

September 2021

Strategic Priorities Fund (SPF)

**Baseline and Interim Process Evaluation –
Main Report (v3)**



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A report from Technopolis in collaboration with Ipsos MORI, CECAN and Science Metrix

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Evaluation of the Strategic Priorities Fund

Baseline and Interim Process Evaluation

Version History

Version No.	Date	Details of changes included in Update	Version reviewed by
1.1	30 th June 2021	Initial Draft	UKRI Evaluation Team UKRI SPF Team
1.2	8 th July 2021	Revised based on preliminary comments to v 1.1	UKRI Evaluation Team UKRI SPF Team Evaluation Advisory Group
2	26 th July 2021	Revised based on comments to v1.2	UKRI Evaluation Team NPIF Evaluation Oversight Board SPF Oversight Board
3	27 th September 2021	Revised based on comments to V2	

Executive Summary

1.1 The SPF

SPF is **an £831m UKRI Fund** that aims to strengthen the UK's research capacity as a world leader in R&I and address gaps in the UK research funding system. It has **three high level objectives**:

MIDRI

To drive an increase in high quality multi-disciplinary and inter-disciplinary research and innovation (MIDRI)

Government Priorities

To ensure UKRI's investment links up effectively with cross-departmental Research and Innovation (R&I) priorities and opportunities

System Agility

To respond to strategic priorities or opportunities

The Fund has supported a portfolio of 34 SPF Programmes across two waves of funding (which were launched in 2018 and 2019), with each Programme co-ordinating a diverse range of R&I activities and projects at various stages of maturity and from across the broad spectrum of R&I areas. As stipulated through the Programme bidding process, each of the Programmes addresses at least one of the three main objectives of the Fund set out above.

1.2 This Evaluation Report

UKRI commissioned Technopolis (in collaboration with Ipsos MORI and CECAN) to undertake a **Fund-level evaluation of UKRI's investments in Waves 1 & 2 of the Strategic Priorities Fund (SPF)**. The study is taking place in four phases (over the period 2020-2025), with this report representing the main output from the second phase (the baseline and interim process evaluation).

We have looked at the Fund from a Theory of Change (ToC) perspective, as recommended by the HMT Magenta Book. We analyse SPF's **main intervention mechanisms**, then the main **outputs emerging from the Fund**, and then initial evidence of progress towards **outcomes and impacts** (most of which are only expected to materialise after completion of the Programmes).

The impact evaluation covers information on a baseline and progress so far. It focuses on assessing increases or changes, either via analysis of qualitative information collected, or via hard metrics (where these are relevant / possible). It also makes comparisons with benchmarks, for example with business as usual or what could have been achieved via other means.

Approximately 200 stakeholders were consulted during this phase of evaluation via interviews and surveys (including representatives from the SPF Oversight Board and Working Group; Go-Science; SPF Programme leads and partners; unsuccessful Programme applicants; Programme Advisory Board members; and members of the Programme selection panels), covering representatives from academia, government, public research establishments and industry.

1.3 Main findings

SPF as a mechanism (process) [Section 2.1]

SPF has been designed as a mechanism to allocate funding to a portfolio of Programmes that each align with one or more of the Fund's high-level objectives. Programme design, implementation and governance is then largely devolved to the Programmes themselves, with some oversight of Programme progress and spend by the SPF Team, Working Group and Board.

By design, the selection of the portfolio of Programmes is the main mechanism that the Fund has at its disposal to provide the strategic steer to meet its high-level objectives.

As part of the process evaluation we have therefore undertaken a critical assessment of this selection process, based on a review of relevant documentation, interviews with GO Science, Programme leads, SPF Board members, bid selection panel members and unsuccessful bidders, plus survey responses from CSAs involved in bid development. Further evidence on



whether the selection process has effectively led to a portfolio of Programmes that are contributing to SPF's expected outcomes and impacts will be sought as Programmes progress.

This analysis breaks down the **three main components** of the process (shown below):

Component	Assessment
<p>Priority setting</p> <p>Identification of priorities/gaps</p> <p><i>Assessment based on interviews with Go-Science, survey of CSAs and analysis of documentation on prioritisation process and outputs</i></p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> Wave 2 helped establish a novel centralised process for engagement between Councils and government to identify / prioritise relevant ideas The list of CSA-prioritised bids was taken into account by Wave 2 panel This SPF-related process has led to further efforts to develop the Government Departments' Areas of Research Interest documents <hr/> <p><u>Weaknesses</u></p> <ul style="list-style-type: none"> There was insufficient time available to arrange a centralised process for determining cross-departmental priorities for Wave 1
<p>Bidding process</p> <p>Instructions, guidance and templates to potential bidders</p> <p><i>Assessment based on 59 interviews with leads and 5 interviews with unsuccessful bid authors, plus study team analysis of documentation</i></p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> General satisfaction amongst successful bidders with the bidding process. They highlighted the simple and straightforward template, with the openness / flexibility to propose different ideas <hr/> <p><u>Weaknesses</u></p> <ul style="list-style-type: none"> Lack of time to develop ideas (with improvements from Wave 1 to 2) Some lack of clarity around fund priorities and intentions Some bidders reported that the bid templates gave insufficient space for a full exposition of the strengths and added value of their ideas
<p>Selection process</p> <p>Panel and guidance for the selection of Programmes</p> <p><i>Assessment based on analysis of assessment / selection process documentation, plus interviews with 3 panel members</i></p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> The depth of the panel discussion regarding the alignment of Programme bids with SPF intentions was greater in Wave 2 than Wave 1 Satisfaction amongst panel members with most aspects of the process <hr/> <p><u>Weaknesses</u></p> <ul style="list-style-type: none"> CSA support letters often provided insufficient information to allow panel members to gauge levels of interest, engagement or commitment to the Programme idea, or prioritisation across bids Panel members were invited to focus on Fund objectives in their decisions, but evidence from minutes suggest these were not discussed in depth (particularly during Wave 1) The assessment process did not undertake the originally intended scoring / ranking process (which would have contributed to the Fund aim of "improved transparency in the decision-making process") The development of full Programme business cases and the timeline for approval delayed the launch of Programmes

Regarding the bidding and selection processes, with £800m+ of public funds dispersed, it is reasonable to expect a thorough and transparent process, that is purposefully designed to encourage and then select the best possible opportunities for supporting Fund objectives.

As with many NPIF Funds, the need to deliver in-year spend in 2018/19 meant the process for allocating Wave 1 SPF funding was run to tight timescales. This was beyond the control of the Fund and efforts were made to implement an effective process within the timescales that had been imposed. Several improvements were then made to the process for Wave 2 (e.g. with

the introduction of a new process for engagement between Councils and government). Nevertheless, the weaknesses identified above suggest that there remains scope for further enhancement in any future iteration of the SPF or a similar Fund.

The next iterations of the evaluation (interim / final impact) will seek to reveal the extent to which the selected portfolio is leading to the outcomes and impacts expected by the Fund (e.g. sustained effects among partners or wider ecosystem change), as well as whether changes in process from Wave 1 to 2, have created two portfolios of Programmes that deliver different benefits (or not).

Fund outputs: driving an increase in high-quality MIDRI [Section 2.2]



MIDRI is embedded in the design and implementation of Programmes, with SPF providing a *steer* (but not a requirement).

Most Programmes were bid on the basis that they will address MIDRI (all 34 Programmes) and cross-government priorities (33 Programmes). There is participation from different types of stakeholders in the design, governance and implementation of all Programmes.

Most SPF Programmes have effectively put in place mechanisms or actions to de-risk the preparation and submission of MIDRI proposals and effectively assess these (i.e. such that MIDRI proposals are not disadvantaged in competition). In most cases these build upon existing mechanisms used by the Councils, rather than representing new approaches and methods.

Early evidence suggests that this is flowing through to project composition and the degree of multi- and inter-disciplinary of SPF publications (although results are preliminary since they are based on a small number of SPF projects that have produced papers so far).

There is strong consensus that SPF allows stakeholders to address more complex / multi-faceted problems than otherwise possible, via a MIDRI approach and because of additional ('neutral' and at-scale) resources.

Fund outputs: addressing government priorities [Section 2.3]



(As above) SPF helped to establish a novel centralised process (Wave 2) for engagement between Councils and government departments to identify and prioritise relevant Programme ideas.

Most Programmes are addressing government priorities & policy needs. Of the 19 bids selected during the second wave, 14 were on the CSA prioritised list.

Most Programmes involve government in their design, governance, and implementation – but the extent varies by programme and over time. 16 government departments are formal partners, 25 are involved in advisory boards. However, some concerns were raised amongst CSAs regarding their 'weight' and involvement in strategic decision making.

SPF has also enabled the participation of PSREs, to some extent. 7/34 Programmes have BEIS PSRE partner (3 of the 6 eligible). Also, there is some (limited) involvement of a wider set of PSREs in grants (7/26 potentially eligible PSREs in 39/504 grants). This is a higher proportion than for UKRI grants more generally over the same period, but the volume of activity may not be sufficient to influence outcomes or ecosystem change.

Fund outputs: responding to strategic priorities and opportunities [Section 2.4]



SPF has provided funding for **medium-scale Programmes** (£10m+), to help address a gap in the funding system. Most (28) Programmes are medium scale. E.g. for NERC, this accounts for 1/3-1/2 of all large scale Programmes currently.

Improved ability to address priorities / emerging opportunities because of neutral, at-scale funding (enabling Programmes to address complex challenges, involve multi-stakeholders, take different approaches). Additional funding also falls between spending reviews and in a period of 'tight' budgets (for Councils and gov depts).

Not an intention, but timing / scale / autonomy of funding is also allowing **agility at Programme level** to respond to changing events / priorities (e.g. through unplanned calls).

Progress towards outcomes [Section 2.6]

Early assessment – but some progress towards achieving:

- Strengthened linkages among relevant stakeholders
- Increased awareness of government R&I priorities amongst Councils (and UKRI capabilities amongst government departments)

Less evidence of other outcomes at this stage

- Improved understanding of what works in intersectoral / cross discipline collaboration
- Relevance, dissemination and uptake of R&I outputs among policy makers

Some suggestion that SPF is making a significant difference to the amount of UKRI investment going towards some of the priority areas it is funding (e.g. space weather, bacterial plant diseases, research on productivity)

SPF is not the only source of funding in these areas, but the implicit hypothesis behind SPF is that investments via the Fund will yield "better outcomes" (e.g. higher uptake among policymakers)

1.4 Recommendations

For ongoing implementation of current SPF	<ul style="list-style-type: none"> • Continue to disseminate findings from the Fund evaluation to Programmes • Raise awareness of opportunities for PSREs to bid into SPF Programmes • Create learning / sharing opportunities between Programme leads • Support cross-NPIF (incl. SPF) dissemination events
For any future SPF Wave (or similar)	<ul style="list-style-type: none"> • Clearly communicate Fund objectives and intentions to bidders • Improve guidance on purpose / content of CSA support letters • Establish a scoring process (to improve transparency) • If gov priority focus.... Facilitate earlier engagement, and encourage / ensure government involvement at all stages of bidding / implementation
For future evaluation phases	<ul style="list-style-type: none"> • Further encourage Programme evaluations to consider Fund objectives • Focus data collection on supporting QCA of outcomes / impacts • Increase the focus within case studies on government involvement • Increase engagement with CSAs to encourage input • Early rapid assessment of prog. Evaluations (timing, value, coverage) • Analyse outputs/outcomes by Wave & characteristics of implementation

[Further details of recommendations are set out in Section 3.2 of the Main report.]

Early Assessment against SPF Business Case Indicators

The SPF Business Case suggests a series of “indicators” (or ambitions) that could be assessed against each of the Fund’s objectives, drawing on a mixture of SPF monitoring data, ResearchFish and surveys of applicants and the wider community. In the table below, we provide a first ‘traffic light assessment’ of each of these indicators (with supporting commentary), based on evidence collected to date through the Fund evaluation. This assessment will be updated at each stage of the evaluation with the latest evidence.

Table 1 Early assessment against SPF Business Case indicators

	Business Case Indicator	Assessment*	Comment
MIDRI	Increased quality and productivity of UK funded research	Insufficient evidence	<ul style="list-style-type: none"> Quality: It is too early to assess the quality of UK funded research (through SPF). In later stages of the evaluation this will be measured by citation analysis and data linking between bibliometric data and uptake in policy documents, plus any examples emerging from primary data collection.
		Insufficient evidence	<ul style="list-style-type: none"> Productivity: It is too early to assess the productivity of UK funded research (through SPF). This will be measured by assessing research outputs per £ invested, relative to a whole-UKRI benchmark. The ‘quality’ indicator above also captures, to some extent, this aspect.
	Community brings forward more MIDRI proposals		<ul style="list-style-type: none"> Qualitative evidence from Programmes that this is the case (compared with business as usual) Further information needed from Programmes to quantify the difference
	Increase in overall Council and IUK success rates for MIDRI projects	Insufficient evidence	<ul style="list-style-type: none"> Further information needed from Programmes
	Increased proportion of UK publications that have MIDRI elements		<ul style="list-style-type: none"> Initial evidence suggests that SPF is supporting more MIDRI publications (in comparison with benchmark), but these results are based on a small number of SPF projects
Links with Government priorities	Increased joint working and consensus on key Government priorities for R&D		<ul style="list-style-type: none"> Novel prioritisation process established Further development of ARIs
	Increased engagement from funders in the R&I community with gov dep on their key priorities		<ul style="list-style-type: none"> Significant involvement of government departments in bid development CSA letters of support for most (47/71) Programme bids
	Significant proportion of projects funded and applying for funds align with cross-Government R&D priorities		<ul style="list-style-type: none"> 32/34 Programmes self-assessed at bid stage as aligned with this objective 14 of 19 Programme bids selected for SPF Wave 2 were on the CSA prioritised list
	Creation of new products and services related to key policy areas	Insufficient evidence	<ul style="list-style-type: none"> Too early to tell, but most Programmes are addressing government priorities
Agility	Improved efficiency and transparency in the decision-making process for new and emerging Programmes		<ul style="list-style-type: none"> No evidence of improved transparency in forming the SPF portfolio (report provides recommendations for improvement) Fund may offer a faster process for large scale Programme funding compared to alternatives, but there were delays with final approval of business cases
	Significant proportions of Programmes funded and applying for funds are medium scale and would not have been funded otherwise		<ul style="list-style-type: none"> 28/33 Programmes are £10m+ 25/37 unsuccessful bids were £10m+ 94% of leads report it would have been difficult to fund Programme via other means 100% of leads report their Programme operates at a scale not otherwise possible
	Evidence of contributions towards supporting growth in emerging sectors, driven by knowledge, innovation and technology developments	Insufficient evidence	<ul style="list-style-type: none"> It is too early to assess support to growth SPF is not industry-led, but half of Programmes address emerging sectors (e.g. Automation, AI, Digitalisation, Bioinformatics, Quantum)

* The traffic light colouring (green, amber, red) indicates the strength of the early evidence (strong, mixed, weak) of progress towards each of the ambitions set out in the Business Case.

2 Introduction

2.1 This report

UKRI has commissioned Technopolis to undertake an independent **Fund-level evaluation** of its investments in Waves 1 & 2 of the Strategic Priorities Fund (SPF). The aims of this study are:

- To inform ongoing and future improvements to the Fund (and in particular the possibility of future growth of SPF), in order to maximise the value of public funding
- To demonstrate what the Fund has delivered for taxpayers
- To help UKRI build the evidence base on ‘what works’ in successfully supporting Multi- and Inter-Disciplinary Research and Innovation (MIDRI) and ensuring that Research and Innovation (R&I) responds to strategic opportunities and priorities

The evaluation is intended to be summative and formative, and to address 6 process, impact, and economic **evaluation questions** (summarised in the box below), as well as a further 29 more detailed sub-questions, which are detailed in full in Appendix A of the Technical Report.

Evaluation Questions

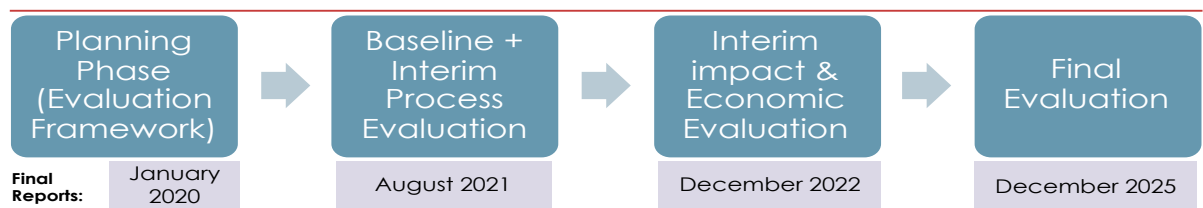
Process Evaluation: To what extent (and how) Is the SPF working and being delivered as intended?

Impact Evaluation: To what extent (and how) ...

- Has the SPF improved the link between UKRI’s investments and cross-departmental R&I priorities and opportunities?
- Has the SPF supported an increase in high quality MIDRI?
- Has the SPF ensured that the R&I system is able to respond to strategic priorities and opportunities?
- Has the SPF delivered economic, knowledge and societal impact?

Economic Evaluation: To what extent does the SPF represent value for money, relative to the size of the investment and compared to possible alternative ways of achieving the same impacts?

The study is taking place in **four phases**, over the period from August 2020 to December 2025. The planning phase concluded with the delivery of an Evaluation Framework report (January 2021). The current baseline and interim process evaluation phase then runs to August 2021.



This report is the main deliverable from this second phase of the evaluation. It begins with this introductory section, setting out details of the evaluation, the Fund, and our approach.

Section 3 then presents the main findings for the interim process evaluation (Section 3.1), as well as baseline information and early evidence of progress towards objectives (Sections 3.2 - 3.7). Concluding remarks and a series of recommendations, for ongoing implementation, for any future SPF Wave, and for the next phase of evaluation are then set out in Section 4.

A first assessment for the economic evaluation (the extent to which SPF represents value for money) will be made as part of the next phase of the study (interim impact evaluation).

The document is accompanied by a **Technical Report** that contains a series of supporting annexes that are referred to at various points in the current document.

2.2 The SPF

The Strategic Priorities Fund (SPF) was announced in the Industrial Strategy White Paper in December 2017 (“We will work with UKRI to develop a new competitive Strategic Priorities Fund, which builds on the vision of a ‘common fund’... [and] will support high quality R&D priorities which would otherwise be missed”). It is part of a wider package of UKRI measures, each designed to deliver against or support one or more foundations of the Industrial Strategy. The SPF is a crucial part of this balanced approach, providing the discovery-led research and innovation to complement the more directed or challenge-led elements¹.

The SPF aims to strengthen the UK’s research capacity as a world leader in R&I and address gaps in UK research funding as identified in the Nurse Review². This review singled out issues with the UK research system’s awareness and coordination of strategic research efforts across the research councils and government, support for multi- and inter-disciplinary research (MIDRI), and ability to respond quickly and materially to emerging challenges or opportunities. SPF is committed to fund R&I that addresses each of these aspects and has defined its main objectives (and sub-objectives) accordingly, as set out in the three boxes below.

Driving an Increase in MIDRI

There is growing recognition that MIDRI can deliver progress on social challenges where monodisciplinary research may struggle. Knowledge and tools from multiple disciplines can be combined to better encircle multi-faceted problems (multi-disciplinarity), while disciplines can be more fundamentally reframed to address specific phenomena (interdisciplinarity). There is also a substantial literature that documents the various barriers as regards the quality and volume of MIDRI supported within the UK. This highlights the wariness of individual researchers and the greater risk of trying to win support for inter-disciplinary research, as well as the capacities of peer review systems to judge monodisciplinary work alongside MIDRI.

SPF Objective: To drive an increase in high quality multi-disciplinary and inter-disciplinary research and innovation (MIDRI), including by:

- De-risking the process of preparing and submitting MIDRI proposals
- Improving the efficacy of the funding system in assessing MIDRI proposals

Alignment with Cross-Departmental R&I Priorities

The Nurse Review reflected that good government depends upon the development of richer networks with the wider research community: promoting and sustaining two-way dialogue, as well as creating awareness and understanding of where current research may be of national benefit and of the nature of both immediate and longer-term problems facing policymakers.

SPF Objective: To ensure UKRI’s investment links up effectively with cross-departmental research and innovation priorities and opportunities, including by:

- Improving join up across departments to establish consensus on priorities
- Increasing understanding of government priorities among R&I funders
- Improving the ability of the R&D funding system to deliver priorities by enabling PSREs to bid for SPF-funded open competitions

Additionally, the original SPF logic map (annexed to the Business Case) reveals that there are also ambitions in this area (not stated explicitly as objectives) for the SPF to:

- Increase R&D spend that aligns with government R&I priorities (e.g. the Industrial Strategy).
- Strengthen linkages and communication mechanisms or structures between and across partners involved in SPF Programmes (i.e. Councils, PSREs, OGDs), including new ways of working or collaborating between them (e.g. new coordination structures with membership from government departments, the third sector, industry, etc)

¹ SPF Business Case (2019).

² Ensuring a Successful UK Research Endeavour, BIS/15/625, Nov 2015

Responding to Strategic Priorities or Opportunities (Agility)

The Nurse Review argued that a new, collective research fund would improve the overall system's ability to respond to emerging challenges and opportunities, by creating financial headroom outside the Councils' (and government departments') budgetary commitments, which extend forward over many years and leave little room for new initiatives. It is argued in the Business Case that these budget pressures also translate into underinvestment in mid-scale investments (i.e. £10m - £15m), since larger, more complex projects can bring larger risks and can also make co-ordination and collaboration harder, resulting in co-ordination failure.

SPF Objective: To respond to strategic priorities or opportunities, including by

- Improving the agility of the funding system to respond to emerging opportunities
- Providing a funding route for medium-scale Programmes

The agility is expected at the Fund / UKRI level, through the provision of waves of funding outside of the spending review cycle. Individual SPF Programmes may also demonstrate agility during their implementation, but this is not an explicit expectation in the design of the Fund.

With around £831m at its disposal, the Fund had the capacity to engage across the UK research and innovation system in these three transformative aspects.

