therapy via cell and gene therapies, and promoting commercialisation of the same.
Robotics for a Safer World	The Robotics for a Safer World Challenge supports the development of novel robotics and AI technologies and systems to reduce the number of people working directly in extreme environments. Supports projects across 4 main sectors: • Offshore wind energy-e.g. drones to maintain wind farms. • Nuclear energy- e.g. assisting with nuclear decommissioning. • Space – future AI and robotics for space • Mining- e.g. inspect subterranean mines. In addition to these 4 sectors, the Challenge includes projects on automating fruit packing, and has also evolved to include new needs like robotic sanitising of care facilities during COVID-19.
Wave 2	
Audience of the Future	The Audience of the Future Challenge supports the development of immersive experiences and technologies in the UK-based creative sector, including research to better understand audiences for immersive productions. Focus:

	• Demonstrator programme covering 4 sectors: e-sports and gaming, performance, moving image, and visitor experience • Production innovation for creating faster, more efficient immersive content • Immersive technology investment accelerator to support early-stage businesses. • Design foundations support for projects exploring human-centred design • StoryFutures Academy as a national centre for immersive storytelling.
Data to Early Diagnosis and Precision Medicine	The Data to Early Diagnosis and Precision Medicine Challenge supports the development of precision medicine for improved early diagnosis and treatment and accelerate the use of research and health data. 3 focus areas: • Genomics: supports large-scale whole genome sequencing for precision medicine. • Health data: combines NHS data with data from research and development programmes to provide analytical and data science support to businesses. • Integrated and early diagnostics: via a network of 5 research centres- pathology, radiology, diagnostics and AI
Healthy Ageing	The Healthy Ageing Challenge aims to enable businesses, including social enterprises, to develop and deliver scaled-up products, services and business models to support people as they age. The Challenge supports enterprises via investment partnerships, its Social, Behavioural and Design Research Programme, and competitions and awards for enterprises that focus on its 7 themes.
Next Generation Services	The Next Generation Services Challenge supports the UK's service industries to use technologies such as artificial intelligence (AI) and data analytics to develop the next generation of services. The Challenge is focused on 3 priority sectors- the legal, accounting and insurance services. Projects focused on the following: • Research on barriers- examining the potential behavioural and socio-technical barriers to the use of the above technologies in the 3 sectors. • Data Access- to develop responsible data access/sharing methods and business models in the 3 sectors.
Prospering from the Energy Revolution	The Prospering from the Energy Revolution Challenge aims to accelerate innovation in smart local energy systems. Focus areas: • Demonstrator projects – on transmission connected EV charging network; integrated virtual energy system; local energy marketplace and intelligent grid. • Detailed designs – developing designs for local energy systems at the level of towns, cities and regions. • Modernising energy data – projects focusing on new open software, hardware and data solutions for the energy sector. • Key technology components for local energy systems. • New knowledge and tools- research on uptake and impact of local energy systems.
Transforming Construction	The Transforming Construction Challenge aims to accelerate a shift in the construction via 3 central challenges: • Moving to a manufacturing approach – from suppliers right through to site • Embracing digital technologies to provide assurance, efficiency of projects and performance feedback to design • Shifting to selling outcomes (what a building does rather than what it is) and maximising whole-life value of assets.

Transforming Food Production	The Transforming Food Production Challenge supports the development and adoption of new ways to produce food with a view to improving the productivity and resilience of primary food production while also reducing emissions and pollution. Focus areas: • Farming Innovation Programme- projects on productivity and sustainability in agriculture and horticulture while orienting towards net zero. • Future food production systems- development of new high-value food production systems. • Science and technology into practice- development and adoption of precision approaches • International opportunities- accelerate shared international priorities and build export opportunities for agri-tech • Investment ecosystem- drive private investment in agri-tech via Investor partnership.
Wave 3	
Accelerating Detection of Disease	The Accelerating Detection of Disease Challenge supports research into the early diagnosis, prevention and treatment of chronic disorders using biological and digital data from up to 5 m volunteers. Focus: • Managing chronic disease and cancer- combine health and other data with AI to accelerate diagnosis, preventative strategies and treatments. • Early detection- long term volunteer data will be linked to NHS and health data to enable early detection and treatment.
Digital Security by Design	The Digital Security by Design Challenge supports projects that help the UK digital computing infrastructure to become more secure. Focus: • Creation of an updated hardware architecture in a physical prototype board • Developing the software and system development tools that will run on it • Demonstration in industry sectors, including automotive, e-commerce, defence, telecoms and operational technologies
Driving the Electric Revolution	The Driving the Electric Revolution Challenge supports the UK's push towards a net-zero carbon economy and clean technology supply chains through investment in electrification technologies including power electronics, electric machines and drives (PEMD). 3 focus areas: • Industrialisation centres- creation of a network of regional centres to develop and scale PEMD technologies and manufacturing. • Collaborative innovative funding- projects to help businesses grow PEMD supply chains and manufacturing capabilities. • Talent and skill development.
Future Flight	The Future Flight Challenge aims to bring together technologies in electrification, aviation systems and autonomy to create new modes of air travel and capability by demonstrating along 3 areas: • Safe integration and operation of drones • Advanced air mobility and regional aircraft • Advancements in electrification and autonomy
Industrial Decarbonisation	The Industrial Decarbonisation Challenge aims to contribute to the UK's drive for clean growth across the six largest industrial clusters through

	development and deployment of technologies such as carbon capture, utilisation and storage and hydrogen fuel switching.
Low Cost Nuclear	The Low Cost Nuclear Challenge aims to develop a compact, standardised nuclear power station product based around a UK-designed Small Modular Reactor (SMR). This is to be achieved via modern mass production methodology. The first phase of the project saw the development of a concept design (Rolls-Royce), and the second phase will focus on development of this technology till a stage that attracts private investment.
Commercialising Quantum Technologies	Building on the UK's National Quantum Technology Programme, the Commercialising Quantum Technologies Challenge supports new products and technologies based on advances in quantum science. 4 focus areas: • Product and service innovations- funding research on new quantum-enabled product and service innovations • Industry-led technology development project • Supply chain- feasibility on innovative components and supply chain elements across the quantum sector Investment accelerator- supporting early-stage, spin-out and start-up quantum technologies companies to secure venture capital.
Smart Sustainable Plastic Packaging	The Smart Sustainable Plastic Packaging Challenge aims to tackle the challenge of plastic pollution in the environment by facilitating the development of a more sustainable plastic packaging value chain. Focus areas: • Sustainable plastic packaging materials and designs. • Collaboration and innovation for integrated circular supply chains- including insights on systems change and consumer behaviour. • Learning and knowledge dissemination from funded projects
Made Smarter Innovation Challenge	The Made Smarter Innovation Challenge aims to help the UK's manufacturing industry become more productive and competitive through innovation and the adoption of the following digital technologies: • AI, ML and data analytics • Additive manufacturing • Robotics and automation • Virtual and augmented reality • Industrial Internet of Things (IIoT) and connectivity (5G, LPWAN)
Transforming Foundation Industries	The Transforming Foundation Industries Challenge supports the development of innovative technologies, collaborations and investment in the foundation industries in order to increase competitiveness, secure jobs and reduce environmental impact. The six relevant sectors are: cement, glass, ceramics, paper, metals and chemicals.

Source: RAND Europe analysis

Annex B. The ISCF process evaluation framework

This annex presents the framework and questions that have been used to conduct the process evaluation of the ISCF.

Table 5: The ISCF process evaluation framework[281]

Theme	Sub-theme	Evaluation question
Strategy and set-up of the ISCF	Approach to identifying and selecting Challenges across waves	• How, and in what ways, did Waves 1, 2 and 3 identify the Challenges? How were improvements made and learnings taken up after each wave? • How responsive was the ISCF to a wide variety of stakeholders in establishing the Challenges?
	Alignment of Challenges to government strategies and priorities	• How has the ISCF funnelled investment into enabling technologies to support key government strategies? • How has the ISCF adapted to evolving ministerial priorities and been agile in response to a changing policy landscape?
	Stakeholder engagement in Challenge design	• How responsive was the ISCF to a wide variety of stakeholders in establishing the Challenges?
	Risk appetite in Challenge design	• To what extent, and how, have the ISCF Challenges focused on 'high-risk' investment areas and enabled the de-risking of investment?
	Funding instruments	• To what extent, and how, have the various funding instruments (e.g. CR&D, Hubs/centres) helped develop an ecosystem within Challenges that enables collaboration across different domains (government, academia and businesses)?
	Role of Challenge Directors	• To what extent have the Challenge Directors maximised R&I opportunities across sectors (government, academia, businesses) for the benefit of the programme in a coherent and directed way? • To what extent have the Challenge Directors led to appropriate investment decisions that focus on the industrial Challenges assigned to each programme?