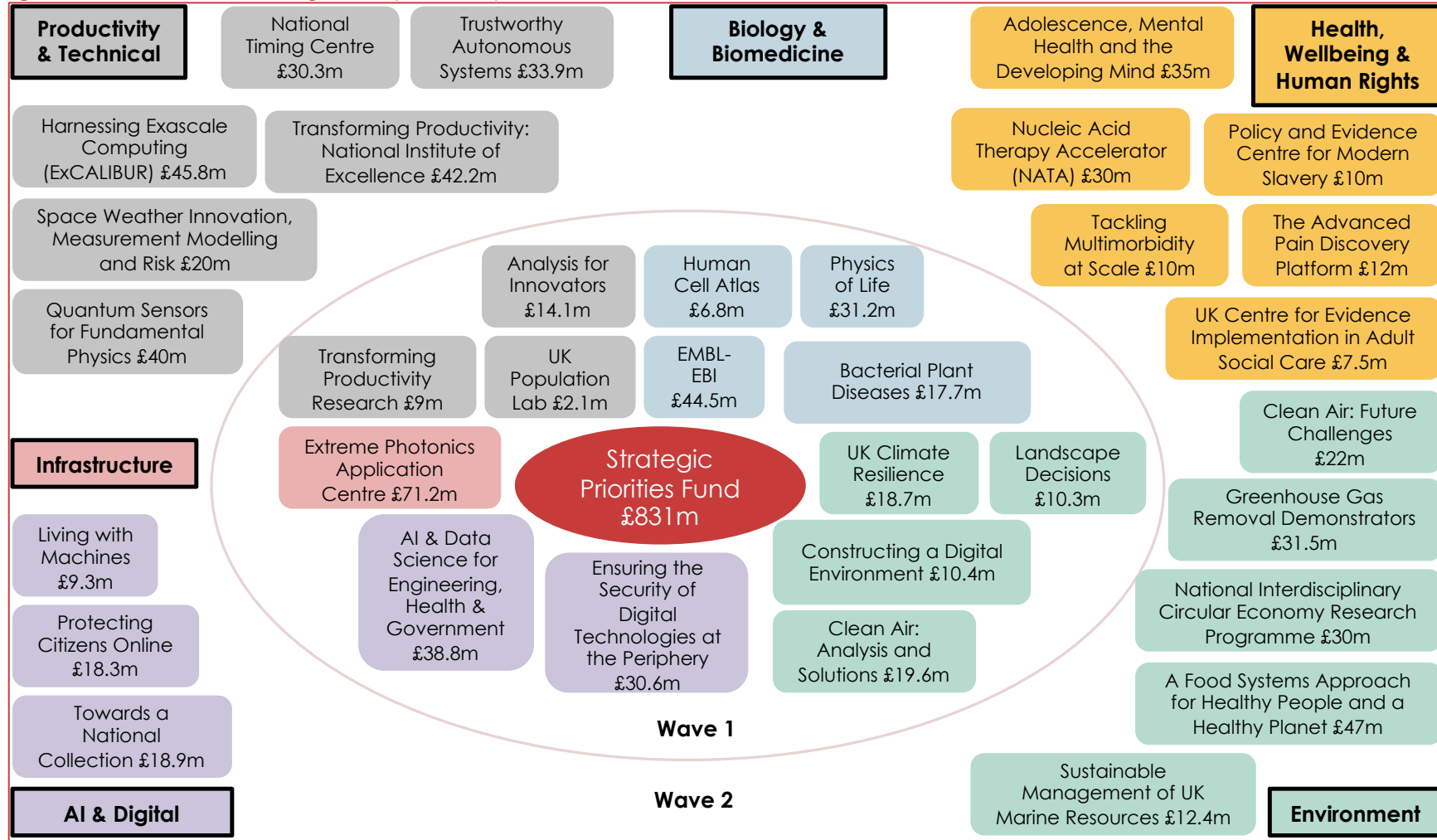
The Fund has supported 34 Programmes across two waves. The first wave (launched in 2018) awarded £334m to 15 Programmes, while Wave 2 (2019) awarded £497m to 19 Programmes³.

The resulting portfolio (Figure 1) encompasses a diverse range of R&I activities at various stages of maturity, each addressing at least one of the three main objectives of the Fund. The portfolio includes thematic Programmes from across the broad spectrum of R&I areas.

All UKRI Councils are leading at least one Programme and partnering on others, along with the great majority of devolved administrations, government departments and executive agencies with significant R&D budgets. A small number of BEIS-funded R&D organisations (Public Sector Research Establishments, PSREs) are also involved as leads or partners for SPF Programmes (other PSREs can apply to be eligible to access funding through the Programmes themselves).

³ Note that while there are 34 Programmes in the SPF portfolio, the Clean Air Future Challenges Programme in wave 2 is a continuation of the Clean Air Analysis and Solutions Programme in Wave 1, with a single management and governance structure, and so these Programmes have been treated as one.

Figure 1 SPF Wave 1 and 2 Programme portfolio by theme



2.3 Our approach to evaluating the Fund

We have looked at the Fund from a Theory of Change (ToC) perspective, as recommended by the HMT Magenta Book when evaluating complex interventions.

The Theory of Change (developed for this evaluation and presented in Figure 2) captures the links between inputs, outputs, outcomes and impacts, but also makes explicit reference to the causal pathways that lead between them; the assumptions that need to hold for those causal pathways to materialise; and the external factors that may affect results (positively, negatively or in an uncertain way).

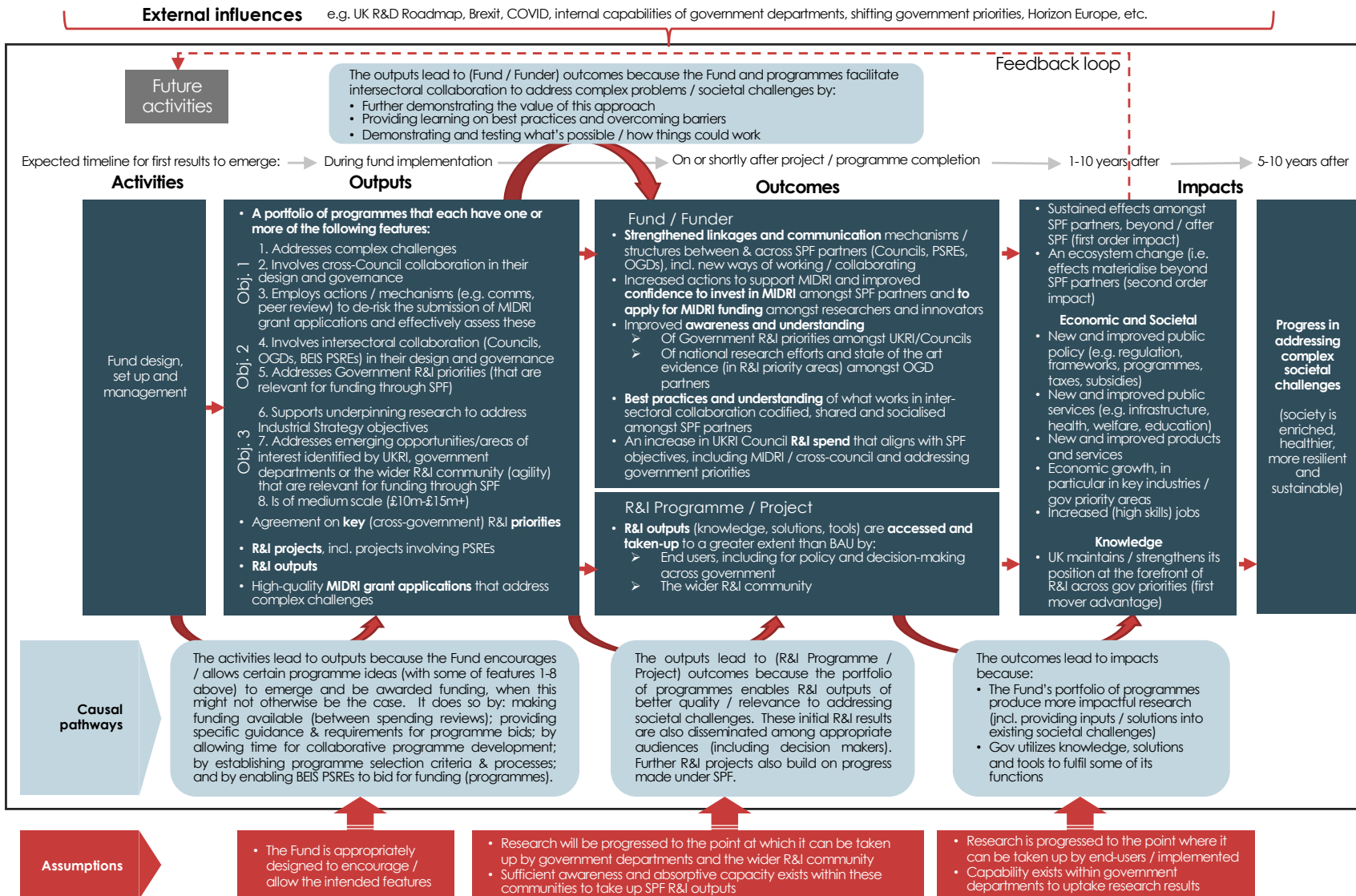
The report then takes each section of the ToC in turn:

- First, we analyse the **SPF main intervention mechanisms** (this relates to the **process evaluation** and is presented in **Section 3.1**)
- We then analyse the main **outputs emerging from the Fund** (this relates to the **impact evaluation** and is presented in **Sections 3.2 to 3.5**). Given the Fund's main delivery mechanism (selection of a portfolio of Programmes that address at least one of its three high level objectives), this analysis concentrates on the composition of the portfolio and Programme implementation (taking each objective in turn). It also covers R&I projects and outputs emerging across all Programmes (Section 3.5). This is where (stronger) links regarding SPF attribution can be made.
- We then analyse the (expected) **outcomes emerging** (across all objectives) (in **Section 3.6**), which, given the nature of the intervention, are influenced by the Fund and mostly delivered via the individual SPF Programmes. As presented in our ToC, these are expected to materialise after completion of the Programmes. At this stage (early in the implementation of SPF Programmes), we present the methodology (which follows a Qualitative Comparative Analysis approach) to provide an indication of the type of analysis that will be presented in the next iterations of the evaluation, and to discuss improvements; along with data on UKRI spend on government priority areas (covered in SPF).

The impact evaluation provides information on the baseline and progress so far (focusing on 'increases' / 'changes', either via the analysis of qualitative information collected or via hard metrics when relevant / possible) and makes comparisons with benchmarks whenever possible (e.g. comparisons with BAU or what could have been achieved via other means).

Note that some of the implementation characteristics captured at this stage (as part of the analysis of outputs) will be used in the next iterations of the evaluation to analyse the extent to which they lead to different / better outcomes. This includes comparing involvement of Government Departments in Advisory Boards and in defining bid/competition calls (a proxy for end-user involvement in shaping research agendas) and R&I outputs (incl. uptake of publications and knowledge emerging from the SPF Programmes in policy documents).

Figure 2 SPF Theory of Change










The approach being employed by the evaluation was set out in the Evaluation Framework (January 2021). It has the following features:

- It follows a theory-based approach, as explained above.
- It has a Fund level focus, drawing on evidence emerging directly from the design and implementation of the Fund, as well as from Programmes and projects only when relevant (e.g. R&I outputs that contribute to the economic and societal impacts of the Fund).
- Information from Programmes and projects will be collated, whenever possible, from the individual Programmes' monitoring and evaluation (M&E) activities to maximise the evidence base. The Fund-level evaluation is being undertaken alongside a wider programme of SPF M&E activities, which includes outcomes monitoring and a series of planned evaluations of most of the individual SPF Programmes. The Fund-level evaluation is not an aggregation of these Programme-level evaluations (it is seeking to answer wider questions on the Fund as a whole), but it is expected that the study team will use Programme-level data and evidence to feed into and inform the Fund-level evaluation, where appropriate. To this end, we will conduct an analysis of available information and a meta-analysis of Programme-level evidence when this is available.
- It focuses on understanding the extent to which the three objectives intended in the design of the Fund have been achieved (and how), whether these effects have been sustained outside of SPF (by the Programme participants and partnerships) and whether this has also translated into changes at the ecosystem level (with lessons learned and new / enhanced ways of working being adopted by others, outside SPF partnerships). Has the SPF experience, for instance, prompted a Council or government department to explore other new collaborations?
- It includes summative and formative elements and will collect a series of hard metrics and indicators of achievement, as well as evidence on lessons learned (what worked or did not work, and why) and on barriers and external factors that could prevent the Fund from achieving its three objectives, sustain them over time, or create a wider ecosystem change.
- It is intended to be iterative and to evolve as we advance through the phases of the evaluation and as more evidence becomes available through Programme evaluations.

The current phase of evaluation is based on seven main groups of data collection and analysis activities (see Figure 3), with activities taking place between February and August 2021. A total **~200 stakeholders have been consulted during this phase of evaluation via interviews and surveys** (including representatives from SPF Oversight Board and SPF Working Group; members of the SPF programme bid selection panels; Go-Science; SPF Programme leads, co-leads and partners; unsuccessful Programme applicants; and SPF Programmes' Advisory Board members), covering representatives from UKRI, Academia, Government departments and agencies, Public Sector Research Establishments, and Industry.

More information on methodology, including a list of contributors is provided in Appendix B of the accompanying Technical Report. The results of the literature review, case studies and surveys are also provided in full within that document.

Figure 3 Evaluation methods

	Documents/Groups	
 Desk review of Programme documentation & secondary data	<ul style="list-style-type: none"> • The SPF business case • Fund management information • Programme bids and assessments • Programme/project data • Other contextual information 	<ul style="list-style-type: none"> • Gateway to Research • ResearchFish • Fame • Pitchbook
 Bibliometric analysis	<ul style="list-style-type: none"> • Bibliometrics (outputs and impact) • Altmetrics (impact beyond the scientific community) • Forward tracing (uptake of research in innovation/policy) • Network analysis / collaborations 	
 Programme monitoring & evaluation	<ul style="list-style-type: none"> • Gap analysis to assess likely available evidence of relevance • Guidance and support to Programmes to improve alignment / reduce duplication of effort (workshop with 90+ SPF Programme / M&E leads to introduce data collection plans and give guidance on key indicators for Programme evaluations – see Technical Report Appendix C) • [A meta-evaluation is also planned to assess and incorporate evidence from Programme evaluations. This will first take place at the interim stage, when first findings and results should be available from many of the Programme evaluations] 	
 Programme Lead Consultation	<ul style="list-style-type: none"> • Collection of basic Programme information (details of partner organisations, advisory boards, Directors & Champions, contact details for stakeholders, list of grants awarded) from all Programmes • Information template completed by all Programmes • Interviews with 50 Programme leads / co-leads (covering all Programmes) 	
 Stakeholder consultation	<ul style="list-style-type: none"> • Survey of government CSAs (42% response rate) • Survey of SPF Programme Advisory Board members (47% response) • Interviews with 15 wider stakeholders (GO Science, UKRI, SPF Board, SPF Team, programme bid selection panel members, authors of unsuccessful Programme bids, BEIS PSRE non-participants) 	
 Longitudinal case studies	<p>Eight in-depth case studies</p> <ul style="list-style-type: none"> • Each focused on a Government R&I priority / challenge that has been identified and is being addressed by a particular Programme • Developed based on desk research and 57 interviews (with Programme leads, partners and participants) • [Case studies will be updated and extended in future phases based on new evidence, allowing them to develop their examination of the outputs and outcomes of the Fund further] 	
 Literature review	<p>Rapid Evidence Assessment:</p> <ul style="list-style-type: none"> • Of recent literature about which mechanisms and processes are, or could be, used by funding organisations to support MIDRI, plus key rationales for supporting MIDRI research • Of examples of mechanisms and processes used in Programmes from the UK and abroad, to describe the key rationales for supporting MIDRI 	

3 Main findings

3.1 SPF as a mechanism (process evaluation)

SPF has been designed as a mechanism to allocate funding to a portfolio of Programmes that each aligns with one or more of the Fund's objectives, with a centralised process for funding allocation and a decentralised process for Programme design and implementation. Councils, PSREs and other partners have a high degree of autonomy in running the Programmes. Ongoing Fund-level involvement is light touch, consisting mainly of oversight from the SPF Oversight Board, Working Group and central SPF team, who monitor spend and progress with implementation, alongside evidence of emerging results.

As such, and by design, **the selection of the portfolio of Programmes is the main mechanism that the Fund has at its disposal to provide the strategic steer** to meet its high-level objectives. This process includes the establishment of objectives and bidding criteria (that are intended to steer or 'nudge' Programme bids to align with Fund objectives and intentions), plus a process and guidance for the subsequent review of these bids by a panel (to help judge alignment and fit with the Fund and select the best proposals) and selection of Programmes. This initial assessment and selection process should ensure that the individual SPF Programmes and their subsequent activities are well aligned with the Fund's overall goals (alongside their own Programme-specific aims).

For the interim process evaluation we have therefore undertaken **a critical assessment of this Programme bidding and selection process**, based on a review of relevant documentation and interviews with GO Science, Programme leads, SPF Board members, panel members and unsuccessful bidders, plus survey responses from CSAs involved in bid development.

Further evidence on whether this process has effectively led to a portfolio of Programmes that are contributing to SPF's expected outcomes and impacts will emerge as the Programmes (and the evaluation) progress.

There are three main components to the process: priority setting, bidding and selection.

3.1.1 Priority setting

The SPF Business Case stated that "the ultimate goal is that UKRI, working with BEIS, GO-Science and other departments, facilitates cross-government co-ordination of research priorities – potentially negating the need for a fund such as SPF to support cross-government work in the long term". However, in the meantime, the SPF was seen as a "necessary interim measure to begin to breakdown artificial barriers to co-operation and foster the coordination and collaboration required" (p14). As such, UKRI intended to work with government departments to draw up a list of key government priorities, with bidders (to Wave 2 only) then encouraged (though not required) to consider submitting proposals that met these priorities.

For SPF Wave 1, there was insufficient time available to arrange a centralised process for determining cross-departmental priorities, or to support engagement between Councils and government. Councils/PSREs submitting a Programme bid were instead asked to indicate if their proposal addressed the government-related Fund objective, and if so to provide evidence that their bid aligned with a key government priority for R&D (e.g. highlighted by a department's published Areas of Research Interest (ARI) document) and to attach a letter from the relevant CSA (providing assurances of a formal collaboration and policy support). As such, there was no centralised mechanism during this first wave to draw up a joint list of priorities.

In preparation for the second Wave, however, the Government Office for Science (GO Science) led work to create greater co-ordination between departments (via the Chief

Scientific Advisors, CSAs) in their dialogue with UKRI over the identification of priorities and the development of SPF bids. Specifically, they employed a multi-step prioritisation process (explained in the box below) to identify and then consolidate cross-departmental R&I priorities, thereby supporting the development of Programme proposals aligned with these.

Box 1 *Priority-setting process (Wave 2)*

- CSAs individually came up with lists of priorities and discussed these in their weekly meetings to arrive at one consolidated list.
- The CSAs discussed this initial list of ~80 priorities at a meeting with UKRI, alongside a developing list of ~80 potential Council bids. The CSAs looked for commonalities and alignment – identifying around 50 proposals / areas of interest as a result.
- A second meeting then considered a revised list of 23 proposals, and 8 were initially identified as top priorities for CSAs.
- GO Science had meetings with 11 government departments, all of whom were also engaging directly with the relevant councils in relation to SPF.
- As a result of this further engagement, a final list of CSA priority proposals was established, which were all submitted to the SPF assessment process. This included 13 top priorities (each with a named department lead) and a further 5 second tier priorities. Some related closely to proposals originally identified at the start of this priority-setting process, while others had evolved or represented amalgams of original ideas.

This Wave 2 process to jointly establish priority Programmes was felt by GO Science to have worked well, helping to move the conversation forward on how research priorities can be addressed collegially. However, some areas for further improvement were identified, particularly around earlier engagement between the Councils and CSAs, including in the initial identification of priorities (using the government ARIs to inform this).

The experiences of Wave 2 have also led directly to further efforts within government to develop and improve the ARIs (as discussed in Section 3.3.1 of the impact evaluation).

3.1.2 *The bidding process*

Programme leads reported that they were generally satisfied with the SPF Programme bidding process. In particular, many highlighted the simple and straightforward bidding template that was relatively easy to complete and enabled them to put their Programme idea forward in a good light, while showing alignment with the Fund's overall objectives. Several also mentioned that the bidding process (and their understanding of it) had improved between the two waves, mainly as a result of the learning and experience from bidding and implementing Wave 1.

Despite this generally positive assessment, there were still a number of issues and challenges relating to the process that were raised amongst the Programme leads and unsuccessful bidders, or that have been identified through the study team's assessment of documentation.

The time available for developing Programme ideas and bids was considered too short.

The time allowed for developing bids (in both waves, but particularly Wave 1) was considered too short by most of the individuals consulted, with little advance warning given of the details of the Fund or the bidding requirements to enable adequate preparations. Given that the Fund was trying to encourage bidders to move away from business as usual, with new partnerships and new ways of working, it was felt by Programme leads that there was insufficient time and space to be able to do this properly (i.e. to engage with various stakeholders, to develop new partnerships, to identify the best opportunities and to design a new or enhanced approach).

As a result, it was also reported by many of the Programme leads that there was a tendency to put forward ideas that were already well-developed, through existing partnerships and

Programmes, and 'looking for a home' – i.e. Programmes that were aligned with the Fund objectives (and further tailored to meet requirements), rather than Programmes that were conceived and developed based on the scope and focus of the Fund. To take one very clear example, the bid for the Ensuring the Security of Digital Technologies at the Periphery Programme already included two research grants and a fellowship that had been peer reviewed and would be ready to be funded via the Programme (if the bid were successful).

As with many NPIF Funds, the need to deliver in-year spend in 2018/19 meant that the process for allocating Wave 1 SPF funding was run to tight timescales. This was beyond the control of the Fund and UKRI had to implement the process as best it could within the time available. Nevertheless, the point still stands that the tight timescales for Programme identification and development were somewhat at odds with some of the strategic ambitions of the Fund.

Bid templates gave limited space for a full exposition of needs, solutions and expected benefits.

Several successful and unsuccessful bidders reported that the bid templates did not provide enough space for them to fully set out the strengths and added value of their Programme ideas. Word limits were quite strict, for instance just 500 words was allowed to set out how the proposed Programme would support the various objectives and sub-objectives of the Fund, including providing the information and evidence requested against each. However, panel members did not suggest that the information provided was insufficient for their purposes.

There could have been greater clarity around Fund priorities and intentions, with additional steer on what the Fund was looking to support, and at what scale.

Many of the Programme leads consulted reported that they would have liked to have received additional information and guidance on what the Fund wanted to support, including additional explanation of objectives, a greater steer as to priorities, and a better sense of likely Programme size that would be awarded.

Several also suggested that there had been particular confusion around the Fund's third objective (ensuring the system is able to respond to strategic priorities and opportunities) and quite what the intention here was. A review of the bidding template supports this (the wording of the objective focuses on the agility of the system, while the evidence required of those bidding asks whether the Programme is addressing a strategic need, which is a slightly different issue). Some Programme leads also felt there was some cross-over between this objective and addressing government priorities, but the extent of distinction or overlap wasn't made clear.