[281] Although we have retained a broad adherence to the original process evaluation framework as presented in our evaluation framework report, the framework and evaluation questions presented here have been adjusted in subtle ways to reflect our improved understanding of the fund – and key lines of process enquiry – since project inception.

		• How much autonomy have Challenge Directors had in designing and delivering their programmes? How would increased autonomy for Challenge Directors regarding preferred timelines, scope and activities for the Challenge have changed the likely benefits and costs? • What additional value have Challenge Directors provided compared to standard grants in UKRI?
	Role of key governance bodies	• How effectively has the ISCF been managed? • How has the ISCF governance and set up, supported and enabled delivery of the ISCF? (e.g. how effective has the ISCF steering board been in decision-making?) • How, if at all, has the ISCF PMO enabled a centralised, coordinated and consistent approach to delivering ISCF Challenges?
	Agility of governance	• How well has ISCF governance allowed for an effective response to disruption (e.g. Covid-19) and guided the Challenges to adjust and adapt appropriately?
	Call, application and monitoring processes	• To what extent are processes, such as the application processes and post-award monitoring processes appropriate and proportionate?
	Coherence and coordination	• Has the ISCF ensured that projects within the Challenges complement each other and do not come into conflict?
Delivery of the ISCF	Approach to ensuring diversity in terms of gender and ethnicity	• How did the ISCF ensure diversity among participants, especially in regard to gender and ethnicity?
	Approach to ensuring diversity in terms of range of organisation types	• What was the extent of diversity in ISCF awardees and participants in terms of sectors and disciplines involved (e.g. industry, businesses, academia, multidisciplinary etc.)? • To what extent, and how, has the ISCF reached business, academia, and broader stakeholders across sectors and across disciplines? • How balanced was the ISCF in selecting the industry it targets (e.g. achieving the balance between selecting small and micro companies and larger companies)?
	Approach to ensuring diversity in terms of regional spread	• How, if at all, did the ISCF contribute to tackling regional inequalities?
Stakeholder engagement	Engagement of stakeholders in fund set-up and delivery	• How effective has the ISCF been in obtaining industry commitment and investment? • How effectively have wider stakeholder groups been involved in programme and Challenge activities? Which activities have been most effective in engaging different stakeholders?

Annex C.Process evaluation methods

This annex provides more detail on the methods used to conduct the process evaluation of the ISCF.

C.1. Interviews with UKRI fund-level stakeholders

We conducted 14 interviews with key UKRI fund-level stakeholders in order to gather their experiences and perspectives on the set-up and delivery processes of the ISCF. Interviewees were selected in collaboration with UKRI to ensure coverage of the different fund-level processes of relevance to the process evaluation framework and to inform case studies. The purpose of these interviews can be broadly grouped into three categories:

- scoping interviews to develop a high-level understanding of ISCF and wave/design Challenge selection processes (n=6)
- targeted interviews to understand more specific fund processes, e.g. monitoring processes, EDI (n=2)
- case study interviews (n=6) (for more information on the case study approach see section C.4 below).

All interviews were up to 1 hour in length and were conducted remotely using Microsoft Teams. For all interviews, we developed topic guides structured around the process evaluation framework, with tailored guides developed for different interviewee types. Notes were taken for all interviews, supported by recordings where consent was provided. For scoping and targeted interviews, notes were mapped to evaluation themes using a coding structure based around the fund-level evaluation framework. The coding was conducted using MaxQDA qualitative data analysis software. Notes from case study interviews were drawn upon to inform the case study write-ups.

All interviews were conducted in line with privacy and General Data Protection Regulation (GDPR) requirements. Interviewees were informed that they would not be identified in reporting in order to ensure they felt comfortable sharing their experiences of ISCF processes, and that no direct quotations would be used that may identify them or be attributed to them. Prior to conducting interviews, RAND Europe ensured that interviewees had received a privacy notice which set out how interviewees' data would be used, including their right to access, correct or erase their personal data. In order to maintain anonymity, interviewees are identified throughout this report using the format 'Int_XX', where XX is an identifier given to each interview.

C.2. Review of Challenge-level process evaluation reports

We reviewed available Challenge-level process evaluation reports (n=14) to capture relevant process-related evidence and map these findings against our fund-level process evaluation framework.

The process evaluation reports reviewed presented Challenge-level evidence on processes derived from varied research methods, including the analysis of secondary documentation and data (including programme documentation and data), stakeholder interviews, surveys, workshops and case studies. Table 6 provides an overview of research methods as reported within Challenge-level process evaluation reports.

Table 6: Summary of research methods reported in Challenge-level process evaluation reports

Challenge-level process evaluation report	Method				
	Analysis of secondary documentation and data	Stakeholder interviews[282]	Surveys[283]	Workshops	Case Studies
Medicines Manufacturing	✓	✓	✓		
Industrial Decarbonisation	✓	✓			
Digital Security by Design	✓	✓			
Robotics for a Safer World	✓	✓	✓		
Audience of the Future		✓			
Data to Early Diagnosis and Precision Medicine	✓	✓			
Smart Sustainable Plastic Packaging	✓	✓	✓		
Next Generation Services	✓	✓	✓		

[282] Number of stakeholders consulted via interview varied by Challenge as follows: Medicines Manufacturing n=29: Industrial Decarbonisation n= 46; Digital Security by Design n=55; Robotics for a Safer World n= 20; Audience of the Future n= 31; Data to early Diagnosis and Precision Medicine n= 69; Smart Sustainable Plastic Packaging n= 65; Next Generation Services n=11; Prospering from the Energy Revolution Challenge Evaluation n= 32; Commercialising Quantum Technologies n= 17; Faraday Battery n= 17; Transforming Construction n= 7; Transforming Foundation Industries n= 58; Transforming Food Production n= 27.

[283] Surveys included industry and applicant surveys with variations in the reported survey respondents as follows: Medicines Manufacturing (n=252); Robotics for a Safer World (n=196); Commercialising Quantum Technologies (n=90); Transforming Construction (n=56); Transforming Food Production (n=209).

Prospering from the Energy Revolution	✓	✓	✓		✓
Commercialising Quantum Technologies	✓	✓	✓	✓	
Faraday Battery	✓	✓			
Transforming Construction	✓	✓	✓	✓	
Transforming Foundation Industries	✓	✓			
Transforming Food Production	✓	✓			

The used the MaxQDA qualitative data analysis software to code Challenge-level process evaluation findings against the fund-level evaluation framework. Analysis of the coded material enabled us to identify common cross-Challenge themes across the different aspects of our framework, and to draw out specific Challenge-level material to exemplify common themes. A list of the reports included in this review is provided in Annex D.

C.3. Review of secondary data and documentation

Secondary documentation and data compiled by UKRI were reviewed to inform our evaluation questions and other aspects of the evaluation, such as interviews. The key documentation and data reviewed included:

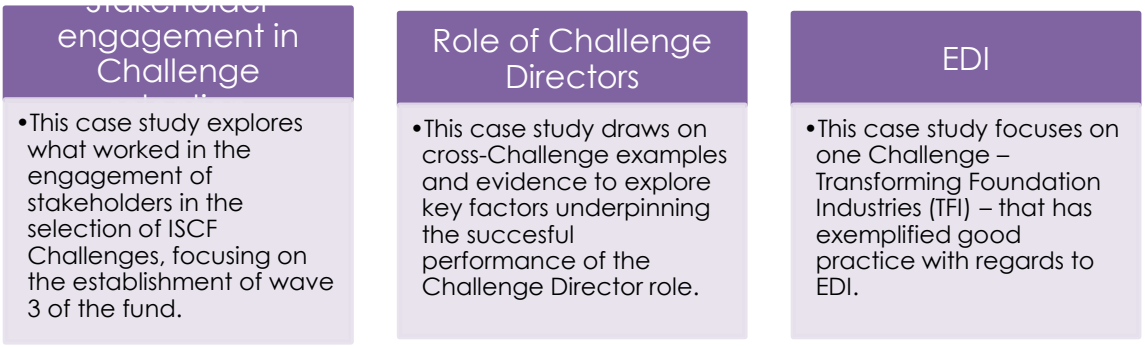
- ISCF wave business cases and timelines
- Internal documents outlining processes relating to wave commissioning processes
- Challenge Director quarterly reviews
- ISCF quarterly portfolio performance and monitoring reports
- An 'ISCF Places Analysis' conducted by UKRI
- UKRI externally-commissioned reports on equality, diversity and inclusion (EDI), specifically:
    - A sector-based analysis of the diversity of industries Innovate UK (IUK) interacts with
    - A pilot survey-based analysis of the diversity within IUK's ISCF funded projects
    - A study of EDI across ISCF industry partners
- Public Accounts Committee (PAC) recommendations on the ISCF
- National Audit Office (NAO) report on UKRI's management of the ISCF.