3.1.3 *The selection process*

CSA letters and the explanation of the importance of the Programme idea (and potential added value of SPF funding) varied in depth

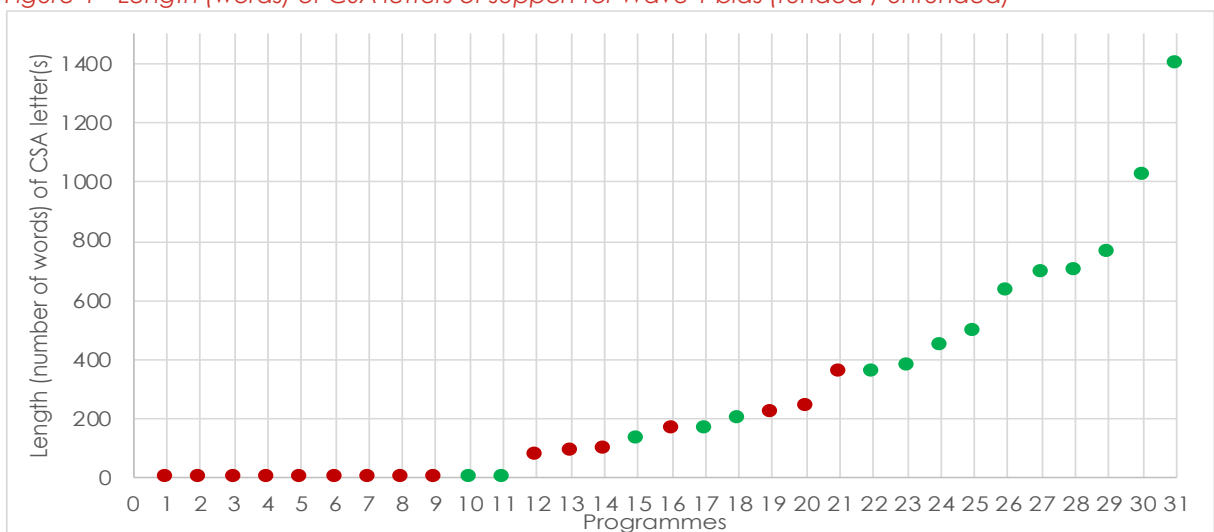
All of the panel members consulted complained about the usefulness of CSA letters of support, many of which were considered too short, simple and generic to be of much value in determining levels of interest, engagement, involvement or commitment to the proposed Programme. Most of the actual bid documents were reported to provide little information on relevant government priorities or on early engagement with the relevant government department(s) and so the panel looked to the CSA letters to gauge the importance and relevance of the proposal to addressing cross-government priorities (which, as was noted above, was seen by panel members as being at the core of the Fund's intentions).

There was no template (or guidance) provided for the CSA letters of support, which were submitted alongside around half of the Programme bids, and which varied in depth and focus as a consequence. Some provided very limited information – just a paragraph or two confirming support for the proposal and the Programme's alignment with department priorities.

(In some cases this text was largely repeated across multiple support letters). Other letters went further in, for example, detailing the way in which the Programme was likely to address their needs and have an impact on areas of policy and practice, or setting out their various intended inputs to the ongoing governance and implementation of the Programme. These are all areas that panel members interviewed for this study wanted to see addressed across all support letters.

Several of the CSA letters were mentioned during the Wave 1 panel discussions (according to the minutes), suggesting that these documents did influence the discussions⁴. There also appears to be a correlation between the inclusion (and length) of CSA letters of support and whether or not bids received funding (see analysis of Wave 1 bids in Figure 4 below), which aligns with the feedback received from panel members on the perceived importance and value of these support letters as part of the assessment and selection process.

Figure 4 Length (words) of CSA letters of support for Wave 1 bids (funded / unfunded)



Source: Technopolis analysis of Wave 1 bid documents. Programmes indicated in green were funded.

Encouraging the provision of more comprehensive explanation across such support letters would have given, by definition, more insights to the panel as to the degree of government department interest and commitment, helping to prioritise opportunities. One panel member also suggested that, in future iterations of a similar Fund, limiting the number of bids that individual departments or CSAs could endorse might further aid the identification of top priorities, while also encouraging greater engagement between the Councils / PSREs bidding and government.

It is important to note that in Wave 2, the Fund managed to successfully support an additional means of assessing government priorities via the introduction of a CSA prioritisation exercise (as detailed above), which was then referred to by the panel to understand government priorities⁵.

⁴ Four references were made to CSA letters in the Wave 1 minutes. In two cases this was to suggest that the CSA had not provided a strong case for support. In the other two cases, the CSA letter was considered to add weight to the proposal (and in both of these cases the bids went on to be funded).

⁵ We have also compared the successful and unsuccessful bids, per wave, in terms of budget requested, SPF objectives (self-assessment provided in the proposals), and degree of cross-council collaborations and did not find any notable differences.

The assessment process did not undertake the originally intended scoring / ranking process.

Guidance provided to the Wave 1 panel stated that bids would be scored against the essential and encouraged criteria, and that (in addition to the full bids) the panel would be provided with a ranked list of bids based on this scoring. However, this scoring and ranking process did not take place (in either Wave). Instead, the process relied entirely on panel views and discussion. This may have been a more efficient way of implementing the decision process, but it goes against the Fund aim of “improved transparency in the decision making process”. Panel members also commented that time was unnecessarily taken up within the session having to undertake a first sift through proposals to identify those that were poorly aligned with the Fund.

Panel members were invited to focus on Fund objectives in their decisions, but evidence from the minutes suggests that these were not always discussed in depth.

Panel members were tasked (through the panel guidance document) with giving their judgement on which bids performed most strongly against the assessment criteria (relating to excellence/quality, meeting SPF objectives and not being fundable from core budgets), and on the portfolio of projects that best meets the objectives of the fund.

Minutes of the panel sessions were then taken (verbatim for Wave 1 and in summary form for Wave 2), which provide evidence on the process that was then followed. While these do not provide insight into any preparatory activities, the minutes from Wave 1 do suggest that on the day of the panel there was quite limited discussion of each individual proposal, with just short overall opinions given by several members and no explicit mention of the Fund objectives at all (see a typical example in the left hand column of Figure 5).

The minutes suggest more elaborate discussions of proposals during the Wave 2 panel (see typical example in the right hand column), with for instance regular consideration of alternative sources of funding and potential alignment or duplication between the competing bids. However there were still only a small number of references made (at least within the summary notes) to the Fund’s objectives (e.g. 2 mentions of multidisciplinary, 3 of interdisciplinary and 6 of government priorities, across the 14 pages of notes and 37 proposals), suggesting that these may not have been a particular focus of the panel’s deliberations.

Figure 5 Example of panel assessment discussions (anonymised)

Wave 1 proposal assessment	Wave 2 proposal assessment
<ul style="list-style-type: none"> • I really wanted to like this bid and didn't. It's too far from industry. A great concept though. Too many different things going on—should be more focussed. • What is it trying to do? • Core activity surely? • Disappointed by this. Strip out some bids and get them talking to [organisation]. • Overambitious. • I liked it but am content to be overruled! <p><i>Decision: Agreed Unlikely</i></p>	<p>The panel noted that [government department] considered this proposal a top priority, making a compelling case for support. It had clear focus on the topic area but needs work to address how the funding flows between its constituent parts. It is clear that this proposal could have high impact in an important area however, the proposal could be strengthened further and currently appears to be too expensive. There were concerns about how the proposal would balance both setting up a centre and commissioning research. The panel asked [name] to liaise with the proposal leads to strengthen the case for funding further and proposed that the budget be lowered to an overall spend of £10M.</p> <p><i>Decision: Recommended for funding provided that several conditions are met</i></p>

The requirement for full business cases was considered demanding and caused delays.

Programme leads reported that insufficient time was given to develop full business cases (which were required by each Programme after the initial selection by the SPF panel and

Board). There was a lack of familiarity with producing such documents within the Councils and so additional guidance and support would have been welcomed to expedite this process.

The business case approval process also then delayed the launch of Programmes (business case approval reportedly took 4-5 months on average, and in at least one case was reported to have taken more than a year), often requiring a reprofiling of spend. Programmes were not allowed to announce their funding until the business case had been approved and a ministerial announcement made, which then limited the ability of Programmes to be able to engage with relevant parties, maintain the enthusiasm and commitment of partners, or prepare the relevant communities for Programme launch. Panel members also noted their disappointment at the slow speed of this approval process, given the often fast-moving, globally competitive nature of the areas in question. One panel member felt that this showed a lack of confidence in the decisions made by the panel and also suggested an appetite for risk that was at odds with the intentions of the Fund to address current strategic needs, priorities and opportunities.

3.1.4 *Conclusions regarding SPF process*

Successful bidders were broadly content with the bidding process, which may in part reflect the 'light touch' nature of requirements and the flexibility allowed to propose their Programme idea as they saw best. Panel members were similarly satisfied with most aspects of the process.

There have been a small number of issues raised in relation to the process however (as set out in the sub-sections above) that may have lessened the connection with Fund objectives (e.g. a lack of clarity around the third objective) and made it more difficult for the panel to select bids that best aligned with priorities (e.g. the lack of depth of CSA letters), as well as reduced the transparency of the decision-making process (e.g. not employing a scoring process).

With £800m+ of public funds dispersed, it is reasonable to expect a thorough and transparent process, that is purposefully designed to encourage and then select the best possible opportunities for supporting Fund objectives. Efforts were clearly made to achieve this (despite the tight timescales imposed upon the Fund), while further improvements were also made to processes between the two waves. However, there remain areas for possible improvement (see recommendations in Section 4.2) for any future iteration of the SPF or a similar Fund.

The next iterations of the evaluation (interim and final impact) will seek to reveal the extent to which the selected portfolio of Programmes is leading to the outcomes and impacts expected from the Fund (e.g. sustained effects among partners or wider ecosystem change), as well as whether changes in process from Wave 1 to 2 (e.g. the introduction of the CSA prioritisation exercise), have created portfolios that are delivering different kinds or levels of benefits (or not).

3.2 Objective: Driving an increase in high-quality MIDRI

→ **Outputs** (During fund implementation) →

• **A portfolio of programmes that each have one or more of the following features:**

1. Addresses complex challenges
2. Involves cross-Council collaboration in their design and governance
3. Employs actions / mechanisms (e.g. comms, peer review) to de-risk the submission of MIDRI grant applications and effectively assess these
4. Involves intersectoral collaboration (Councils, OGDs, BEIS PSREs) in their design and governance

5. Addresses Government R&I priorities (that are relevant for funding through SPF)

6. Supports underpinning research to address Industrial Strategy objectives

7. Addresses emerging opportunities/areas of interest identified by UKRI, government departments or the wider R&I community (agility) that are relevant for funding through SPF

8. Is of medium scale (£10m-£15m+)

- Agreement on **key** (cross-government) R&I **priorities**
- **R&I projects**, incl. projects involving PSREs
- **R&I outputs**
- High-quality **MIDRI grant applications** that address complex challenges

3.2.1 *MIDRI is embedded in the design and implementation of Programmes, with SPF providing a steer to mobilise or enhance existing mechanisms*

Most SPF Programmes have effectively put in place mechanisms or actions to de-risk and assess MIDRI proposals. In most cases these build upon existing mechanisms used by the Councils, rather than representing new approaches and methods.

This use of MIDRI-related actions is linked to SPF in so far as funding was made available for Programmes that intended to support MIDRI, with councils retaining the autonomy as to how best to execute this objective. It has also been enabled by the focus on supporting challenge-led Programmes that address cross-departmental government priorities, which has subsequently embedded the participation of different stakeholders at the design stage, in the shaping of research agendas, and

selection process (for competitive calls), further enhancing the MIDRI perspective. This is a subtle added value of SPF, but based on the evidence collected, effective to some extent.

Stakeholder involvement in Programme design and implementation

In light of the focus on multi- and inter-disciplinary research and innovation, SPF bidders were encouraged to work collaboratively.

As shown in Figure 6 and Table 2, a great variety of stakeholders were involved in the **Programme design / bidding process**. This figure and table show that:

- **Two-thirds of Programmes had heavy involvement from other Councils (beyond the lead organisation) in their design / bid.** 20 out of 33 Programmes (63%) provided a rating of 4 or 5 to the involvement of Councils, on a scale from 0 (not involved) to 5 (heavily involved)
- **Half of Programmes had heavy involvement from Government departments / agencies.** 16 out of 33 Programmes (53%) gave a rating of 4 or 5.
- **A quarter of Programmes had heavy involvement from PSREs (apart from the lead organisation) at the bid stage.** 7 out of 33 of Programmes (25%) gave a rating of 4 or 5). Additionally, PSREs were the lead or co-lead for 4 Programmes (not shown in the figure).
- There was also heavy involvement from industry and Universities/Academia in 2 and 13 Programmes respectively (noting that industry involvement in Programme design was not expected in this Fund)
- **Strong involvement of different stakeholders was more widespread in Wave 2 than Wave 1,** particularly for government departments, showing that the process for engaging with these stakeholders improved over time (as further discussed below, in Section 3.3.1)

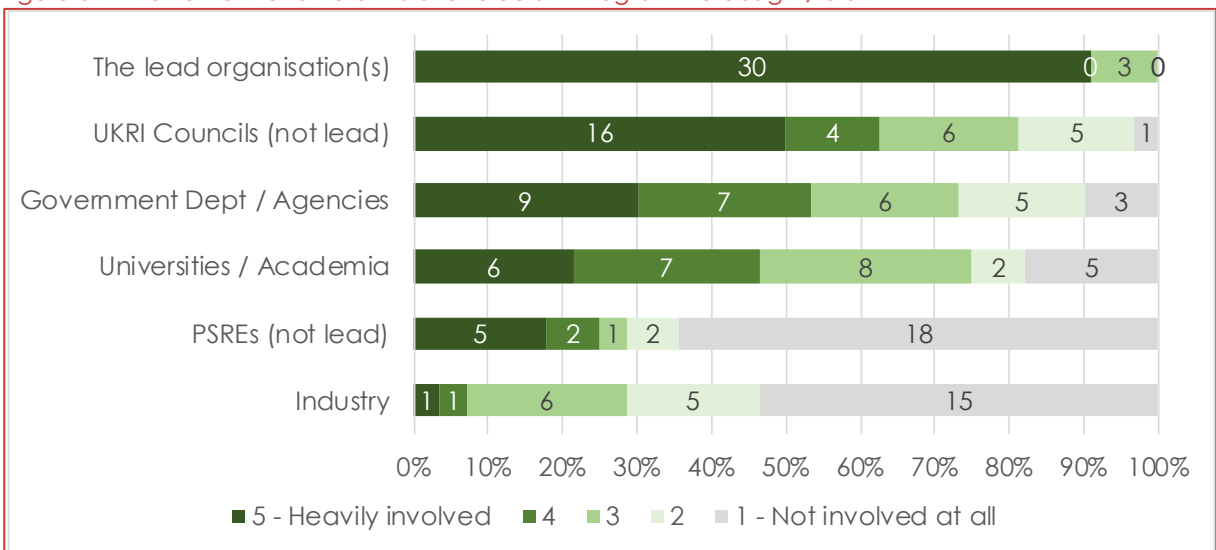
Additionally, we also find that:

- Different Programmes have different configurations and the strongest links achieved, in terms of bringing different stakeholders together are between Councils and government departments, and between Councils and Academia (see Figure 7).
- Notably, two Programmes had heavy involvement from Industry, Councils, Universities/Academia and Government Departments: the 'Protecting Citizens Online' and 'Ensuring the Security of Digital Technologies at the Periphery' Programmes. Other Programmes have also been able to mobilise a breadth of partners, within the same type of organisations, or mobilised the input of different stakeholders at the design stage (even if they have not been heavily involved in the Programme bid) as shown in Figure 9 below.

Future iterations of the evaluation will shed more light as to whether different configurations led to Programmes that are achieving better outcomes, as this could provide important lessons / insights for future interventions.

Given that the incentives and steer provided by SPF were light touch, any conclusion on the best (more impactful) configuration (of partners/collaborators at different stages of the Programme design and implementation) would have weak links to SPF as a mechanism. One could argue that in practice, SPF has worked as a source of funding for testing what works best, and as such, one of its major outcomes would be those lessons learned.

Figure 6 Involvement of different stakeholders in Programme design / bid



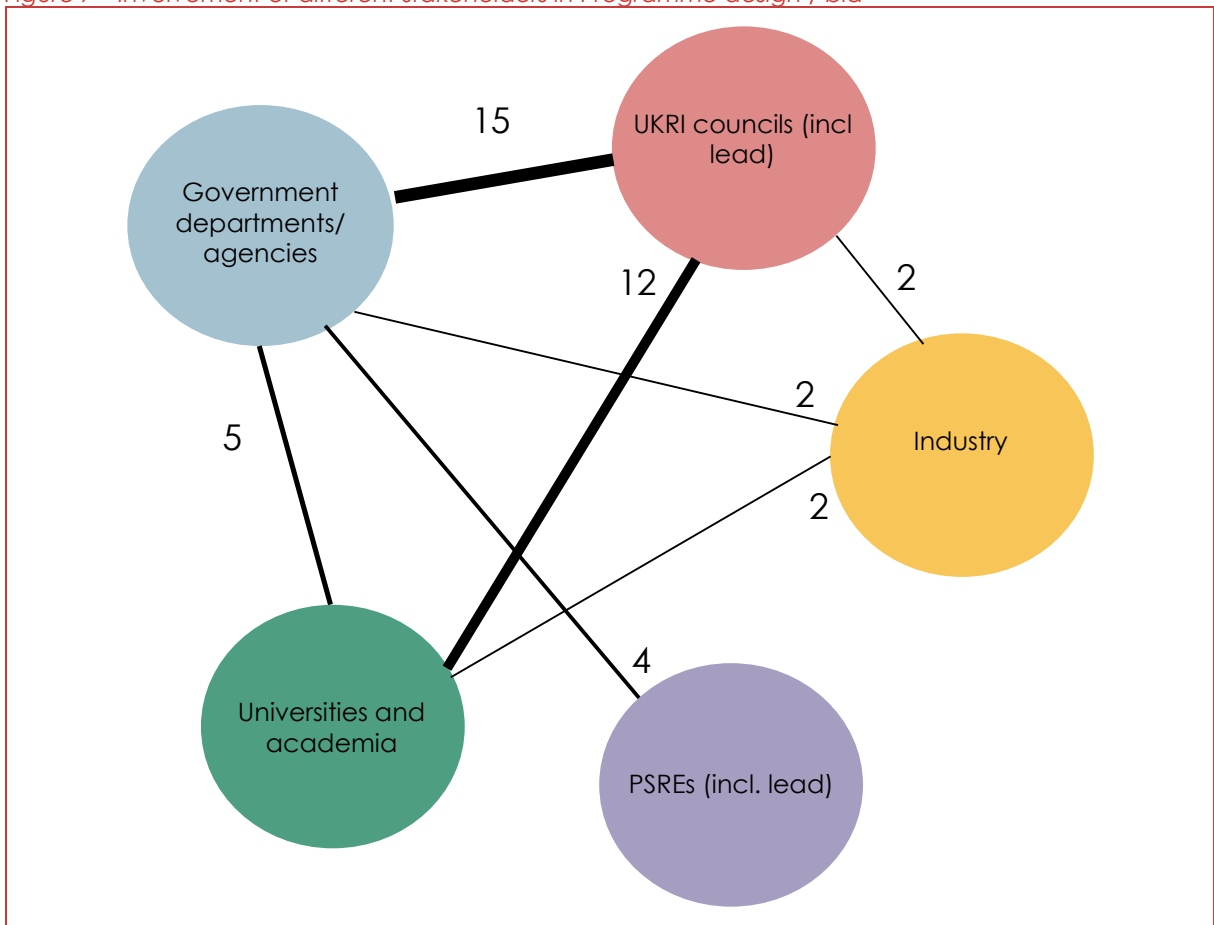
Source: Technopolis (2021) based on Programme Leads template (n=33)

Table 2 Intensity of involvement of different stakeholders

	Government	PSREs	Universities	Industry
Wave 1	3.4	1.4	3.1	1.6
Wave 2	4.3	1.8	3.2	1.7
All	3.9	1.7	3.2	1.7

Source: Technopolis (2021) based on Programme Leads template (n=33).

Figure 7 Involvement of different stakeholders in Programme design / bid

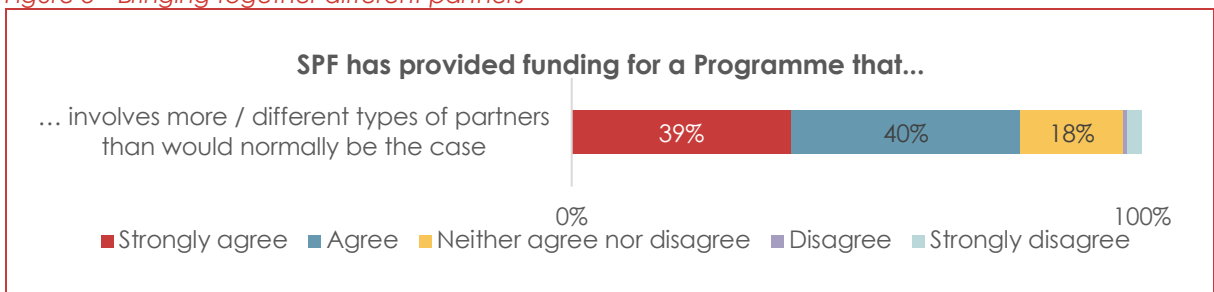


Source: Technopolis (2021) based on Programme Leads template (n=33)

In terms of partners, 79% of stakeholders agree or strongly agree that SPF has provided funding for Programmes that involve more / different type of partners than would normally be the case.

Across the SPF portfolio, Programmes have between 2 and 25 organisations (Councils, PSREs, government departments and other organisations such as charities and institutes) involved in the delivery of the Programme (a mean average of 6). Additionally, there are 28 Programmes that involve cross-Council collaboration (82% of the total).