Data and evidence from these sources was captured in Microsoft Word documents and then mapped to data from interviews and Challenge-level process evaluation reports that had been coded in MaxQDA.

C.4. Case studies

Drawing on other data collection activities, we also developed three case studies. The case studies were selected through discussion with UKRI based on a longlisting exercise. The purpose of these case studies was to develop vignette-style examples and good practice at different levels of the implementation of the ISCF. The three case studies focused respectively on: good practice in stakeholder engagement in the fund-level process of Challenge selection, good practice in the role of Challenge Directors, and good practice in Challenge-level EDI (Figure 11). To inform the case studies, we reviewed relevant documentation as provided by UKRI and conducted focused case study interviews (see Section C.1. above). Importantly, while the case studies focused on surfacing evidence regarding good practices and underpinning conditions, each case study is to be read in the context of the broader process evaluation report, which provides a more balanced overview of the performance of ISCF in the respective areas.

Figure 11: Case studies



C.5. Validation workshops and interviews with Challenge-level stakeholders

To validate emerging findings of our fund-level process evaluation, we conducted workshops (n=2) and interviews (n=2) with Challenge-level stakeholders. This was conducted as the final analysis step prior to submission of the ISCF process evaluation report. We conducted workshops engaging stakeholders in Wave 2 (9 participants) and Wave 3 Challenges (14 participants) respectively. Due to difficulties engaging sufficient participation for a Wave 1 workshop[284], two validation interviews were conducted with Challenge stakeholders instead. Participants in workshops/interviews comprised programme managers and representatives of the evaluation teams of the relevant Challenges. Each workshop/interview considered and provided feedback on general fund-level process evaluation findings as well as findings specific to each wave. Workshop findings were used to refine and nuance the findings presented in the process evaluation report.

[284] This was likely a reflection of the fact that Wave 1 Challenges were completed at the time of conducting our process evaluation, with many of the relevant stakeholders having moved to new positions.

Annex D. Challenge-level process evaluation reports reviewed

This annex presents a table summarising the Challenges for which we have reviewed process evaluation reports as part of our fund-level process evaluation of the ISCF.

Table 7: Challenge-level process reports reviewed as part of the fund-level process evaluation

No.	Challenge process report	Wave
1	Faraday Battery	1
2	Medicines Manufacturing	1
3	Robotics for a Safer World (RAI-EE)	1
4	Audience of the Future	2
5	Quantum Technologies[285]	2
6	Data to Early Diagnosis and Precision Medicine	2
7	Next Generation Services	2
8	Prospering from the Energy Revolution	2
9	Transforming Construction	2
10	Transforming Food Production	2
11	Digital Security by Design	3
12	Industrial Decarbonisation	3
13	Smart Sustainable Plastic Packaging	3
14	Transforming Foundation Industries	3

[285] Following on from the Quantum Technologies Challenge, the Commercialising Quantum Technologies Challenge was established in Wave 3.

Annex E. Key UK government strategies and priorities of relevance to the ISCF

This annex presents a more detailed version of the mapping table of ISCF-supported technologies to key UK government strategies as presented in summary form in Table 2 of the report. This is followed by a table summarising the priority areas within the selected government strategies relevant to the ISCF (Table 9).

Table 8: Mapping ISCF supported technologies to key UK government strategies

		Alignment of technologies to enabling key UK government strategies						
Challenge	**Technology development**	**Plan for Growth**	**National Infrastructure Strategy**	**Life Sciences Vision**	**UKRI Strategy**	**UKRI Innovation Strategy**	**25-year Environmental Plan**	**Climate Change Strategy**
Faraday Battery	Battery R&D and manufacturing throughout the supply chain	Net Zero ☒ Green Revolution ☒ Transforming Communities ☐ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☒ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☐ Emerging Industries ☐ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☒ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☒ Clean Growth ☒
Medicines Manufacturing	Manufacturing capabilities in small-molecules pharmaceuticals, advanced therapies, vaccine	Net Zero ☐ Green Revolution ☐ Transforming Communities ☐	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☒ Innovation uptake ☒	Technology ☒ Emerging Industries ☒	Infrastructure and technology ☐ Regulation ☐	Sustainability ☐ People and Environment ☐	Net Zero ☐ Clean Growth ☐

	Speeding up delivery of novel treatments to patients Digital health technologies	Life Science ☒ Digital and Creative Industries ☐		Health missions ☒	Net Zero ☐ Health ☐	Commercialisation ☐ Innovation Missions ☒	Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	
Robotics for a Safer World	Novel robotics and AI technologies that will reduce # of people involved in infrastructure inspection, maintenance, and repair in extreme environments	Net Zero☐ Green Revolution☐ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☒	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☐ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☐ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☐ Clean Growth ☐
Audience of the Future	immersive technologies and experiences (e.g. AR) for moving image, sports entertainment, visitor experience, performances	Net Zero☐ Green Revolution☐ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☒	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☒ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☐	Sustainability ☐ People and Environment ☐ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☐ Clean Growth ☐
Data to Early Diagnosis and Precision Medicine	Data and new technologies in diagnosis of disease and adoption of precision medicine Genomics, health data diagnostics and AI Whole genome sequencing trials	Net Zero☐ Green Revolution☐ Transforming Communities☐ Life Science ☒ Digital and Creative Industries ☐	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☒ Innovation uptake ☒ Health missions ☒	Technology ☒ Emerging Industries ☒ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☐ Resource efficiency ☐ Biological diversity ☐	Net Zero ☐ Clean Growth ☐

							Global Environment ☐	
Healthy Ageing	Digital technology to support social engagement and physical activity (e.g. digital platform to match local care needs with thousands of solution providers to deliver adult care)	Net Zero☐ Green Revolution☐ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☒	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☒ Health missions ☒	Technology ☐ Emerging Industries ☐ Net Zero ☐ Health ☒	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☐	Sustainability ☐ People and Environment ☐ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☐ Clean Growth ☐
Next Generation Services	AI, data and digitisation in delivery of insurance, legal and accounting services	Net Zero☐ Green Revolution☐ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☒	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☒ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☐	Sustainability ☐ People and Environment ☐ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☐ Clean Growth ☐
Prospering from the Energy Revolution	Delivering cleaner, cheaper energy services (e.g. heat pumps, electric vehicle charging points)	Net Zero☒ Green Revolution☒ Transforming Communities☒ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☒ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☐ Emerging Industries ☐ Net Zero ☒ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☒ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☒ Clean Growth ☒
Quantum Technologies	Quantum technologies (e.g. gravity sensing,	Net Zero☐ Green Revolution☐	Net Zero ☐	Technology ☐	Technology ☒	Infrastructure and technology ☒	Sustainability ☐	Net Zero ☐

	miniature atomic clock, QKD for secure communications via fibre and satellite)	Transforming Communities ☒ Life Science ☐ Digital and Creative Industries ☒	Accelerating and improving delivery ☐	Innovation uptake ☐ Health missions ☐	Emerging Industries ☐ Net Zero ☐ Health ☐	Regulation ☐ Commercialisation ☒ Innovation Missions ☒	People and Environment ☐ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Clean Growth ☐
Transforming Construction	Adoption of new digital manufacturing approaches in construction Creation of active buildings	Net Zero ☐ Green Revolution ☐ Transforming Communities ☒ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☐ Accelerating and improving delivery ☒	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☐ Emerging Industries ☐ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☐ Resource efficiency ☒ Biological diversity ☐ Global Environment ☐	Net Zero ☒ Clean Growth ☐
Transforming Food Production	Data-driven precision agriculture approaches	Net Zero ☐ Green Revolution ☐ Transforming Communities ☐ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☐ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☒ Commercialisation ☐ Innovation Missions ☒	Sustainability ☒ People and Environment ☐ Resource efficiency ☐ Biological diversity ☒ Global Environment ☐	Net Zero ☒ Clean Growth ☐
Accelerating Detection of Disease	Data and AI to improve and accelerate diagnosis	Net Zero ☐ Green Revolution ☐ Transforming Communities ☐ Life Science ☒	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☒ Innovation uptake ☒ Health missions ☒	Technology ☒ Emerging Industries ☒ Net Zero ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐	Sustainability ☐ People and Environment ☐ Resource efficiency ☐	Net Zero ☐ Clean Growth ☐