Figure 8 Bringing together different partners



Source: Technopolis (2021) based on Programme Leads templates (n=33), Programmes Advisory Board survey (n=89), Chief Scientific Advisor Network (n=7)

There is also multi-stakeholder involvement in the implementation of the Programme via participation in governance mechanisms such as Programme coordination teams, and Advisory Boards/ Steering Committees. On the latter we find that:

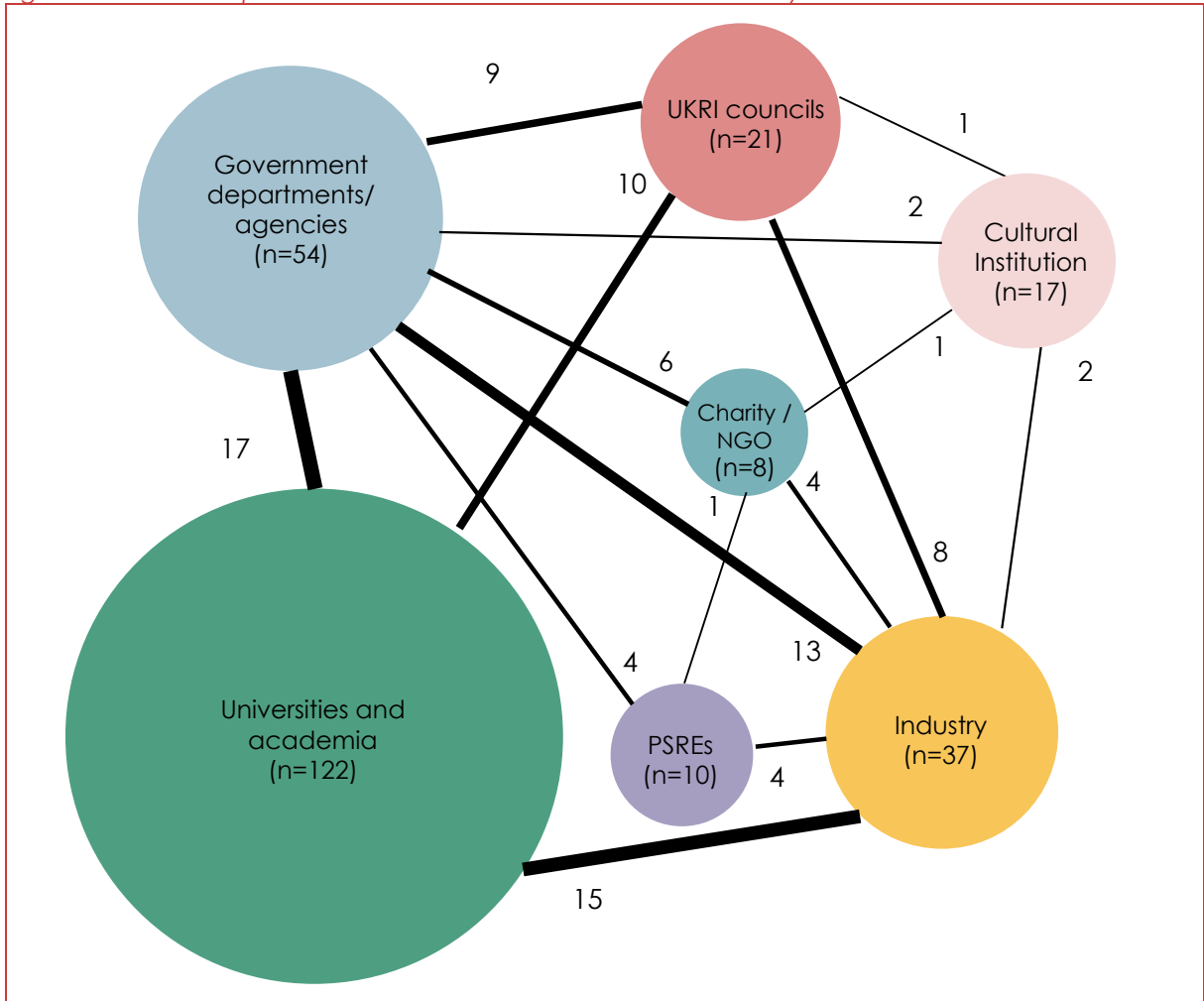
- A total of 25 Programmes (74%) currently have dedicated Advisory Boards in place (a further 6 are in construction)
- Each Board has 12 members, on average, and they include a total of 274 representatives from seven different type of organisations: Government Departments, UKRI/Councils, PSREs, Academia, Industry, Charities / NGOs, and Cultural Organisations
- Typically, four types of organisations are represented in each Advisory Board (based on the median), showing a wide breath of stakeholders involved
- The number, size and composition of advisory boards is similar across the two waves

The composition of the Advisory Boards is represented in Figure 9 below. In this graphic, the bubbles represent each type of organisation and are proportional in size to the number of representatives across all Advisory Boards (with total numbers provided). The links represent the number of Programmes that include each combination of stakeholder types.

The figure shows that there are between 13 and 17 Programmes (40%-51% of all SPF Programmes) connecting Government, Academia, and Industry within those Advisory Boards. Universities have a higher representation, and this is to be expected as there are far more universities than Government Departments or Councils in the overall population. Representation of PSREs is small, and they have only a small number of connections with others.

There are 11 Programmes that do not currently have a multi-stakeholder perspective via an Advisory Board (either because such a structure is not yet in place, or because it does not include different organisation types), and this may have an effect on their ability to contribute to SPF intended outcomes. In fact, with the exception of two, we find that all the Programmes that put forward concrete examples of identifying new ways of working among different stakeholders and increased awareness of R&I priorities (among Councils and Government Departments) have multi-stakeholder Advisory Boards (see Section 3.6).


Figure 9 Network representation of stakeholders involved in Advisory Boards



Source: Technopolis (2021) based on Programme Leads information (n=33)

The boxes below showcase from the case studied Programmes how the Fund has supported the bringing together of different stakeholders (and disciplines) across partners and oversight committees at Programme level, thanks in part to the scale of funding provided (which is signalled as a key value added of SPF).

Box 2 *Bringing together different partners to address a multifaceted problem (1)*



The Adolescence, Mental Health and the Developing Mind Programme

This is a £35m Wave 2 Programme led by the MRC and delivered with AHRC and ESRC. The Programme started in 2019. It aims to support better understanding of the developing adolescent mind and the genetic, physiological, social, and cultural factors that shape it and influence lifelong mental health, educational attainment, identity, social relationships, and behaviour.

The large scale and multi-disciplinary nature of the Programme was considered outside of any single funding partner's remit and could not be met from core budgets. This therefore required external investment. While other UKRI funds were not suitable, SPF provided a unique opportunity to coordinate an integrated, multi-sectoral approach at the scale needed.

When partners reflected on how this compared to usual, it was noted that the breadth of government departments engaged in the bid development was more varied than typical collaborations. Furthermore, while designing and developing the Programme idea, the MRC engaged with a variety

of different organisations to ensure coverage of research priorities (including academic experts, government departments, mental health services, young people, and other stakeholders). The research community was engaged throughout, including MRC Neurosciences and Mental Health Board, ESRC Mental Health Leadership Fellow, NIHR MindTech, UKRI Mental Health Network directors, and McPin Foundation. In addition, young people, and mental health service users and the NIHR Young Person's Mental Health Advisory Group were also consulted.

Source: Technopolis (2021). Case study: Adolescence, Mental Health & the Developing Mind Programme

Box 3 Bringing together different partners to address a multifaceted problem (2)



Bacterial Plant Diseases Programme

The Bacterial Plant Diseases Programme is being delivered by BBSRC, with support from NERC, alongside DEFRA and the Scottish Government.⁶ Matched funding of £1.1m was provided by DEFRA and the Scottish Government, with SPF funding of £17.8m. The focus of the Programme is interactions of bacterial pathogens with host plants, invertebrate vectors, and wider ecosystems, which (according to the original Programme bid) "present many research challenges of practical and policy relevance"

The depth and breadth of the threat posed by bacterial plant pathogens and the lack of knowledge about them was felt by all partners to be too large for any individual funder to make significant progress in knowledge. The SPF provided the opportunity for all the partners to be actively involved in a Programme that was on a much larger scale, with the potential for greater complexity of science and scope than any of the partners would have been able to fund from their individual budgets.

The fund also allowed a common pot of money across councils and with some financial input from Government departments, which meant that there was less competition for the funds. This allowed a shared focus and the opportunity to have input to some or all areas of the Programme as relevant, which meant the focus of the Programme was led by the priority rather than territory.

The Government partners in particular noted that the Programme would significantly impact on the development of policy to manage bacterial plant diseases. The size and scope of the Programme was felt to provide a much stronger evidence base for developing policy.

The Fund objectives provided a clear emphasis for the Programme to embed a MIDRI perspective, to ensure that UKRI investment linked up effectively with government priorities and that strategic priorities were addressed. The involvement of government partners was not a new feature resulting from the SPF, but the Fund encouraged greater ongoing involvement and a more forensic understanding of the government R&I priorities. It was reported that because of changes to funding over the past 10 years, the opportunity for research into UK plant issues had been relatively limited until SPF.

Source: Technopolis (2021). Case study: Bacterial and Plant Diseases Programme

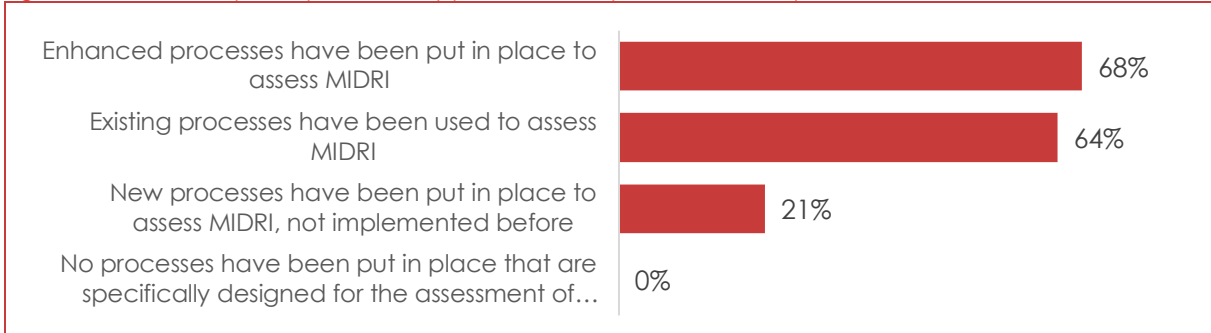
This high degree of MIDRI and multi-stakeholder involvement seen at the Programme level is also reflected in the team composition of projects funded by SPF Programmes (through competitive calls) and publications. This is explored in Section 3.5.

⁶ See: <https://www.ukri.org/our-work/our-main-funds/strategic-priorities-fund/>

Enhancing existing mechanisms to support MIDRI

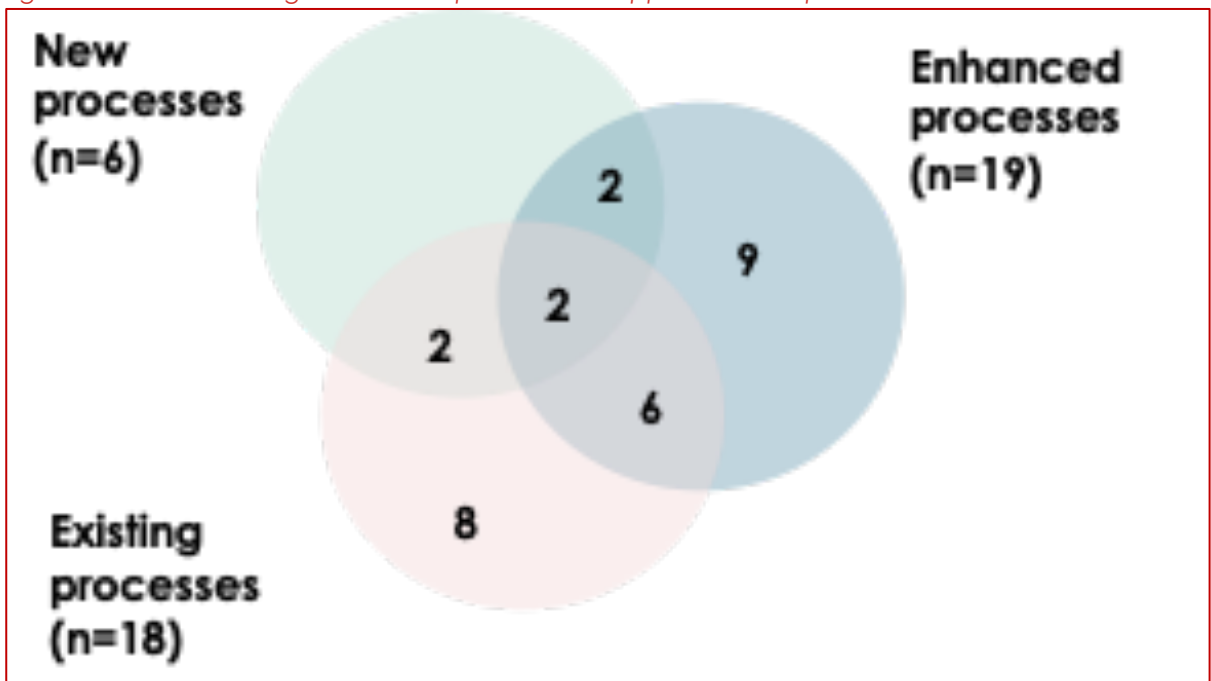
The majority of Programmes have made incremental changes to existing processes to assess MIDRI (68%) or have mobilised existing ones (64%), rather than introducing entirely new mechanisms (see Figure 10). In fact, Programmes have used a combination of different approaches (new, enhanced, or existing) in their competitive calls (see Figure 11).

Figure 10 Processes put in place to support MIDRI as part of SPF competitive calls



Source: Technopolis (2021) based on Programme Leads template. n=33

Figure 11 Number of Programmes with processes to support MIDRI as part of SPF calls

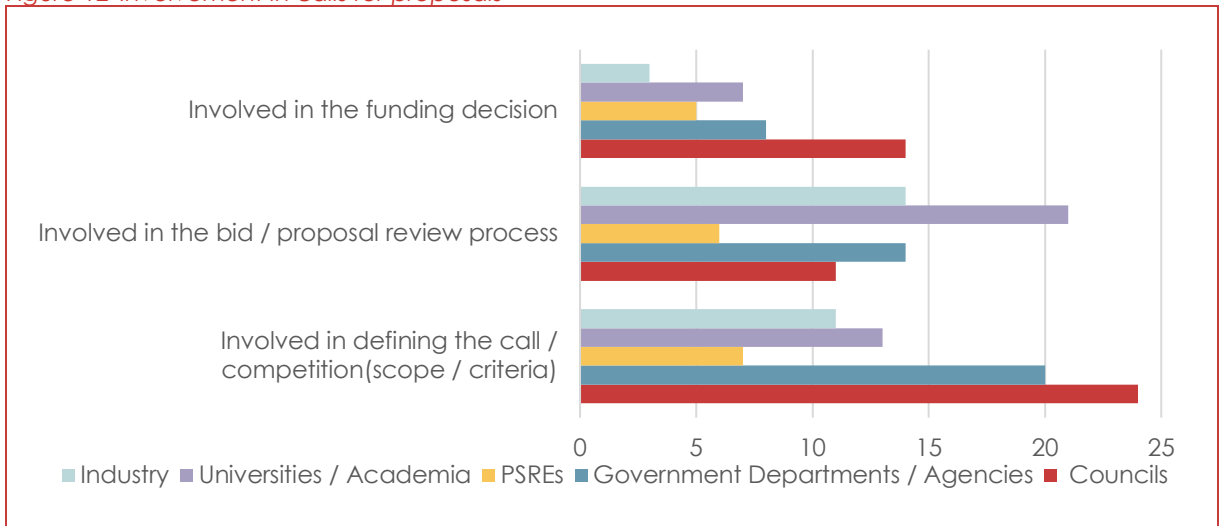


Source: Technopolis (2021) based on Programme Lead template. n=29 (4 Programmes have not had competitive calls).

Evidence collected via templates and interviews with Programme Leads shows that changes and enhancements relate, in most cases, to the participation of government departments in the assessment of proposals (for competitive calls). Where this already existed in the ways of working of the Councils, SPF's main added value has been the ability to implement such a process due to the scale of the funding available. Involvement of Government departments in defining the call / competition and in the bid/ proposal review process happened in 20 and 14 Programmes, respectively (out of 29) that have run competitive calls so far (see Figure 12).

Councils have also implemented specific assessment criteria to assess proposals against the suitability of the teams (including disciplinary mix) and panel members and reviewers were selected from a spread of disciplines (for which the Programmes engaged with colleagues across UKRI and partners). This is usual practice among Councils, but the Fund has allowed a closer connection with stakeholders, making it easier to identify and deploy relevant panel members.

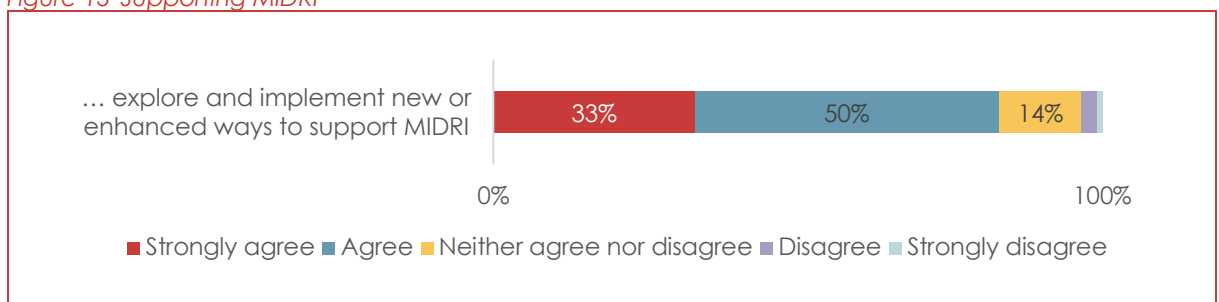
Figure 12 Involvement in calls for proposals



Source: Technopolis (2021) based on Programme Leads templates (n=29).

This is further validated by the different stakeholders (representatives from the Councils, but also from academia, government departments, industry and the third sector taking part in the different Programmes, Advisory Boards and Chief Scientific Advisors). In fact, 86% of those representatives reported, via survey, that they agree or strongly agree that SPF allowed their Programme to explore and implement new / enhanced ways to support MIDRI (see Figure 13).

Figure 13 Supporting MIDRI



Source: Technopolis (2021) based on Programme Leads templates (n=33), Programmes Advisory Board survey (n=89), Chief Scientific Advisor Network (n=7)

This is further substantiated by remarks made by members of the Advisory Boards set up by the different Programmes (representing universities and industry):

The Programme involves collaborative research across disciplines. I have based my research career on such activities, though I am aware for some this Programme offers them such an opportunity for the first time.

This has been a key Programme that has enabled cross-disciplinary projects between physicists and biologists, not fundable easily elsewhere, and it is already starting to generate key outputs.

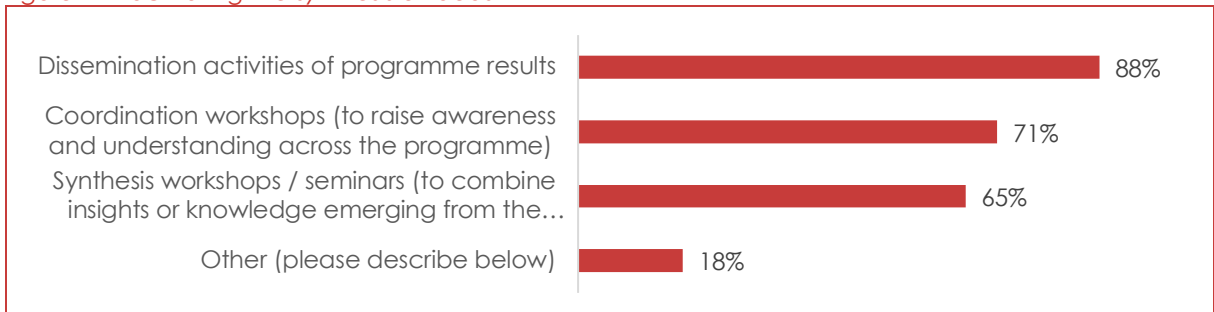
The Programme is very positive and is making a big difference. It will take time for university-based researchers to change from single issue research to the system-based research the SPF asks for. More cycles will cement this important change. It is important to continue to drive collaborations between researchers and the users of research - both social and technical

The Programmes have also taken **additional actions to facilitate interdisciplinarity** (i.e. going beyond the parallel multidisciplinary work), with the majority of Programmes funding (or planning to fund) a series of activities to bring together insights or knowledge across projects / work packages / research activities. This includes dissemination activities (88%), coordination workshops (to raise awareness and understanding across the Programme) (71%) and, to a lesser extent, synthesis workshops (to combine insights and knowledge emerging from the Programme) (65%) (see Figure 14). These types of activity are identified in the literature as important mechanisms to facilitate “genuine exchange of knowledge”⁷.

As remarked by one Programme Lead (via template):

The key point was the establishment of the coordination function – a multidisciplinary team charged with ‘providing the glue’ between the work packages, projects, and diversity of activities. This focus differs from the more common practice of a coordination function and Programme oversight.

Figure 14 Facilitating the synthesis of ideas



Source: Technopolis (2021) based on Programmes lead templates (n=33)

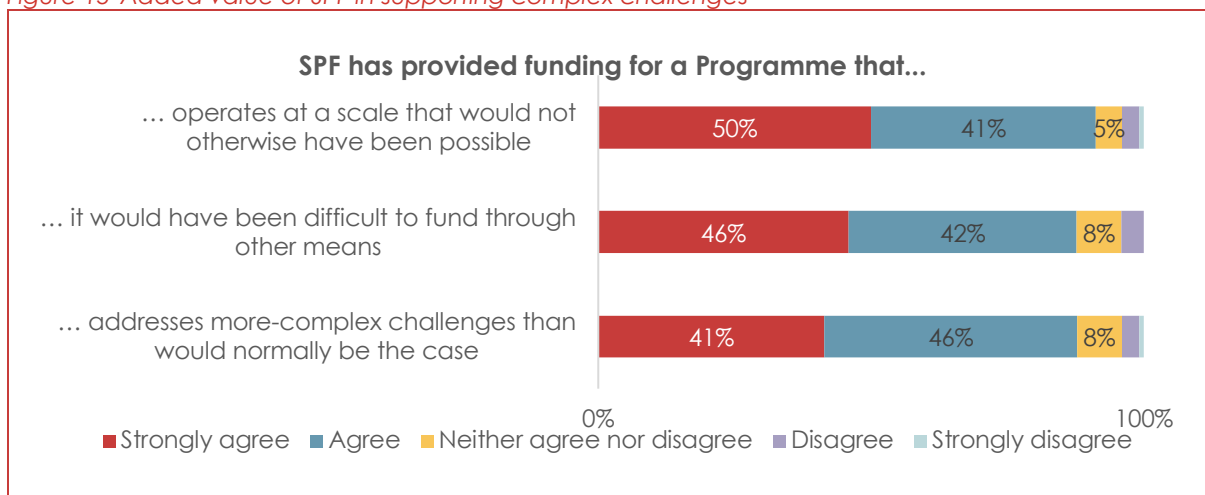
⁷ Strang, V., & McLeaish, T. (2015). Evaluating Interdisciplinary Research: a practical guide.