		Digital and Creative Industries ☐			Health ☐	Innovation Missions ☒	Biological diversity ☐ Global Environment ☐	
Digital Security by Design	Digital computing infrastructure	Net Zero☐ Green Revolution☐ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☒	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☒ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☐ Net Zero ☐ Health ☐	Infrastructure and technology ☒ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☐ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☐ Clean Growth ☐
Driving the Electric Revolution	Low carbon electrification technologies (e.g. power electronics, electric machines, drives)	Net Zero☒ Green Revolution☒ Transforming Communities☒ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☒ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☐ Net Zero ☒ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☒ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☒ Clean Growth ☒
Future Flight	Low carbon air vehicle technology (e.g. drones)	Net Zero☒ Green Revolution☒ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☒ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☒ Net Zero ☒ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☐ Resource efficiency ☐ Biological diversity ☐ Global Environment ☐	Net Zero ☒ Clean Growth ☐

Industrial Decarbonisation	Decarbonisation technologies (e.g. carbon capture and storage, carbon capture and utilisation, direct air carbon capture, bioenergy with carbon capture and storage)	Net Zero☒ Green Revolution☒ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☒ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☐ Emerging Industries ☐ Net Zero ☒ Health ☐	Infrastructure and technology ☒ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☐ Resource efficiency ☒ Biological diversity ☐ Global Environment ☐	Net Zero ☒ Clean Growth ☐
Low Cost Nuclear	Nuclear technologies (e.g. small modular reactors)	Net Zero☐ Green Revolution☐ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☐ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☒ People and Environment ☐ Resource efficiency ☒ Biological diversity ☐ Global Environment ☐	Net Zero ☒ Clean Growth ☒
Smart Sustainable Plastic Packaging	Smart and sustainable plastic packaging technology (materials and designs; recycling processes and infrastructure; radio-frequency identification and AI technologies to trace reusable food grade plastic packaging)	Net Zero☐ Green Revolution☒ Transforming Communities☐ Life Science ☐ Digital and Creative Industries ☐	Net Zero ☐ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☐ Emerging Industries ☐ Net Zero ☐ Health ☐	Infrastructure and technology ☐ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☒ People and Environment ☐ Resource efficiency ☒ Biological diversity ☐ Global Environment ☐	Net Zero ☐ Clean Growth ☒
Manufacturing Smarter Innovation	industrial digital technologies (AI, VR, machine learning, data analytics, additive manufacturing, robotics	Net Zero☐ Green Revolution☐ Transforming Communities☒ Life Science ☐	Net Zero ☐ Accelerating and improving delivery ☒	Technology ☐ Innovation uptake ☐	Technology ☒ Emerging Industries ☐	Infrastructure and technology ☒ Regulation ☐	Sustainability ☒ People and Environment ☐	Net Zero ☐ Clean Growth ☐

	and automation, augmented reality, IIoT, 5G, LPWAN)	Digital and Creative Industries ☒		Health missions ☐	Net Zero ☐ Health ☐	Commercialisation ☐ Innovation Missions ☒	Resource efficiency ☒ Biological diversity ☐ Global Environment ☐	
Transforming Foundation Industries	Decarbonisation technologies for foundational industries (e.g. carbon capture and underground storage; biofuels; recycled glass)	Net Zero☒ Green Revolution☒ Transforming Communities☐ Life Science ☒ Digital and Creative Industries ☐	Net Zero ☒ Accelerating and improving delivery ☐	Technology ☐ Innovation uptake ☐ Health missions ☐	Technology ☒ Emerging Industries ☐ Net Zero ☒ Health ☐	Infrastructure and technology ☒ Regulation ☐ Commercialisation ☐ Innovation Missions ☒	Sustainability ☐ People and Environment ☐ Resource efficiency ☒ Biological diversity ☐ Global Environment ☐	Net Zero ☒ Clean Growth ☐

Table 9: Key UK government strategies and priority areas relevant to ISCF

Key UK government strategy	Priority areas in the strategy of relevance to the ISCF
Plan for Growth	**Net Zero:** the UK will continue to be at the forefront of tackling climate change and delivering clean growth. UK will deliver the Ten Point Plan for a Green Industrial Revolution, leveraging significant private sector investment and ensuring the finance sector can play its role to support the transition to net zero.
	Innovation: incentivising creative ideas and technology for a sustainable economy, and boosting SMEs
	Green revolution: accelerate the deployment of existing technology, such as retrofitting the UK's building stock and electrification of vehicles, while advancing newer technologies such as carbon capture and low carbon hydrogen for sustainable and greener infrastructure
	Transforming communities: electric vehicle charging infrastructure rollout, establishment of carbon capture and storage, giga-bit broadband rollout, secure 5G networks and continue with testbeds, protection from flooding and coastal erosion
	Life Sciences: create the most advanced genomic healthcare system in the world
	Digital and creative industries: nurture a safe, fair, and open digital economy nurturing technologies like AI, quantum computing and digital twins
National Infrastructure Strategy	**Net Zero:** Putting the UK on the path to meeting its net zero emissions target by 2050 by taking steps to decarbonise the UK's power, heat and transport networks – which together account for over two-thirds of UK emissions – and take steps to adapt to the risks posed by climate change.
	Accelerating and improving delivery: greater use of cutting-edge construction technology
Life Sciences Vision	**Technology:** harnessing the UK's unique genomic and health data for predictive health and improved public health, early diagnosis, and treatment, and creating an offer on functional genomics
	Innovation uptake: test, purchase and spread innovative technologies more effectively, so that cutting-edge science and innovations can be embedded widely across the NHS as early as possible
	Health missions: Improving translational capabilities in neurodegeneration and dementia; Enabling early diagnosis and treatments, including immune therapies such as cancer vaccines; Sustaining the UK position in novel vaccine discovery development and manufacturing; Treatment and prevention of cardiovascular diseases and its major risk factors, including obesity; Reducing mortality and morbidity from respiratory disease in the UK and globally; Addressing the underlying biology of ageing; Increasing the understanding of mental health conditions, including work to redefine diseases and develop translational tools to address them
UK Innovation Strategy	**Infrastructure and tech:** rollout world class digital infrastructure including countrywide broadband access, and 4G and 5G network provision, development of radio telescope, digital twins and carbon capture technologies
	Regulation: promote innovative opportunities for tech like GE and GM in food production, use of data in a regulated manner to improve health of the population
	Commercialisation: getting technologies to market using programmed like the Biomedical Catalyst

	Innovation Missions: focussing on emerging technologies and taking a mission-oriented approach to funding and development, focussing on the areas of-: • Advanced Materials and Manufacturing • AI, Digital and Advanced Computing • Bioinformatics and Genomics • Engineering Biology • Electronics, Photonics and Quantum • Energy and Environment Technologies • Robotics and Smart Machines
UKRI Strategy to 2027	**Technology**: enhancing global discovery research and technology leadership, securing advantage in AI, quantum computing and engineering biology,
	Emerging industries: catalysing growth in space, life sciences and creative industries
	Net Zero: driving the development, adoption and diffusion of green technologies for a circular sustainable economy
	Health: reducing health inequalities and tackling infectious diseases and their threat
25-year Environment Plan	**Using and managing land sustainably:** embedding environmental net gain principle for housing and infrastructure, improving soil health, and establishing efficient farming to minimise environmental impact, reduce risk from flooding and coastal erosion
	People and Environment: creating greener infrastructure and engaging people with their natural environments
	Resource efficiency: zero avoidable plastic waste by 2042, reduce food supply chain emissions and wate, improving waste management, curbing emissions from combustion plants and generators
	Biological diversity in oceans and seas: introducing a sustainable fisheries policy and achieving good environmental status in our seas for marine industries to thrive
	Global environment: tackling climate change, supporting sustainable agriculture, supporting zero deforestation supply chains
Climate Change Strategy	**Net Zero by 2050:** We will support UK exporters and suppliers through the global transition to net zero, embedding consideration of climate change into our business.
	Clean growth: increasing our support to clean growth and climate adaptation and mitigating our climate-related financial risks.