3.2.2 *SPF is allowing stakeholders to address more complex / multi-faceted problems than would otherwise be possible*

There is a strong consensus among the ~130 stakeholders of the R&I community involved in SPF and consulted for this study, that SPF is supporting the funding of complex challenges, and that the Programmes would have been difficult to fund via other means. Stakeholders include representatives from the Councils and PSREs leading Programmes (n=33), representatives from academia, government departments, industry and other organisations taking part in SPF Programme advisory boards (n=89), and Chief Scientific Advisors (n=7).

We find that 89% of stakeholders agree or strongly agree, via survey, that SPF has provided funding for a Programme that addresses more complex challenges than would normally be the case. Furthermore, 86% agree or strongly agree that it would have been difficult to fund those initiatives via other means, while a similar percentage (88%) agree or strongly agree that the Programmes operate at a scale that would not otherwise be possible (see Figure 15).

Figure 15 Added value of SPF in supporting complex challenges



Source: Technopolis (2021) based on Programme Leads templates (n=33), Programmes Advisory Board survey (n=89), Chief Scientific Advisor Network (n=7)

Addressing those complex challenges often requires a multi or interdisciplinary perspective, which normal funding mechanisms may not be well suited to create. This is in line with the findings of the Technopolis 2016 review of the interdisciplinary landscape in the UK⁸. The disciplinary focus of competitive funding was a concern across the stakeholder groups consulted as part of this review. Researchers, and strategic leaders specifically highlighted experiences of interdisciplinary (IDR) proposals ‘falling through the cracks’ at disciplinary boundaries, even when cross-Council mechanisms are used. There was a view among funders that reviewers may opt for a conservative approach, viewing projects perceived as lower risk more favourably, which may disadvantage IDR projects (that can be perceived as higher risk). It was unclear at that point whether either of these problems were substantive or perceived, but they were in line with previous studies (e.g. Travis and Collins, 1991).

As a centralised funding pot, SPF provides additional “neutral” resources, i.e. not tied to a specific Council or Government department’s budget, which facilitates funding to problems /

⁸ Davé, Anoushka et al (2016) “Landscape Review of Interdisciplinary Research in the UK”. Report to HEFCE and RCUK by Technopolis and the Science Policy Research Unit (SPRU), University of Sussex.

challenges that cross those disciplinary boundaries. As remarked by a member of an Advisory Board (from Industry):

It is rare that existing research proposals and funding opportunities take a systems-based approach. By only considering research that requires system stakeholders to come together to drive a sustainable system shift, this fund is unique and hugely valuable. Without It, it is unlikely that this type of research would happen.

SPF is, of course, not the only source of funding available to address complex challenges, and it was not intended to be so, but rather to add to resources in that direction. The Councils do fund other large-scale (£10m+) Programmes, but not often (see Section 3.4.1). Additionally, there are other funds supported by National Productivity Investment Fund (NPIF) that support large-scale Programmes, such as the Industrial Strategy Challenge Fund and Strength in Places Fund, but the first is industry-led (in comparison with SPF that is, mostly, led by challenges faced by government departments), and the second has a specific 'place' focus. One could argue that a more distinct focus on government priorities would, in turn, have given SPF a more distinct added value (as a source of funding) and position within the landscape.

As such, SPF adds to the suite of other initiatives with a focus on challenges and complex/multifaceted problems, and the evidence collected in this study shows that there is appetite in the R&I community (the Councils, universities, government departments) for access to funds that allow the resourcing of this scale (see Section 3.4.2).

There are contextual issues to consider when assessing SPF's added value in the future (with respect to the MIDRI objective), including the existence of a growing number of other MIDRI-related initiatives (through a more general expansion in challenge and mission-based funding), the critical importance of institutional funding for much MIDRI research (especially in the arts and humanities), and the influence of the REF's evolving rules and procedures in changing attitudes, with REF2014 introducing special measures and REF2021 doubling-down on this.

We summarise below SPF mechanisms and main value added in relation to MIDRI.

Box 4 MIDRI - main SPF mechanisms and added value

- Steer and selection of Programmes focused on addressing complex challenges (mostly driven by government priorities), which in turn has called for the need to bring together teams covering a variety of disciplines
- Scale of the funding (which in turn allows tackling more complex projects and bringing more partners to address those than would normally be possible)
- Nature of the funding (i.e. funds provided on top of core budgets of the organisations involved)
- The last two points are shared characteristics with other NPIF investments.

3.3 Objective: Addressing government priorities

➔ **Outputs** (During fund implementation) ➔

- **A portfolio of programmes that each have one or more of the following features:**
 - 1. Addresses complex challenges
 - 2. Involves cross-Council collaboration in their design and governance
 - 3. Employs actions / mechanisms (e.g. comms, peer review) to de-risk the submission of MIDRI grant applications and effectively assess these
 - 4. Involves intersectoral collaboration (Councils, OGDs, BEIS PSREs) in their design and governance
 - 5. Addresses Government R&I priorities (that are relevant for funding through SPF)
 - 6. Supports underpinning research to address Industrial Strategy objectives
 - 7. Addresses emerging opportunities/areas of interest identified by UKRI, government departments or the wider R&I community (agility) that are relevant for funding through SPF
 - 8. Is of medium scale (£10m-£15m+)
- **Agreement on key (cross-government) R&I priorities**
 - R&I projects, incl. projects involving PSREs
 - R&I outputs
 - High-quality MIDRI grant applications that address complex challenges

As stated in its Business Case, SPF was expected to address its high-level objective of 'ensuring UKRI's investment links up effectively with cross-departmental R&I priorities' by:

- Supporting joint work between UKRI and government departments to draw up a list of key government priorities
- Encouraging participation of government departments in Programmes, in the form of policy and/or governance support
- Allowing government departments' Public Sector Research Establishments (PSREs) to be eligible to bid for competitive funding alongside universities, businesses, and research establishments

Each of these immediate expected outputs from the Fund are explored in this section below.

3.3.1 *SPF has enabled a process for identifying cross-departmental government priorities and matching these with cross-council areas of strength*

SPF (Wave 2) helped to establish a novel centralised process for engagement between UKRI Councils and government departments to identify and prioritise relevant Programme ideas.

As was reported in Section 3.1.1 of the process evaluation, in preparation for the second Wave of SPF, GO Science led work to create greater co-ordination between departments in their dialogue with UKRI over the identification of priorities and the development of SPF bids. This involved a multi-step prioritisation process to identify and then consolidate cross-departmental R&I priorities, thereby supporting the development of Programme proposals aligned with these.

The SPF provided a first 'test' of the new government Areas of Research Interest (ARIs) and has encouraged further efforts to develop and improve their fitness for purpose.

The Nurse Review challenged government departments to take a more strategic approach to their R&D Programmes and relationships with academia, which resulted in the Cabinet Office and GO Science asking departments to begin publishing their ARIs from 2018, encompassing both near- and longer-term needs (with the latter typically involving closer links with academia and cross-departmental collaboration). SPF Wave 2 was considered the first real test of these early ARIs and GO Science reported that this had revealed that they were generally not yet mature enough to be used as the basis for determining cross-departmental priorities.

As a consequence, GO Science (in coordination with ESRC) has established two ARI fellows to promote academic-policy engagement around the ARIs, including to streamline and make sustainable the process of producing and updating these documents. These Fellows have since been working with departments to understand how ARIs were produced, how they were used, and what resources might be required to optimise engagement with them.

As part of this process, an analysis of the existing ARIs identified cross-cutting issues and themes of importance across departments, and between April and November 2020 the Fellows ran a proof of principle academic-policy engagement process. Nine working groups were established, each based around a particular theme (and a list of Areas of Research Interest),

with around 200 people involved in total (government officials, funders, and researchers). Their task was to identify existing evidence, key messages for decision-makers arising from this evidence, and gaps in the current research. This resulted in nine reports, setting out what is already known and where current gaps are in each of the cross-cutting areas. These reports are available as a resource for use by academics, policy makers and funders.⁹

These additional ARI-related activities have flowed directly from the experiences of SPF and further support progress towards SPF goals of cross-government co-ordination of research priorities and improved join-up and consensus across government and with the R&I community.

3.3.2 *SPF has established a portfolio of Programmes that address government R&I priorities and policy needs*

The Fund (through its objectives) and the Programme selection process (through the evidence required of bidders) were designed to encourage and identify Programmes that addressed key government priorities. As described above, bidders to both waves were asked to indicate if their Programme met this Fund objective and to then provide evidence of how it did so (through the template and a letter of support from a CSA). For Wave 2, bidders were also asked to provide evidence that government departments had been involved in bid development.

Across Waves 1 and 2, nearly all of the Programmes selected for funding (32 of the 34) self-assessed at bid stage as addressing the SPF objective relating to alignment with government priorities. As such, the final version of the SPF business case could report that 91% of SPF funding went to proposals involving a close partnership with a government department or agency (the HMT requirement had been at least one-third). Examples from some of the case studied Programmes of the identified links to government priorities are summarised in the boxes below.

Box 5 Alignment with government priorities – example of the SDTaP Programme



The Ensuring the Security of Digital Technologies at the Periphery (SDTaP) Programme

The SDTaP (SPF wave 1), is a £31m Programme led by EPSRC, in partnership with AHRC, ESRC and IUK. Government partners include the DCMS, the Home Office and GCHQ. The Programme builds on the pre-existing Privacy, Ethics, Trust, Reliability, Acceptability and Security (PETRAS) centre, and aims to create a centre of excellence for Internet of Things (IoT) Systems Cybersecurity. This will serve as a central point for knowledge dissemination and engagement, addressing threats arising from digital technological products in people's homes.

The bid document and letters of support from several CSAs highlighted important links between the Programme and government policies and priorities, including that:

- Cyber security is a UK Tier One National Priority and at the heart of GCHQ's mission, and the shift in focus (through this Programme) towards the periphery is welcome
- The proposal is well aligned with Government policy priorities on digital, as per the Industrial Strategy and Digital Strategy
- DCMS aspires for the UK to be an international leader in IoT development and uptake, and for people to access and benefit from connected technologies safely
- The Programme will allow government to gain a better understanding of key risks and opportunities in various market sectors, and to prioritise where it needs to develop security policies, metrics, and controls (and where it should place further research money)

Source: Technopolis (2021). Case study: The SDTaP Programme

⁹ https://www.upen.ac.uk/go_science/

Box 6 Alignment with government priorities – example of the PEC for Modern Slavery



The Policy and Evidence Centre (PEC) for Modern Slavery and Human Rights

The PEC is a £10m Programme led by AHRC in partnership with ESRC and the Home Office, plus universities, institutes, and centres active in the field. The Programme aims to develop and transform understanding of modern slavery, and to establish a connected and shared, joined-up approach to addressing it. Critical to this, is policy-relevant research that responds to strategic challenges in a collaborative and connected way, advances understanding, and stimulates innovative and effective solutions.

The Programme bid document and accompanying CSA support letter highlight a number of links to government policy and priorities, including that:

- Ending modern slavery is one of the Government's top priorities
- There is a need to understand more about all aspects of modern slavery to further improve the UK's response to tackling and preventing this crime
- The Programme can address a number of cross-Governmental research priorities which have been identified in the annex to the Home Office's Annual Report on Modern Slavery and which have informed the development of the bid
- Based on conversations with government departments (during bid development), the Programme will address areas of research interest that they would not be able to undertake otherwise

Source: Technopolis (2021). Case study: The PEC Programme

Box 7 Alignment with government priorities – example of the Clean Air Programmes



Clean Air Programmes

The Clean Air Programmes (Analysis and Solutions in wave 1, continued through Future Challenges in wave 2) were awarded £42.5m in SPF funding. The Programmes are led by NERC and the Met Office (a BEIS PSRE), in partnership with five other UKRI Councils and the National Physical Laboratory (another BEIS PSRE). There are also government bodies directly involved, including Defra, DHSC, DfT, and the Scottish and Welsh Governments. The Programmes aim to bring together the UK's research base (from multiple disciplines) to develop solutions to current air quality issues and future challenges, including reducing emissions of atmospheric pollution.

The bid document and supporting letters from CSAs identified a number of links to government policy and priorities, including that:

- Air quality is a key cross-Departmental priority of relevance to Defra, DHSC, DfT, BEIS, MHCLG and the Devolved Administrations. This is reflected in the UK Government's 25 Year Environment Plan (2017) and the Clean Air Strategy (2018)
- Poor air quality is acknowledged as the top environmental risk to public health in the UK (Clean Air Strategy, 2018) and the R&I in this Programme will support the evidence needs and ambitions set out in this strategy (along with the equivalents in Scotland and Wales)
- The emerging issue of indoor air quality in the UK is a priority for the Government CSA
- Most of the "easy wins" to reduce air pollution have already been implemented in the UK. Future improvements will require innovative solutions underpinned by new research
- Stakeholders are faced with multiple evidence streams leading to inconsistent analysis and inefficient application of new science to support policy and action

Source: Technopolis (2021). Case study: The Clean Air Programmes

Box 8 Alignment with government priorities – example of the TPR Programme



Transforming Productivity Research: productivity & health and healthy working practices

The TPR Programme was awarded £8.9m through SPF Wave 1. It is led by ESRC, in partnership with EPSRC and MRC, plus three government departments (DWP, BEIS, DHSC).

The bid document and supporting letters from CSAs explained the alignment of the Programme with the policy priorities of these government departments:

- DWP: the Programme will address a clear national priority, and is well-aligned with a number of DWP ARIs, including producing an integrated approach to improving health and work outcomes and joined-up, tailored and personalised health and work support structures and practices
- DHSC: there is potential benefit to the joint work carried out by DWP and DHSC, particularly around the new government strategy relating to 'Improving lives: The Future of Work, Health and Disability' (and the importance given within this to managers in delivering healthy and inclusive workplaces)
- BEIS: Areas of Research Interest include understanding the drivers of productivity differences and dynamics, investigating cross-UK and international comparisons, and exploring solutions to tackling our 'long tail' of low productivity, all of which would be addressed via this programme of research

Source: Technopolis (2021). Case study: The PEC Programme

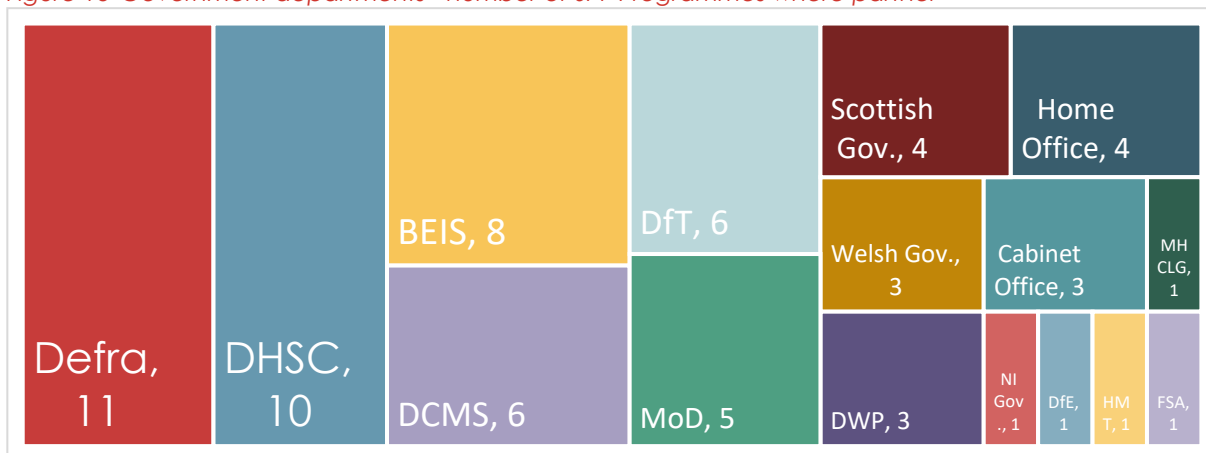
Section 3.3.1 explained the centralised (Go-Science / CSA) process for identification of cross-departmental priorities during Wave 2, which established a final list of 18 priority proposals (15 top priority and a further 5 second tier). This process helped to establish close links between Councils and government departments during the formation of Programme ideas, which is then reflected in the bids that were submitted (in terms of demonstrating alignment with government priorities, but also in the plans already established for government involvement in the ongoing implementation and governance of Programmes). We also see in the minutes of the assessment panel that this prioritisation exercise was taken into account in the discussions of the merits of bids, with a 'prioritised bid' providing a strong rationale for selection.

As a result, the eventual portfolio of 19 Wave 2 SPF Programmes included 14 of the 18 CSA-prioritised bids, including 10 of the 15 that were classified as a top priority. As such, we conclude that this additional process has been effective in identifying government priorities for R&I Programmes to address and in encouraging greater co-creation of Programme ideas, with the result that a majority of the top priorities identified by CSAs have been supported through SPF.

3.3.3 SPF has facilitated government department involvement in the design and implementation of Programmes (including their governance)

Most SPF Programmes involve one or more partners from a government department, agency, or devolved administration. Of the 34 Programmes in the SPF portfolio, 30 involve at least one government department (or agency or devolved administration) as a partner, with 16 different organisations involved in total (Figure 16), covering the great majority with significant R&D budgets. Defra (11), DHSC (10) and BEIS (8) are the most active, in terms of the number of Programmes that they are involved in.

Figure 16 Government departments - number of SPF Programmes where partner

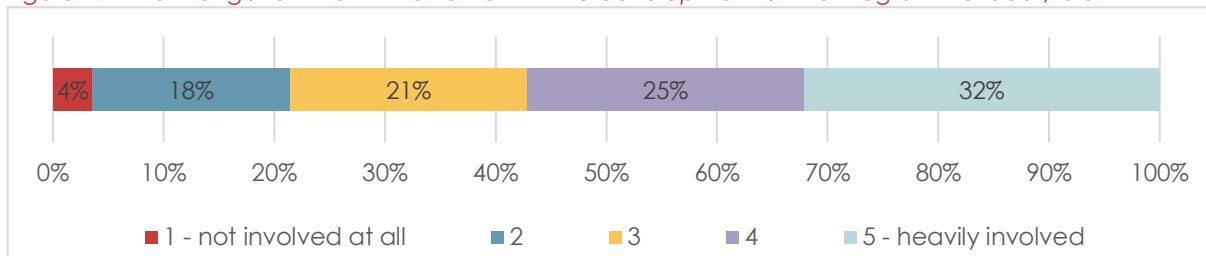


Source: SPF Programme leads

However, the extent of government input to Programme ideas/bids was variable. Programme leads reported on the extent of involvement of government partners in the development of their Programme idea / bid, on a scale from 1 (not involved at all) to 5 (heavily involved). Of the 28 responding (with a government partner) a majority (17, or 59%) gave a rating of 4 or 5 (i.e. a high level of involvement), while 6 (22%) reported little or no involvement.

SPF has therefore successfully encouraged some participation and input from government departments to the development of most of the Programmes within its portfolio. However, the level of involvement has been variable, between Programmes and over time. The evaluation team will work with UKRI to engage more closely with government departments during the next phase of the evaluation to explore the reasons for and consequences of this variability in more depth.

Figure 17 Extent of government involvement in the development of the Programme idea / bid



Source: Programme lead responses (n=28). Excludes 2 Programmes reporting no government partners.

The following two boxes give examples (from the case studies) of government involvement in the development of SPF Programme bids.

Box 9 Government input to SPF Programme bids – example of the SDTaP Programme



The Ensuring the Security of Digital Technologies at the Periphery (SDTaP) Programme

There was significant discussion and input to the SDTaP proposal from DCMS, the Home Office and GCHQ/NCSC, as well as the Office for Security and Counter Terrorism, National Security, and the Department for International Trade (DIT). This included identifying areas of research that were of a clear strategic focus to the UK. This early engagement with government partners in the design of the Programme was considered by those consulted within the Programme's governance, to be very important, and quite different to business as usual.

Source: Technopolis (2021). Case study: The SDTaP Programme

Box 10 Government input to SPF Programme bids – example of the PEC for Modern Slavery



The Policy and Evidence Centre for Modern Slavery and Human Rights

The concept for PEC was developed by AHRC, in close consultation with the Home Office and experts working in modern slavery and interrelated fields. This included a series of workshops held with key parties (academics, data scientists, media, businesses, government) to understand needs and begin to establish the structure of a potential policy and evidence centre. It was agreed at these workshops that an independent authoritative voice able to move the research agenda at 'scale' was required. The PEC proposal would therefore enable a focus on this identified priority by facilitating a collaborative approach, drawing together different disciplines and organisations, and integrating research and evidence that was hitherto disconnected and disparate.

Source: Technopolis (2021). Case study: The PEC Programme

Amongst the (12) government CSAs responding to our survey, 5 had been involved in the development of at least one SPF Programme bid (in all cases these were successful). In the previous figure, these Programmes were all rated by Programme leads at between 3 and 5 (out of 5) in terms of the input and involvement from government departments at the bid stage.

All five of these CSAs reported that their involvement had included the provision of inputs for the design of the Programme, as well as a letter of support for the Programme bid. Most (4) reported that they had also contributed to the identification of areas of interest, while one reported having helped with identifying partners. Most of these CSAs (four) reported that the bid development process had worked well 'to some extent' and made suggestions for improvement (see below), while only one said that it had worked well 'to a great extent'. (None of the respondents reported that the process had 'not worked at all').

Suggestions for improvement to bid-stage involvement from these representatives centred around earlier communication and engagement between Councils and CSAs (i.e. before bid development begins), supported by a centralised coordination function that could provide early communication of intentions and plans, as well as help to facilitate broad initial engagement (e.g. through preparatory scoping workshops). It was suggested that the process had instead relied too heavily on individual initiative and existing relationships.

We were slightly late to the party, the proposal in response to the SPF call being in development when we were asked to support. From this point we were well engaged, but perhaps we should have been better coordinated earlier on in the overall SPF process. (Government CSA)

Government departments are now playing an active role in the ongoing governance and implementation of most SPF Programmes. Programme leads also reported on the involvement of government departments / agencies in subsequent call processes to select R&I projects (where these are taking place). Of the 30 leads that responded, most (67%) reported government involvement in defining the call or competition (e.g. helping to determine the scope and criteria). Half (47%) then also reported government involvement in the bid / proposal review process, while fewer (27%) indicated that government representatives were involved in the eventual funding decisions. The following boxes provide examples of this government involvement in implementation, taken from the case study Programmes.

Box 11 Government input to SPF Programme implementation – example of the SDTaP



The Ensuring the Security of Digital Technologies at the Periphery (SDTaP) Programme

The government departments and agencies now sit on the governing board of the Programme, alongside representatives from five Councils. They all meet twice a year to address strategic issues relating to the Programme, while monthly meetings also take place between sub-groups. Feedback from those involved in the Board was that this had been working as an effective mechanism, helping to facilitate communication across partners and providing a regular opportunity for discussion and input. The board was playing a central role in shaping the ongoing evolution of the Programme, based on a shared understanding of needs and priorities, as well as providing an opportunity for strengthening relationships and interaction between different organisations.

Source: Technopolis (2021). Case study: The SDTaP Programme

Box 12 Government input to SPF Programme implementation – example of Clean Air



Clean Air Programmes

The Programme is ensuring that its funding links up with government priorities, via government involvement and steer through governance and advisory bodies. The multi-stakeholder and multi-disciplinary approach to the Programme was felt by those involved to be very important for supporting future policy making. The current governance of the Programme (Programme Board and Steering Committee) ensures that representatives from seven councils, two PSREs and several government bodies are responsible for research conducted on Clean Air, bringing a more comprehensive perspective on the issues investigated. A Programme partner reported:

“One of the simple things we were saying at the start is, ‘If we could just get a few people from the medical research world talking to people who do atmospheric composition, we could tie up how much air pollution there is going to be in the atmosphere with what effect that has on people.’ It’s so important to have that link. How do you build a policy to address equality issues, if you haven’t?”

Source: Technopolis (2021). Case study: The Clean Air Programmes

Seven of the 12 CSAs that responded to our survey had been involved in the implementation of at least one SPF Programme (in addition to any involvement in bid development). They indicated that this had taken many different forms, including providing advice on the research agenda (5 of the 7 CSAs); designing calls for proposals (4), assessing proposals (4), sitting on advisory boards (2), involvement in dissemination activities (2), and providing advice on implementation (1).

These CSAs were broadly positive about their degree of involvement in Programme implementation, with respondents split ('to some extent' / 'to a great extent') in their assessment of this being fit for purpose to capture CSA insights and to support the Programme in addressing government R&I priorities. The usual tensions between end-users and the research community have emerged within the governance mechanisms of the Programme, but generally these have been resolved over time. Just one of the CSAs reported ongoing concerns about their involvement, highlighting that the focus of all other members of their Programme's steering committee were focused on research excellence, rather than the

usefulness / usability of Programme and project outputs. This individual recommended that SPF Programmes should ensure expanded steering bodies that include more end user perspectives, as well as greater explicitness about the Programme's priorities, intentions, and targeted end users (that would help focus the minds of governance bodies).

One CSA also reported that, on occasions, strategic decisions had been made by the Programme without steering committee input or knowledge, limiting the input of the CSA (as well as other committee members). They suggested that, where government priorities are supposed to be being addressed, it should be ensured that Programmes provide meaningful opportunities for government representatives to participate and steer implementation.

At the same time, several other Programme leads (n=4) pointed out that changes in CSA personnel and difficulties in involving government departments sufficiently (i.e. maintaining strong lines of communication with a key individual) were seen as a barriers to Programme implementation (and to the likely achievement of outcomes) (see Section 3.6).

More broadly, we have collected information on the **advisory board membership** of all SPF Programmes. From this, we have identified 51 individuals (19% of the total) that represent government departments or agencies. These are spread across 17 (77%) of the 22 Programmes providing details. Each of these Programmes therefore has 3 government representatives on their board on average (22% of their total membership). There are 25 different government bodies represented in total, including most commonly Defra (7 representatives), DCMS (6), the Home Office (4) and the Scottish and Welsh governments (4 each).

Section 3.6.1 assesses early signs of progress towards achieving outcomes related to strengthening linkages among different partner organisations. It includes examples from Programmes of new or enhanced ways of working between governments departments and Councils within SPF Programmes (as well as some examples of where this experience has also influenced thinking and working outside of SPF). It also highlights some of the main barriers and facilitators reported in joint working and collaborating across different types of organisations.

3.3.4 *SPF has also facilitated PRSE involvement in the design and implementation of Programmes (including governance), but to a more limited extent*

Eligibility for Public Sector Research Establishments (PSREs) was incorporated into the design of the SPF (at both the Fund and Programme level) to support the achievement of its objectives. The rationale was that PSREs are integrated (to a greater / lesser extent) into the science function of government departments, familiar with their R&D priorities and connected to policy makers and practitioners. It was therefore envisaged that PSREs (as partners) would support the connection with government department priorities, as well as pull-through of outputs.

This section focuses on the involvement of PSREs at the Fund level (i.e. in the design and implementation of Programmes). PSRE involvement in projects is then covered in Section 3.5.1.

SPF has encouraged PSREs to participate as partners in some Programmes. BEIS-funded PSREs (UKSA, UKAEA, NPL, NNL, the Met Office and Go-Science) were eligible to submit SPF Programme proposals, and of the 34 Programmes in the eventual SPF portfolio, 7 (21%) involve one or more of these PSREs as a lead / partner¹⁰. In addition, another 7 Programme bids that were not selected for funding also included PSREs as partners.

The following table summarises the number of bids / Programmes that each PSRE was involved in (as a lead or partner). Note that Go-Science is not listed, as it took a conscious decision not to lead or partner on particular Programmes, but rather to support coordination efforts between Councils, Government Departments and PSREs (see Section 3.3.1).

Table 3 PSRE involvement in SPF Programmes/bids as leads and partners

	Programme Bids		Successful Programmes	
	Lead	Partner	Lead / co-lead	Partner
Met Office	5	1	5	1
NPL	1	6		4
UKAEA	1	1		1
UKSA	1	3		
NNL		1		
Total	8	12	5	6

Programme leads have reported on the extent of involvement of PSREs in the development of their Programme idea / bid, using a scale from 1 (not involved at all) to 5 (heavily involved). Just 8 (24% of all Programmes) gave a rating of 4 or 5 (i.e. a high level of involvement), while 1 Programme gave a rating of 3. The remainder reported little or no involvement (rating of 1 or 2). This suggests there was not widespread significant PSRE involvement across the full portfolio at the bid stage. However, just amongst the seven Programmes with a PSRE involved as a lead or partner, there is evidence of substantial input. Of these 7 Programmes, 6 (86%) gave a rating of 4 or 5 to PSRE involvement at the bid stage (the other Programme gave a rating of 1).

We summarise below SPF's mechanisms and main value added.

Box 13 Government priorities - main SPF mechanisms and added value

- The high-level objective (alignment with government priorities) has flowed through to Programme bid requirements and assessment criteria (evidence of government involvement in bid, alignment with government priority, CSA letter of support)
- It has also provided additional funding (at scale), at a time when both Council and government department R&I budgets are constrained, limiting their ability to collaborate (and address these priorities)
- This has resulted in a portfolio of Programmes that has strong alignment with government priorities and policy needs, as well as partnerships and governance mechanisms that allow for ongoing involvement of government in Programme implementation
- The Fund has allowed BEIS PSREs to bid for SPF Programmes, with some (limited) uptake

¹⁰ A fifth Programme (Quantum Sensors for Fundamental Physics) did originally include UKSA and NPL as partners, but UKSA was not involved after the business case and NPL were removed as a partner due to a conflict of interest.

3.4 Objective: Responding to strategic priorities and opportunities

➔ **Outputs** (During fund implementation) ➔

- **A portfolio of programmes that each have one or more of the following features:**

MIDRI	<ol style="list-style-type: none"> 1. Addresses complex challenges 2. Involves cross-Council collaboration in their design and governance 3. Employs actions / mechanisms (e.g. comms, peer review) to de-risk the submission of MIDRI grant applications and effectively assess these
Gov.	<ol style="list-style-type: none"> 4. Involves intersectoral collaboration (Councils, OGDs, BEIS PSREs) in their design and governance 5. Addresses Government R&I priorities (that are relevant for funding through SPF)
Agility	<ol style="list-style-type: none"> 6. Supports underpinning research to address Industrial Strategy objectives 7. Addresses emerging opportunities/areas of interest identified by UKRI, government departments or the wider R&I community (agility) that are relevant for funding through SPF 8. Is of medium scale (£10m-£15m+)

- Agreement on **key** (cross-government) R&I **priorities**
- **R&I projects**, incl. projects involving PSREs
- **R&I outputs**
- High-quality **MIDRI grant applications** that address complex challenges

There are two main aspects to the third objective of SPF, which relates to the funding system's agility. These are:

- The provision of funding for medium-scale Programmes (those above £10m in size), to address a gap in the current funding system
- The provision of funding to respond to strategic priorities and emerging opportunities

3.4.1 *The scale and mode of funding has been singled out as the most important value added of SPF*

The SPF Business Case points to a gap in the funding system for projects that are typically too large to be funded through a Council award (where responsive research projects tend to be funded up to the low millions and only a small number of strategic research Programmes are £10m+), but not large enough to constitute an ISCF

Grand Challenge (where the average Wave 2 challenge received £72m in funding).

Nearly all (28/33) of the Programmes within the SPF portfolio are medium scale (£10m+). In fact, the average SPF Programme is £24m in size. For comparison, we have updated an analysis used in the original SPF Business Case, which provides an illustrative example from NERC (which publicises a list and details of all of its research Programmes)¹¹.

NERC currently lists 80 research Programmes on its website (of £375k to £109m in size). Amongst these, 49 were active in 2018 (when SPF was launched), and the left-hand side of Figure 18 shows that these were mostly under £10m in value, with just 12 larger Programmes (24% of the total). The total number of Programmes has reduced slightly in recent years (there are currently 40 that are active), but this still includes 12 larger Programmes (30% of the total).

The right-hand side of Figure 18 then shows the contribution of different funding sources to this current total. It shows that SPF Programmes account for 2 of the 28 current smaller Programmes (7%) and 4 of the 12 larger Programmes (33%). Other than one GCRF Programme, there are currently no other £10m+ NERC Programmes supported by cross-Council Funds (although half of the remaining large Programmes are initiatives involving other Councils).

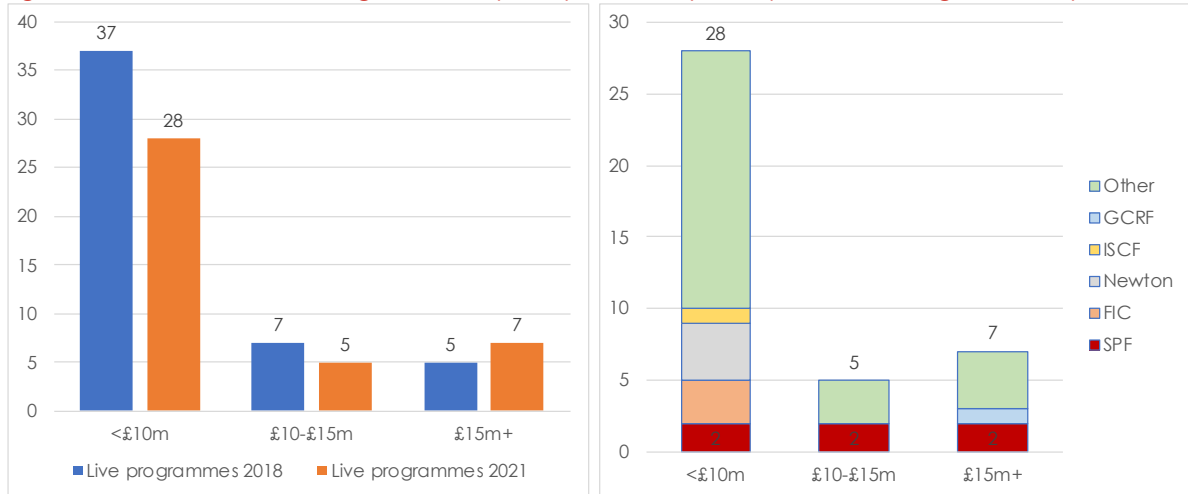
Note that the published list does not currently include *all* SPF Programmes with NERC involvement. NERC leads on 5 SPF Programmes (of which 4 are listed) and partners on 7 Programmes (of which 1 is listed). Six of the missing Programmes are £10m+. If these were added, SPF Programmes would account for 45% of NERC's current larger Programmes (which would number 22 overall).

This analysis suggests (at least for NERC, where sufficient data is made publicly available) that a gap in the funding system did exist for larger Programmes, which were very much in the minority before SPF. Also, NERC's SPF Programmes have mainly been in the £10m+ range and

¹¹ <https://nerc.ukri.org/research/funded/Programmes/> (accessed 1st June 2021)

now account for between one-third and a half (depending on the data source used) of all NERC's current larger Programmes.

Figure 18 Number of NERC Programmes, by size (2018, 2021) and split of 2021 Programmes by source



Source: Technopolis (2021) based NERC data <https://nerc.ukri.org/research/funded/Programmes/> (accessed 1st June 2021)

As has been mentioned in previous sections, another key feature of this additional funding is that it represents “neutral resources”, i.e. not tied to a specific Council or Government department’s budget. This has been reported to have encouraged greater openness and flexibility and facilitated the addressing of problems / challenges that cross disciplinary boundaries. Councils reported being less proprietorial when developing and implementing SPF Programmes, compared with business as usual, and more focused on supporting the best opportunities, rather than securing a share of the budget for their own purposes.

Importantly also, this funding has been made available in between spending review allocations, at a time when R&I budgets (both of Councils and government departments) are reported to have been “tight” and with existing funding mostly already committed, leaving limited room for new initiatives (at scale) to address emerging opportunities and priorities.

Although not an explicit intention of the Fund, the timing and scale of the funding (along with the autonomy provided to individual SPF Programmes) has also allowed for agility at the Programme / project level. We see this, for example, in the previously unplanned Covid-related rapid response calls that were issued in 2020 by two of the SPF Programmes (the Modern Slavery Policy and Evidence Centre Programme and the Adolescence, Mental Health and the Developing Mind Programme).

3.4.2 Sourcing at this medium scale has then in turn facilitated progress against SPF objectives

There is a strong sense among Programme leads and partners that SPF funding has allowed them to address opportunities that might otherwise have been missed, both because of a lack of funding (at scale) in the system otherwise, and also because the Fund (through its objectives and selection criteria, and its stated intention to support larger Programmes) has provided additional impetus to look across Councils and to work more closely with government departments. This in turn has encouraged and enabled Programme ideas that address emerging opportunities and more complex problems, and to do so through a multi-stakeholder approach.

Two examples, taken from the case studied Programmes, are shown in the boxes below, which demonstrate the influence of providing funding at a medium-scale.

Box 14 *Benefits of addressing challenge via a medium scale Programme (1)*



Space Weather, Innovation, Measurement, Modelling and Risk Programme (SWIMMR)

The SWIMMR Programme was funded under the second wave of SPF. The £20m Programme was launched in April 2019 and will run for four years. It is led by STFC in partnership with NERC and the UK Met Office. Other partners include Surrey Space Centre (SSC) and Surrey Satellite Technology Limited.

The Programme aims to provide a strategic UK approach to Space Weather, enabling the Met Office to better predict space weather events and reduce their threat to economic and social activities.

The relatively large Programme budget is allowing the Councils to finance more ambitious projects than would have been feasible under traditional research Programmes: “[SPF] has given us a broader canvas to paint on and therefore it has allowed us to include some things that definitely do address priorities, but that we might not necessarily have included if the opportunity was smaller”. Although, the first outputs will only be available at the end of 2021, SWIMMR appears to be on track to deliver on its objectives and to respond to strategic priorities for the UK.

Source: Technopolis (2021). Case study: Space Weather, Innovation, Measurement, Modelling and Risk Programme (SWIMMR)

Box 15 *Benefits of addressing challenge via a medium scale Programme (2)*



The National Timing Centre

The National Timing Centre (NTC), which sits within the National Physical Laboratory (NPL), was funded under the second wave of SPF. Its overall budget is £30.3m and the centre commenced operations in July 2019 (a few months later than intended).¹² NPC is a five-year Programme.

NTC’s key government stakeholder departments are the MoD (through DSTL and StratCom), BEIS and DfT. However, there are 18 other partners involved.

The organisations and individuals involved in the Programme are from multiple organisations. These organisations were known to each other before, however, with many working together on the existing Position, Navigation and Timing (PNT) working group. At this stage there is therefore no evidence of new relationships and working arrangements having been established outside the ‘Business as Usual’ context. Most of the individuals working together are also of the same discipline (the same type of job roles focusing on the same areas – timing and navigation – but for different organisations). As such, there is also limited evidence of multi-disciplinary working at the level of the Programme’s governance and leadership.

However, despite this, the interviewees still felt that in the absence of the SPF support, this type of research would not have proceeded at the time or pace that it has. This means that, without this SPF support, the UK’s risk exposure to PNT services disruption, and the economic and national security consequences, would be greater than it currently is.

Source: Technopolis (2021). Case study: The National Timing Centre

One quarter of the surveyed representatives of the Programmes Advisory Boards singled out the scale of funding as the ‘single’ most important benefit of having the SPF. They provided a variety of explanations for what this enables, a selection of which are shown below:

¹² Work began in April 2019, although the contract for the Programme was not signed until December 2019. Therefore, up until December 2019 NPL were working at risk, which presented a barrier to working to the intended timeline.

- It enables larger scale funding than might otherwise be available and allows complex problems to be addressed
- The SPF fund enables large-scale research Programmes that require multidisciplinary approaches that go over and above the limitations of a single large grant
- The ability to have a single, coordinated, UK Programme in an area of R&D (exascale) helps to prevent fragmentation.
- The scale is very significant in this domain - humanities projects usually work at a small granularity, and it makes a considerable difference to have a larger team working for longer on a common but multidisciplinary endeavour
- Sufficient scale in funding and time to deliver to enable it to have a lasting impact
- Funding collaborative projects on a large scale among multi-national and private institutions that would have never been able to get done individually.
- The SPF allows for long-term funding and collaboration - this is critical, as the scale of the capability development needs a strong long-term focus on skills development, collaboration to build trust and cooperation to build common tools and software.

The influence of the scale of funding also filters through to influence the wider relevant R&I communities. For instance, the following two quotes (from an independent research organisation and a university) discuss the importance of SPF (and in particular the scale of its funding) for energising and enthusing the community around Programme goals.

SPF funding (alongside a charity partner matching funding) has provided a rallying banner which has seen the research community organise itself in ways that would not otherwise have been possible,

The ambition and scale of the funding stimulated an impressive number of proposals from multidisciplinary groups of researchers- and linked stakeholders. The successful proposals demonstrated high potential for transformation of the food system

3.5 R&I projects and outputs

→ **Outputs** (During fund implementation) →

- A portfolio of programmes that each have one or more of the following features:
 1. Addresses complex challenges
 2. Involves cross-Council collaboration in their design and governance
 3. Employs actions / mechanisms (e.g. comms, peer review) to de-risk the submission of MIDRI grant applications and effectively assess these
 4. Involves intersectoral collaboration (Councils, OGDs, BEIS PSREs) in their design and governance
 5. Addresses Government R&I priorities (that are relevant for funding through SPF)
 6. Supports underpinning research to address Industrial Strategy objectives
 7. Addresses emerging opportunities/areas of interest identified by UKRI, government departments or the wider R&I community (agility) that are relevant for funding through SPF
 8. Is of medium scale (£10m-£15m+)
- Agreement on key (cross-government) R&I priorities

- **R&I projects**, incl. projects involving PSREs
- **R&I outputs**
- High-quality **MIDRI grant applications** that address complex challenges

This section addresses the final part of the outputs section in the Theory of Change, covering the R&I projects and outputs supported within individual SPF Programmes during their implementation.

Currently, the analysis of R&I outputs focuses mainly on publications. Evidence on other types of outputs is expected to be collected by Programme level monitoring and evaluation (see Appendix C of the Technical Report) and available for inclusion in the next stage of the Fund evaluation (interim impact).

3.5.1 *The multidisciplinary and intersectoral nature SPF Programmes are flowing through to research teams leading SPF projects*

We explored the extent to which SPF is supporting multi- and inter-disciplinary at the project level (i.e. in terms of bringing together researchers from different disciplines to collaborate) using bibliometric data and information from Gateway to Research (GtR), as explained in the box below.

Box 16 *Indicators used to assess the disciplinary diversity of SPF projects*

We combined an analysis of GtR with bibliometric data to arrive to an estimate of the disciplinary diversity of SPF research projects awarded so far. This approach involves assessing the diversity of disciplinary backgrounds in a project, by analysing the prior publication profile (in Scopus) of the researchers listed as participants in that project in GtR.

The **Multidisciplinary Index (MI)** is used to measure the diversity of the co-participants' disciplinary background, which aims to capture the collaborative aspect in cross-disciplinary research. Specifically, it captures the average multidisciplinary of publications linked to a given group/entity. Multidisciplinary at project level was normalized using paper-level multidisciplinary in the relevant subfields (considering the subfields of the projects' papers) using the world level as a reference (i.e. the whole of Scopus provides the value of 1).

More information on the methodological aspects of the bibliometric analysis can be found in the Technical Report, Appendix B3. (Note that one underlying assumption to this analysis is that a project's list of co-applicants in GtR is comprehensive, or at least representative, of the corresponding SPF research team).

Using this approach, we found a **high degree of multidisciplinary in some SPF projects** (see Table 2), in particular those funded through the Living with Machines, Clean Air, Excalibur (Super-computing), and Securing Digital Technologies at the Periphery (SDTaP) Programmes, all show results that are four times the world average (=1). Note that the index has not been expanded to provide an aggregate value (for the SPF overall) because a high proportion of projects (201 out of 754) only listed one researcher in GtR, and it is unclear if this is due to the incompleteness of the data (although this is likely). Further iterations of the analysis could include benchmark Programmes to assess the robustness of the indicators (as discussed in the Technical Report, Appendix B3).

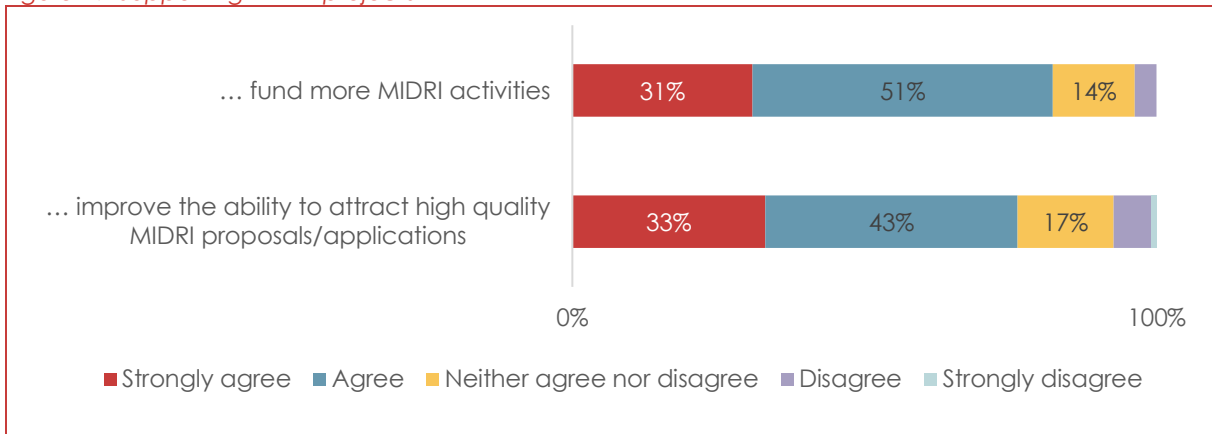
Table 4 Multidisciplinarity of selected SPF projects

Project identifier in GtR	title	Project level			
		MI raw	MI normalised	Researchers	Researchers matched
AH/S01179X/1	Living with Machines	0.84	13.06	10	9
EP/T003189/1	Health assessment across biological length scales for personal polluti	0.84	6.79	9	9
EP/V001493/1	Gen X: ExCALIBUR working group on Exascale continuum mechanics tl	0.53	5.59	8	8
EP/S035362/1	PETRAS 2	0.45	4.64	28	27
EP/R033722/1	Trust in Human-Machine Partnership	0.34	4.55	9	8
EP/T002654/1	Biological metamaterials for enhanced noise control technology	0.46	4.49	4	4
EP/T002778/1	The Physics of Antimicrobial Resistance	0.38	2.33	6	6
NE/S017186/1	Unlocking the potential of surface water flood nowcasting for emerger	0.28	2.00	3	3
MR/S035826/1	Understanding the molecular and cellular complexity of human cornea	0.20	1.84	3	3
MR/T046732/1	The DREAM Project: Diversity, Research, and Engagement for Adolesc	0.29	1.79	4	4
EP/R029563/1	AutoTrust: Designing a Human-Centered Trusted, Secure, Intelligent a	0.12	1.42	5	5
MR/S035915/1	How heterogeneous are oligodendroglia from normal human brain anc	0.17	1.08	3	3
MR/S036113/1	A protein-transcriptome atlas of haematopoiesis across the human lif	0.08	0.51	4	4

Source: Computed by Science-Matrix using Scopus and GtR data

In support of the findings from this data, 79% of representatives surveyed from SPF Programmes Advisory Boards, CSAs and Programme Leads reported that they agree or strongly agree that SPF allowed their Programme to improve the ability to attract high quality MIDRI proposals / applications. The same percentage (79%) also strongly/agreed that SPF allowed their Programme to fund more MIDRI activities.

Figure 19 Supporting MIDRI projects



Source: Technopolis (2021) based on Programme Leads templates (n=33), Programmes Advisory Board survey (n=89), Chief Scientific Advisor Network (n=7)

3.5.2 PSREs involvement in SPF projects is higher in comparison with other grants funded by UKRI, but it is unclear if their level of involvement is sufficient to meet one of the Fund's objectives and expected outcomes

In addition to BEIS PSRE involvement as Programme partners (see Section 3.3.4), SPF also allows a wider set of PSREs (supported by BEIS, as well as other government departments) to bid for competitive funding through individual Programmes, alongside universities, businesses, and research establishments. This represents a widening of the standard eligibility criteria, following the precedent set by the Global Challenges Research Fund. In this way, SPF provides an opportunity to further test how the involvement of PSREs in UKRI grants could work in practice.

There is no agreed definition or definitive list of PSREs. However, UKRI (with the support of BEIS and Go-Science) developed a preliminary (non-exhaustive) list of 26 PSREs that were

potentially eligible to bid for Research Council grants under the SPF. Those (on the list or not) wishing to apply for funding through an SPF Programme had first to apply to UKRI for eligibility.

There are now (June 2021) 13 organisations that have been deemed eligible (12 from the original list of potentially eligible organisations, plus one extra). However, UKRI have informed us that some of these organisations are likely to have applied for eligibility because the policy was recently (2020) extended to a Covid-19 Open Call, rather than their application being driven by SPF. This conjecture is supported by the numbers awarded SPF grants (see below).

UKRI are not aware of other PSREs applying for eligibility (unsuccessfully), other than two organisations that were not on the original list, who on initial enquiry were immediately identified as not being a PSRE (e.g. one was a trade body). The other 24 organisations originally listed as potentially eligible (but who have not yet applied) should all be aware of the opportunity, as this has been communicated via the CSA network (which encouraged the policy of PSRE eligibility in the first place).

Analysis of GtR data shows that seven PSREs have been awarded SPF grants so far (see table below), between them accounting for 39 of the 504 grants awarded (8%).

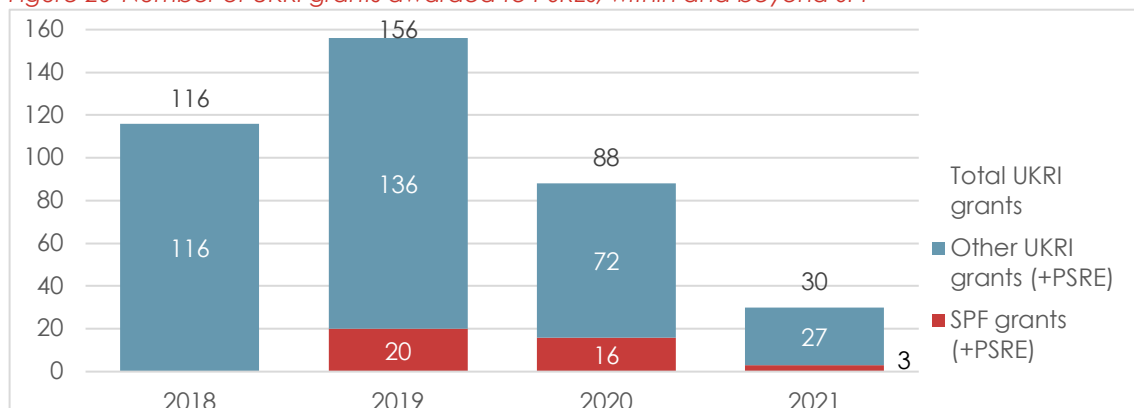
Table 5 Number of SPF grants awarded to different Public Sector Research Establishments

PSRE	SPF grants (2019-21)
Laboratory of the Government Chemist (LGC Ltd)	14
Natural England	10
Defence Science and Technology Laboratory	7
Public Health England	4
Agriculture and Horticulture Development Board	2
Ordnance Survey	2
Centre for Environment, Fisheries and Aquaculture Science	1
Total	40

Source: Technopolis (2021) based on GtR data. Note that one grant involves two PSREs, so the total number of unique grants is 39.

In relative terms, this compares well with other UKRI grants awarded over the same period (2019 to 2021), where just 1.3% of the 26,467 total involved a PSRE participant. However, the volume of activity within SPF (39 grants with PSRE involvement) is small in absolute terms compared to UKRI activity overall (351) (see figure below).

Figure 20 Number of UKRI grants awarded to PSREs, within and beyond SPF



Source: Technopolis (2021) based on GtR data

It is difficult to judge the extent to which this level of PSRE involvement in SPF projects should be considered a success. The business case does not set out clear expectations for the extent or scale of PSRE involvement, just that the Fund would “improve the ability of the R&D funding system to deliver cross-Government R&D priorities through enabling PSREs to bid for open competitions funded through the SPF”. In this sense, the Fund has been successful, in that it has introduced eligibility, and this has enabled PSREs to bid (with 7 PSREs involved across 39 projects so far). The incidence of PSRE involvement (8% of all SPF projects) is also much higher than the rate for UKRI grants more generally, demonstrating that this eligibility is unusual (though not unique). However, with the intention of the Fund more generally to support ecosystem change (e.g. strengthening linkages and communication between PSREs, government and Councils), the scale of PSRE project activity so far (just 7 of the originally identified 26 PSREs applying, and only 39 projects involving PSREs compared with nearly ten-times this outside of SPF in the same period), the influence of the Fund (above and beyond other activities) may be limited.

Initial analysis on intersectoral collaboration in publications (presented in the sub-section below), including with PSREs does show higher collaboration between academics, and government departments and these organisations, although results are preliminary. Future iterations will provide more clarity as to whether this further output has been achieved and will allow a clearer conclusion on PSRE involvement.

3.5.3 *The multidisciplinary and intersectoral nature SPF Programmes are also flowing through to R&I outputs (at least in terms of publications)*

We also looked at the degree of MIDRI and intersectoral collaboration in publications. At this stage our methodology sets-up a baseline as well as benchmarks for comparison. We do present some initial SPF results, but these need to be taken with caution, given the early stage of Programme implementation.

From a ToC perspective, the premise is that greater interactions between actors representing different communities will increase the odds of research results being of more immediate relevance to communities outside academic circles. In fact, multidisciplinary research and public-private co-publications were previously found to be positively linked with the uptake of research findings in innovation (through the citation of publications in patents).^{13,14} More recently, Science-Metrix has also shown a similar link between multidisciplinary research and uptake of research findings in the policy-relevant literature.¹⁵ Evidence on uptake (in particular on policy documents) will be collected in the next stage of the evaluation, while Section 3.6.2 presents some early examples of uptake of results emerging from SPF Programmes.

Multi and interdisciplinarity at paper level

Four indicators were used to assess the disciplinary diversity of SPF papers, as set out in the box below.

¹³ Campbell, D., Struck, B., Tippett, C., & Roberge, G. (2017). Impact of multidisciplinary research on innovation. *16th International Conference of ISSI*, Retrieved from http://www.science-metrix.com/sites/default/files/science-metrix/publications/issi2017_paper_153_d_campbell_impact_multidisciplinarity.pdf. Accessed 26 October 2020.

¹⁴ Campbell, D., Tippett, C., Struck, D. B., Lefebvre, C., Côté, G., & Archambault, É. (2017). *Data mining on key innovation policy issues for the private sector: Application report*. Prepared by Science-Metrix for the EC.

¹⁵ Vignola-Gagné, É., Pinheiro, H., & Campbell, D. (Submitted). A large-scale validation of the relationship between cross-disciplinarity and policy-relevant uptake of research using the novel Overton altmetrics database.

Box 17 Indicators used to assess the disciplinary diversity of SPF papers

Two of the indicators are based on the **diversity of co-authors' disciplinary background**. These aim to capture the collaborative aspect in cross-disciplinary research (as described in Section 3.5.1) and are a proxy for multidisciplinary. They are:

- The Multidisciplinarity Index (MI) (as described in Section 3.5.1), and
- The index of Highly Multidisciplinary Publications (HMP10%), which captures the share of papers in that group that falls among the 10% most multidisciplinary papers in the same subfield, document type and year in the world (as a ratio of the expected share at world level which is 10%)¹⁶.

The other two indicators are based on the **diversity of disciplines within the citations included in those papers** (i.e. the reference list of papers). These aim to capture the knowledge integration dimension in cross-disciplinary research (measuring the extent to which authors mobilised knowledge produced in other disciplines to inform their research) and are a proxy for interdisciplinarity. This includes the Interdisciplinarity Index (II) and the index of Highly Interdisciplinary Publications (HIP10%). The difference in definition between these is equivalent to the difference between the MI and HMP10% above.

All the indicators are also normalised by subfield, year, and document type, using the world level as a reference (i.e. information from whole of Scopus provides the value of 1).

We analyse this data for five groups:

- SPF papers (those identified as being SPF papers within GtR and Scopus)
- Prior publications from SPF researchers (papers authored by SPF researchers and published prior to the first year of any of the SPF projects in which the researcher has participated. In the aggregate, this group includes papers published between 2006 and 2019)
- Parallel publications from SPF researchers (papers authored by SPF researchers after their first year in any SPF project, that have not been identified as an SPF paper in GtR and Scopus). These are presumed to be publications associated with concurrent projects by SPF-funded researchers. They include papers published between 2018 and 2020. Note that the parallel papers group may include SPF papers not correctly identified as such in GtR or in Scopus acknowledgments
- UKRI papers (all UK publications with funding from a UKRI council, identified in GtR and Scopus acknowledgements)
- UK papers (all publications with at least one UK-based author)

The baseline figures for SPF awardees are provided by the prior and parallel papers, while UKRI and UK figures provide a benchmark for comparison.

Using the approach described above, we found that:

- The two groups of SPF researchers' other publications (prior and parallel) scored higher than UKRI papers on all four MIDRI indicators. This may reflect **a higher inclination of multidisciplinary researchers to apply for SPF grants and/or the success of SPF's review process in selecting researchers with prior cross-disciplinary achievements**¹⁷, both of which would be in line with SPF's objectives.
- **SPF papers scored higher on the four MIDRI indicators than all comparators** (for instance, 2.39 on HMP10%, against 1.77 for parallel papers; 1.59 for prior papers; 1.22 for UKRI papers; 1.19 for UK papers). While it is too soon to attribute the observed differences to SPF, **these preliminary results (from a few SPF funded projects) do suggest a positive outcome of SPF in terms of MIDRI, one of its core objectives**. As noted above, it is possible that the set of papers

¹⁶ Single-authored papers are not considered in these indicators; by definition, these papers are monodisciplinary since they do not integrate the expertise of different authors. A measurement of the share of single-authored papers was included to complement these analyses.

¹⁷ Note that the group 'SPF prior papers' includes publications from 2018-2020. This is a consequence of the criteria used to classify a paper in this group, that is papers published before the starting year of the SPF projects in which SPF researchers participated. Therefore, if a SPF researcher's first SPF project started in 2020, all her/his publications from 2019 and 2018 would be included in this group.

identified as SPF-funded at this stage of the project has insufficient recall – it may be associated with a high rate of false negatives, because researchers have yet to fully fill out their GtR profiles. It is also clear that the current data cannot be regarded as representative of the whole SPF portfolio. Moreover, there may be unknown confounding factors meaning that researchers from highly cross-disciplinary projects tend to be more systematic in updating their GtR profiles.

Table 6 Multi and interdisciplinary research indicators (MIDRI) of SPF papers and comparators

Multi and interdisciplinary research indicators (MIDRI) for SPF papers and comparators (2006-17 and 2018-20)

Number of publications and trends, multidisciplinary index (MI), highly multidisciplinary publications 10% (HMP_{10%}), interdisciplinary index (II), highly interdisciplinary publications 10% (HIP_{10%} author publications (SSA))

	Publications			MI		HMP _{10%}		II		HIP _{10%}	
	2006-17	2018-20	trend	2006-17	2018-20	2006-17	2018-20	2018-20	2018-20	2006-17	2018-20
UK papers	1,811,903	570,918		1.08	1.09	1.13	1.19	1.01	0.99	1.05	1.01
UKRI papers	284,287	98,146		1.08	1.09	1.17	1.22	1.00	0.99	1.03	0.96
SPF prior papers	64,544	13,193		1.26	1.24	1.58	1.59	1.05	1.02	1.24	1.17
95% stability interval				1.25 to 1.27	1.22 to 1.25	1.55 to 1.60	1.53 to 1.65	1.04 to 1.05	1.01 to 1.03	1.21 to 1.26	1.11 to 1.22
SPF parallel papers	0	8,897		N/C	1.34	N/C	1.77	N/C	1.04	N/C	1.24
95% stability interval					1.32 to 1.36		1.69 to 1.85		1.03 to 1.05		1.18 to 1.31
SPF papers	0	242		N/C	1.51	N/C	2.39	N/C	1.12	N/C	1.55
95% stability interval					1.36 to 1.66		1.85 to 2.97		1.08 to 1.16		1.11 to 2.04

NOTES:

- SPF prior papers corresponds to the publications from SPF researchers prior to the first year of their respective SPF projects.

- SPF parallel papers corresponds to the publications from SPF researchers after the first year of their SPF projects (exclude publications in the group SPF papers).

Source: Computed by Science-Metrix using Scopus and GtR data

For the interim and final Fund evaluation report, the problem of attribution, mentioned above, may be alleviated by using multivariate analysis and by improving the classification of papers by SPF researchers into the groups of SPF, prior and parallel publications¹⁸.

Note that **the degree of multidisciplinary of SPF projects is higher** than multidisciplinary at paper level, which is an interesting but not surprising result. Not every participant in a project team (and, by extension, their disciplines) will appear on every output by the project team. For instance, the individual members of a MIDRI project might start publishing individual, yet complementary, papers before integrating their respective streams of work in the project's MIDRI papers (published closer to the end of the project). Under such a scenario, one would expect early-stage SPF papers (i.e. those covered in this iteration of the assessment) to score lower than the corresponding SPF projects. This also highlights the importance of looking at multidisciplinary not only from the perspectives of the outputs (papers) but also from the perspective of the composition of the research teams.

Finally, it is important to highlight that the multidisciplinary computed at paper-level for individual research projects are, in most cases, based on very few papers and results need to be taken with caution at this stage¹⁹.

¹⁸ The table also show another interesting result, albeit unrelated to SPF. It shows that the groups of UK and UKRI papers scored similarly in multidisciplinary and interdisciplinary in the 2018-2020 period (for example, 1.19 on the HMP10% indicator for UK papers compared to 1.22 for UKRI papers). However, the UKRI exhibited lower shares of single-author publications (by default monodisciplinary papers) in both periods and would have scored slightly above UK papers on all four indicators if single-authored papers had been considered in computing the cross-disciplinary indicators (data not shown). This means that for those publications involving partnerships, both UK and UKRI perform similarly in terms of MIDRI, but UK papers less frequently involves partnerships.

¹⁹ In future versions of this table (2022 and 2023), it would be useful to add at least one extra research program to compare with the SPF scores. Such an approach would involve matching researchers from GtR to Scopus AUIDs for this extra research program, an effort that was not initially planned. Its viability will be assessed based on the performance of automated matching of GtR researchers to AUIDs to be performed in the next phases of this project (in 2022). It would provide an additional reference to the multidisciplinary scores computed at project level, supporting a better assessment regarding the multidisciplinary levels achieved by SPF projects.

Table 7 Multidisciplinarity of selected SPF projects (Project vs. Paper-level indicators)

Project Identifier in GtR	title	Project level				Paper level		
		MI raw	MI normalised	Researchers	Researchers matched	Papers	MI raw	MI normalised
AH/S01179X/1	Living with Machines	0.84	13.06	10	9	6	0.33	3.57
EP/T003189/1	Health assessment across biological length scales for personal polluti	0.84	6.79	9	9	27	0.26	1.80
EP/V001493/1	Gen X: ExCALIBUR working group on Exascale continuum mechanics ti	0.53	5.59	8	8	4	0.23	2.66
EP/S035362/1	PETRAS 2	0.45	4.64	28	27	44	0.15	1.46
EP/R033722/1	Trust in Human-Machine Partnership	0.34	4.55	9	8	5	0.11	0.90
EP/T002654/1	Biological metamaterials for enhanced noise control technology	0.46	4.49	4	4	15	0.28	2.66
EP/T002778/1	The Physics of Antimicrobial Resistance	0.38	2.33	6	6	9	0.23	1.32
NE/S017186/1	Unlocking the potential of surface water flood nowcasting for emerger	0.28	2.00	3	3	4	0.28	2.41
MR/S035826/1	Understanding the molecular and cellular complexity of human cornea	0.20	1.84	3	3	20	0.24	1.97
MR/T046732/1	The DREAM Project: Diversity, Research, and Engagement for Adolesc	0.29	1.79	4	4	4	0.32	1.72
EP/R029563/1	AutoTrust: Designing a Human-Centered Trusted, Secure, Intelligent a	0.12	1.42	5	5	9	0.14	1.28
MR/S035915/1	How heterogeneous are oligodendroglia from normal human brain anc	0.17	1.08	3	3	9	0.25	1.53
MR/S036113/1	A protein-transcriptome atlas of haematopoiesis across the human lif	0.08	0.51	4	4	13	0.07	0.43

Source: Computed by Science-Metrix using Scopus and GtR data

Intersectoral collaboration at paper level

There are also early signals that SPF publications include more intersectoral collaboration, in comparison with benchmarks (but results need to be taken with caution).

We have estimated intersectoral collaboration in publications. As above, we analyse this data for five groups (SPF, UK, UKRI, Prior publications from SPF researchers and Parallel publications from SPF researchers). As above, the baseline figures for SPF awardees are provided by the SPF prior and parallel papers, while UKRI and UK figures provide a benchmark for comparison.

The data has been normalised to account for differences in research practices within each of these dimensions. The indicators are computed using the UK as reference. For example, the group of UKRI papers scores 1.07 on the share of papers involving the UK Government, meaning that the share of UK-Government papers for the UKRI group is 7% higher than for the UK, after accounting for subfield, year, and document type.

Using the approach described above, we found that:

- SPF projects, currently represented in 242 SPF papers, contain a greater contribution from authors affiliated to UK Government (4.24) than UK (1.00, benchmark) and UKRI papers (1.23), which is also in line with SPF prior and parallel papers (1.87 and 2.10 respectively). As above, this may reflect the Programmes / projects attracting researchers that tend to collaborate with authors affiliated to government (to a greater extent in comparison with UK and UKRI). It also indicates that this collaboration is more prevalent within SPF.
- Contribution from authors affiliated to UK PSREs (1.05) is, in contrast, lower than UKRI (1.22), but also than SPF prior and parallel papers (1.96 and 1.91 respectively). However, there is higher contribution from authors affiliated to Government, PSREs, and Councils in SPF papers, in comparison with the baseline and benchmarks.
- Contribution from authors affiliated to UK companies is lower for UKRI papers in comparison with the UK (0.90) and lower for SPF papers in comparison with baseline and benchmarks.

Note, however, that any difference between the group of SPF-supported papers and any of the comparators should be seen, at most, as a provisional signal that may not be reproduced in subsequent years. The stability intervals presented in these tables help to illustrate this point, as most of the scores computed for the SPF-supported group overlap the scores from other groups. This indicates that the scores for SPF-supported papers generally cannot be considered statistically different from those of the comparators at this stage. The differences among the remaining groups can be considered more robust as these groups accumulated more papers. (Also note that in the case of the MIDRI results, the results are more stable).

At this point, these results are useful to inform what to expect (in terms of analysis) in the next iteration of the report, and to discuss improvements.

Table 8 Intersectoral collaboration in papers

Normalised share of intersectoral co-publications for SPF papers and comparators (2006-17 and 2018-20)

A: Share of papers by sector: Academic institutions, UK government, UK public sector research establishments (PSRE), UK research councils (RC), UK combined institutions (government, PSRE, or RC), private institutions, institutions with other sectoral classifications.

B: Share of co-publications between authors from academic institutions and other sectors.

A: Share of papers per sector

	Publications		Academic		UK Government		UK PSRE		UK RC		UK Gov PSRE RC		Private		Other	
	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20
UK papers	1,811,903	570,918	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
UKRI papers	284,287	98,146	1.03	1.02	0.88	1.07	0.91	1.08	3.34	3.19	2.33	2.20	0.78	0.83	0.90	0.89
95% stability interval			1.03 to 1.03	1.02 to 1.02	0.82 to 0.95	0.95 to 1.19	0.84 to 0.98	0.95 to 1.23	3.28 to 3.40	3.06 to 3.31	2.30 to 2.36	2.14 to 2.25	0.77 to 0.79	0.81 to 0.85	0.90 to 0.91	0.88 to 0.90
SPF prior papers	64,544	13,193	1.04	1.03	1.35	1.58	1.25	1.76	2.81	2.86	2.20	2.27	1.01	1.05	1.10	1.08
95% stability interval			1.04 to 1.04	1.03 to 1.03	1.21 to 1.48	1.26 to 1.91	1.07 to 1.45	1.22 to 2.43	2.69 to 2.93	2.59 to 3.19	2.14 to 2.26	2.11 to 2.42	0.97 to 1.05	0.97 to 1.13	1.08 to 1.11	1.05 to 1.12
SPF parallel papers	0	8,897	N/C	1.02	N/C	1.75	N/C	1.77	N/C	3.08	N/C	2.43	N/C	1.04	N/C	1.15
95% stability interval				1.02 to 1.02		1.43 to 2.12		1.20 to 2.48		2.71 to 3.55		2.27 to 2.60		0.96 to 1.12		1.11 to 1.19
SPF papers	0	242	N/C	1.01	N/C	3.79	N/C	0.95	N/C	2.67	N/C	3.40	N/C	0.75	N/C	1.04
95% stability interval				1.00 to 1.03		1.38 to 6.91		0.07 to 2.35		1.79 to 3.67		2.23 to 4.65		0.44 to 1.13		0.80 to 1.30

B: Share of papers in cross-sectoral collaboration between Academic sector and each sector below

	Publications		Academic		UK Government		UK PSRE		UK RC		UK Gov PSRE RC		UK Priv		UK Other	
	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20	2006-17	2018-20
UK papers	1,811,903	570,918			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
UKRI papers	284,287	98,146			1.06	1.23	1.13	1.22	3.38	3.20	2.52	2.33	0.88	0.90	0.97	0.95
95% stability interval					0.99 to 1.14	1.10 to 1.36	1.05 to 1.23	1.08 to 1.36	3.31 to 3.45	3.08 to 3.32	2.48 to 2.57	2.27 to 2.40	0.87 to 0.90	0.88 to 0.93	0.97 to 0.98	0.93 to 0.96
SPF prior papers	64,544	13,193			1.73	1.87	1.61	1.96	3.00	2.96	2.54	2.52	1.16	1.17	1.22	1.17
95% stability interval					1.53 to 1.91	1.49 to 2.31	1.35 to 1.87	1.40 to 2.67	2.87 to 3.13	2.64 to 3.31	2.45 to 2.64	2.32 to 2.76	1.12 to 1.20	1.08 to 1.25	1.20 to 1.24	1.13 to 1.20
SPF parallel papers	0	8,897			N/C	2.10	N/C	1.91	N/C	3.10	N/C	2.69	N/C	1.12	N/C	1.21
95% stability interval						1.66 to 2.61		1.29 to 2.71		2.71 to 3.57		2.42 to 3.02		1.03 to 1.21		1.18 to 1.26
SPF papers	0	242			N/C	4.24	N/C	1.05	N/C	2.53	N/C	3.61	N/C	0.82	N/C	1.11
95% stability interval						1.40 to 7.37		0.11 to 2.38		1.67 to 3.58		2.34 to 5.10		0.46 to 1.23		0.84 to 1.40

NOTES:

- SPF prior papers corresponds to the publications from SPF researchers prior to the first year of their respective SPF projects.
- SPF parallel papers corresponds to the publications from SPF researchers after the first year of their SPF projects (exclude publications in the group SPF papers).
- Normalisation by subfield, document_type and year of publication using UK papers as reference (UK = 1)

Source: Computed by Science-Matrix using Scopus and GtR data

3.6 Contribution towards outcomes (early assessment)

➔ **Outcomes** (On or shortly after project / programme completion) ➔

- **Strengthened linkages and communication** mechanisms / structures between & across SPF partners (Councils, PSREs, OGDs), incl. new ways of working / collaborating
- Increased actions to support MIDRI and improved **confidence to invest in MIDRI** amongst SPF partners and to **apply for MIDRI funding** amongst researchers and innovators
- Improved **awareness and understanding**
 - Of Government R&I priorities amongst UKRI/Councils
 - Of national research efforts and state of the art evidence (in R&I priority areas) amongst OGD partners
- **Best practices and understanding** of what works in inter-sectoral collaboration codified, shared and socialised amongst SPF partners
- An increase in UKRI Council **R&I spend** that aligns with SPF objectives, including MIDRI / cross-council and addressing government priorities

- **R&I outputs** (knowledge, solutions, tools) are **accessed and taken-up** to a greater extent than BAU by:
 - End users, including for policy and decision-making across government
 - The wider R&I community

In this section, we turn to the outcomes / impacts expected to emerge from SPF (across all objectives). As mentioned before, given the nature of the intervention, these are influenced by the Fund, and in practice are mostly delivered by the individual SPF Programmes.

As presented in our ToC, these are expected to materialise after the completion of Programmes. As such (with most Programmes still ongoing) it is really too early report on outcomes at this stage. These outcomes are also mostly qualitative in nature, which means that the baseline is given by the views and actions of stakeholders with respect to a period prior to SPF (with the support of additional sources of evidence).

At this stage in the Fund evaluation, we have implemented an initial Qualitative Comparative Analysis (see box below on the approach) for four main outcomes:

- Strengthening linkages among stakeholders (Councils, OGD, PREs)
- Improving understanding among stakeholders (Councils, OGD, PREs)
- Awareness of priorities and capabilities (between Councils and OGD)
- R&I outputs accessed and taken up

This is an opportunity to showcase initial (early) results and to test the methodology in order to adjust future data collection exercises (e.g. interview guides and surveys) to capture more information in the next stages of the evaluation.

Box 18 Employing a Qualitative Comparative Analysis approach

A Qualitative Comparative Analysis is a pragmatic method to compare different aspects of an intervention and contextual factors to understand the different characteristics or combinations of characteristics which are associated with outcomes. It enables systematic comparison based on qualitative knowledge²⁰. This is a methodology recommended by the HMT Magenta Book to address complex interventions. This theory-based approach is also relevant for assessing the influence of SPF (where contribution is less direct).

We have broken each of the main outcomes (listed above) into dimensions (areas / factors) where we would expect to see progress going forward for the outcomes to be achieved.

The analysis is then based on triangulating evidence from different sources, including the Programme Lead templates, interviews with leads and case studies (which in turn are informed by further interviews with Government Departments and other partners). We have assessed the evidence to provide a traffic light assessment of progress and provided a commentary for the assessment, as well as concrete examples of how those factors and outcomes are materialising in practice. The analysis also includes information on enabling factors and barriers / challenges.

²⁰ HMT Magenta Book (2020) Annex A. Analytical methods for use within an evaluation.

As mentioned in Section 3.2, all of the concrete examples presenting strengthening linkages among stakeholders (Councils, OGD, PREs), improving understanding among stakeholders (Councils, OGD, PREs) and increasing awareness of priorities and capabilities (between Councils and OGD) correspond to Programmes that include multistakeholder Advisory Boards. The only exceptions being the Greenhouse Gas Removal Demonstrator and the European Bioinformatics Initiative, for which we have also identified some examples of outcomes, but where these Programmes do not have Advisory Boards.

In future iterations of the analysis, we will include an analysis of the combination of factors that lead to final outcomes. For example, we will explore if the composition and focus of the Programmes leads to higher uptake of lessons learned and of R&I outputs, as well as increased levels of awareness. We will also complement the analysis with additional indicators, such as uptake of SPF research in policy documents (which is one of the main outcomes expected from the Fund), plus data emerging from the Programme level evaluations.

Results are presented in Sections 3.6.1 and 3.6.2 below.

Additional baseline information on outcomes related to improved confidence to invest in MIDRI and R&I spend that aligns with SPF government priorities is presented in Sections 3.6.3 and 3.6.4.

3.6.1 Early assessment shows that SPF is making some progress towards achieving outcomes related to strengthening linkages among relevant stakeholders and increasing awareness of R&I priorities and capabilities.

Outcomes: Strengthening linkages and communication mechanisms / structures between and across partners (Councils, PSREs, OGDs) involved in SPF Programmes, including through new ways of working / collaborating between these partners.

Components	Assessment/ Test		Commentary
Composition (*)	The Programme involves intersectoral collaboration (between Councils, OGDs and PSREs) in its design and implementation (including governance)		Most of the Programmes include this characteristic as shown in Section 3.3
Focus (*)	The Programme addresses Government R&I priorities that would not have been funded otherwise		32 Programmes self-assessed (at bid stage) as addressing Government R&I priorities and the leads for all-but-one of these Programmes declared that this would have been difficult to fund through other means.
Demonstration	The Programme has demonstrated new or enhanced ways of working / collaborating between the partners involved		Evidence from interviews and case studies show that at least 24 Programmes (leads & partners) are demonstrating new or enhanced ways of working. This mostly related to the scale of the collaboration and intensity of the collaboration (which in turn have led to multi-stakeholder Advisory Boards & stronger coordination). See examples below.
Uptake	The lessons from the Programme (about ways of working / collaborating) are being implemented outside the Programme		Five Programmes have provided evidence of uptake so far. See examples below. This dimension is expected to progress further in the next stages of the Fund.

(*) These two dimensions covered outputs that are discussed in Section 3.3

Box 19 Examples of new or enhanced ways of working

- **Trustworthy Autonomous Systems:** Advisory Board has provided access to partners that EPSRC would not normally liaise with
- **European Bioinformatics Institute:** New systems in place to ensure transparency and share information on a 'live' basis with stakeholders and funders.
- **Tackling Multimorbidity at Scale:** Although the collaboration between MRC and DHSC/NIHR was well-established, the SPF Programme has created even tighter and more frequent interaction. It has also re-invigorated relationships between MRC and ESRC teams.
- **Constructing a Digital Environment:** Joint SRO role between NERC and Met Office (a significant new way of working between partners)
- **Landscape decisions:** SPF has allowed NERC to really work collaboratively with BBSRC, EPSRC, AHRC and ESRC to solve the challenge instead of imposing their own R&I priorities.
- **Transforming the UK Food System for Healthy People and a Healthy Environment:** SPF enabled more senior level relationships between BBSRC, and the government departments involved, especially from the participation and interest of the Chief Scientific Advisers. Also, collaboration between councils have been different than BAU as they are working towards a common goal rather than trying to impose their own research agenda.
- **Adolescence, Mental Health and the Developing Mind:** Evidence from the interviews suggested there were enhanced ways of working between existing partners e.g. diverse panel representation, co-chairing of panels across councils. There are also new ways of working among newer partnerships e.g. between MRC, AHRC and DfE.

Box 20 Examples of implementing new ways of working outside the Programme

- **Harnessing Exascale Computing (ExCALIBUR):** Met Office taking learnings and applying these to their interactions with other research councils
- **Landscape decisions:** NERC is developing new bids working closely with more targeted Defra policy teams and bringing in other UKRI partners at the start of any processes to ensure a bid is co-developed and not a bolt-on activity.
- **Greenhouse Gas Removal Demonstrators:** NERC invited to observe a new BEIS committee (Bioenergy, GGR, renewables, cross cutting committee) as an observer.
- This new committee follows on from a previous one, where IUK and STFC were observing. This was unlikely to have included NERC if BEIS hadn't worked with NERC as part of GGR-D
- **Policy and Evidence Centre for Modern Slavery and Human Rights:** Partners are involved in new collaborations or developing future collaborations
- **Transforming Productivity Research:** Lessons learned from the composition of this Programme as a series of discrete funded research projects that made up a portfolio were (and continue to be) fed into the Wave 2 Productivity Institute

Facilitators and Barriers / Challenges

Additionally, stakeholders provided insights into the main barriers / challenges that they have faced across their Programmes, as well as the main facilitators. Note that multistakeholder involvement is identified as a facilitator in three Programmes, but also as a barriers / challenge by four (but there is clear pattern in terms of composition, research area or Wave across those two groups).

In terms of **facilitators**, stakeholders pointed out that, as mentioned before, the scale of funding has facilitated the implementation and testing of new ways of working (n [Programmes] =6). They also pointed out the benefits of having inputs from multi-stakeholder advisory boards / working groups / steering committees / panels in the implementation of the Programme (n=3), as well as access to a neutral /common pot of money (n=2).

Additionally, some stakeholders also pointed to the benefits of working on an area where there is clear interest from Government departments (and unlikely to change in political importance in the short-term (n=2) (which is then mentioned also as barrier when it does not work well). Other aspects mentioned include pre-existing relationships (n=1) and the Programme Champions (n=1). One of the CSAs surveyed mentioned that the Programme champions have played an important role in bringing together different Programme stakeholders and understanding the needs of government.

In terms of **barriers / challenges**, there were several mentions to the COVID pandemic (delays, coordination) (n=7). Stakeholders also pointed out that changes in staff (CSAs) and ability to involve government departments sufficiently had been a barrier in the implementation of the Programme (and may be a barrier to the likelihood of achievement of the outcome) (n=4), and additional feedback points to the fact that the fundamental nature of research makes it difficult to engage government departments and / or communicate results (n=7).

In contrast with the view on enabling factors, some stakeholders pointed out that they were facing challenges related to working with a large consortium of partners, with different interests (n=4). Finally, delays in funding or changes in landscape / priorities and inability to re-profile, as well as a (potential) lack of follow-on funding to build on work, were also named as potential barriers for achieving the outcomes (n=1).

Outcomes: Improved understanding of what works in inter-sectoral / cross-discipline collaboration codified, shared, and socialised amongst SPF partners

Components	Assessment/ Test		Commentary
Codification	A written assessment has been made of the approach to, and experience of, inter-sectoral / cross-discipline collaboration through the Programme		No evidence that experiences are being codified in a systematic way, with the exception of one Programme. Note that Programme-level evaluations may codify these experiences.
Dissemination	The Programme (or individual Programme partners) has shared their experience related to inter-sectoral / cross-discipline collaboration with colleagues		Evidence that 13 Programmes are sharing experiences, but only via their governance / oversight / working groups (mostly among colleagues). Just one example of Programme partners sharing learnings with other colleagues has been identified so far (although more could be happening informally).
Uptake	Learnings from the Programme (related to inter-sectoral / cross-discipline collaboration) have been taken into account elsewhere (outside the Programme)		No evidence / examples yet.

Box 21 Examples of codification of experiences and dissemination

Example of codification of experiences:

- **Living with Machines:** The Alan Turing Institute is developing a Project Handbook, a short book to share the lessons learnt in delivering the project, including a chapter on interdisciplinary collaboration.

Example of dissemination of experiences related to inter-sectoral / cross-discipline collaboration:

- **Constructing a Digital Environment:** Environment team within ESRC brought together all champions from NERC SPF Programmes that have an environmental science interest and ran workshops. Trying to get best practice out of champions but also share lessons learned. Also note the Group of Champions across SPF Programmes discussing and sharing lessons learned (but not all Programmes have champions).

Facilitators and Barriers / Challenges

For this outcome, stakeholders also mentioned the benefits of having inputs from multi-stakeholder advisory boards / working groups / steering committees / panels in the implementation of the Programme (n=6), as an **enabling factor**, as well as pre-existing relationships (n=1).

In terms of **barriers / challenges**, the lack of communication platforms to share lessons was mentioned in one Programme, pointing to the lack of a formal process or way to share best practices across the SPF portfolio.

Outcome: Improved awareness and understanding of government R&I priorities amongst UKRI/Councils

Components	Assessment/ Test		Commentary
Council awareness	The Programme has led to increased awareness of government R&I priorities amongst UKRI/Councils (1)		14 Programmes stating so, but not collected in a systematic way across the whole portfolio ²¹ . Examples provided shown below
OGD awareness	The Programme has led to increased awareness of national research efforts and state of the art evidence (in R&I priority areas) amongst OGDs (2)		12 Programmes stating so, but not collected in a systematic way across the whole portfolio. Examples provided shown below

Box 22 Examples of codification of experiences and dissemination

- **Landscape decisions:** A trilateral group has been formed between DEFRA, NERC, and the Royal Society to share experiences about the Programme and improve the internal understanding of common R&I priorities.

Also, close engagement between NERC with OGDs (Defra and BEIS), especially CSA of Defra, and improved understanding of government R&I priorities. NERC has also improved its understanding about BEIS strategic objectives and had discussions with high level officers in BEIS about ways in which BEIS objectives can be integrated into the Programme.

- **Transforming the UK Food System for Healthy People and a Healthy Environment:** Government departments (especially DEFRA) have been hugely involved in the design and implementation of the Programme.

Also, the councils have had several conversations with the OGDs involved in the Programme to discuss further funding and projects that respond to the R&I priorities of the councils and the preliminary Programme outputs.

- **Sustainable Management of Marine Resources:** SPF mechanism has been crucial to engage policy officers including Defra, Marine Scotland, the Welsh, and the Northern Ireland government in the Programme and integrate their R&I priorities into the Programme.
- **National Interdisciplinary Circular Economy Research Programme:** SPF has enabled much stronger input from government than standard Programmes. Defra engaged more (and at a higher level via CSA). NICER allowed links to other parts of Defra not previously engaged with by Research councils.

²¹ The wording of the relevant consultation question was not entirely clear and so this test was not properly assessed across the full portfolio. This finding is part of the testing of the methodology and we will adjust future data collection exercises accordingly.

Facilitators and Barriers / Challenges

Similar to what has been presented above, stakeholders also mentioned multi-stakeholder advisory boards / working groups / steering committees / panels, and neutral / common pot of money as **facilitators** in relation to this outcome.

Some **barriers**, such as the fundamental nature of research also apply.

3.6.2 *There is limited evidence of uptake of R&I outputs among policymakers, as expected, with some outstanding examples identified*

Outcome: R&I outputs (knowledge, solutions, tools) generated with support from the Fund are accessed and taken-up by the R&I community and by end users, including for policy and decision-making across government

Components	Assessment	Commentary
Relevance	R&I outputs emerging from the Programme are of better quality / relevance to potential end-users (incl. government departments / decision makers)	Too early to assess. Two CSAs stated (via survey) that they are very confident SPF Programmes will help to address the originally identified (gov) priorities / challenges, while four are somewhat confident. For one CSA, it is too soon to tell.
Access	R&I outputs emerging from the Programme have been disseminated among end-users (incl. government departments / decision makers)	Too early to assess. Evidence provided shows that initial outputs are being disseminated (15 Programmes) but not specifically to end-users. However, dissemination is also likely to be happening within the Advisory Boards / Steering Groups.
Uptake	R&I outputs emerging from the Programme are being used, taken-up and / or implemented by end-users (incl. government departments / decision makers)	Too early to assess (but some examples have been identified so far from five Programmes, see below). The assessment will be completed in future iterations of the evaluation with data on uptake of SPF publications in policy documents (and comparisons with UKRI benchmark to assess the counterfactual)

Box 23 Examples of uptake of SPF research outputs

- UK Climate Resilience: Informing the 2021 Climate Change Risk Assessments Evidence.** In the view of the CSA, the Programme has led to improvements and progress in building the evidence case for future Climate Change Risk Assessments (CCRA) and starts to move towards more multidisciplinary outputs. The intent is certainly there for more useful/usable outputs (shown by aspects like outcome harvesting) but there is more that could be done to build on this and go further in this direction for future Programmes (but this Programme has progressed things).
Several of the outputs from Programmes have been used to directly inform the upcoming CCRA Evidence Report. Seminars raising awareness of Programme outputs and bringing together the research and end users have been well attended and improved understanding. (UK climate resilience).
- Transforming the UK Food System for Healthy People and a Healthy Environment:** Principles and concepts of the Programme are being used to build the second part of the National Food Strategy (due in July 2021).
- AI and Data Science for Science, Engineering, Health and Government:** The Programme is implementing projects focus on supporting UK's response to COVID-19. Through the 'Shocks and Resilience' project, a multidisciplinary team of researchers are coupling epidemiological and socio-economic models to measure policy impact in the pandemic and will produce generalised models and tools that enable

Also, the Met Office is currently using some of the tools and methods developed in the Programme.

- **Bacterial Plant Diseases: Informing preparedness against *Xylella fastidiosa*.** According to the CSA, information from the Programme T feeds directly into the work of the UK *Xylella* Preparedness Board. The Programme is producing high-quality outputs that will directly improve the way that the UK can manage an outbreak of the highly concerning pathogen *Xylella fastidiosa*. This includes such things as information to inform contingency plans and enhance diagnostic testing.

policy makers to make better informed decisions.²²

- There are also examples of uptake in Industry:
 - **Analysis for Innovators Scale-Up:** The Programme provides direct support to companies (to solve specific measurement challenges); hence uptake is happening among users.
 - **Harnessing Exascale Computing (ExCALIBUR):** The work has already gained some traction with industry. The Programme has engaged with the computer systems design company, Nvidia, working with them on the development of graphics processing units (GPUs)".

Facilitators and Barriers / Challenges

In addition to delays related COVID and potential difficulties related to the nature of research (present above), one Programme also mentioned the ambition of targets and high UKRI board expectations was also mentioned.

In terms of enabling factors, stakeholders pointed to the existence of a Programme coordination team (n=3) which allows steady progress of the Programme but also maintaining linkages across work-packages /projects, as well as (again) the inputs gathered from multi-stakeholder advisory boards / working groups / steering committees (n=2) and keeping a user-focused approach (n=2).

3.6.3 *It has increased UKRI spend in government priority areas, to a varied degree*

We have conducted an analysis (see box below) of UKRI spend in the areas identified and funded by SPF, to draw comparisons with a baseline (2008-2018) and a benchmark (UKRI).

Box 24 *Approach to analysing UKRI spend in priority areas*

Analysing UKRI spend in priority areas required mining the entire GtR database to compare investments made historically in the areas of interest (using a classification algorithm applied to grant abstracts). Given the scope of the exercise (and diversity of areas covered by SPF), we have focused the analysis on the eight areas that correspond to the eight longitudinal case studies selected for this evaluation, which provide a good spread in terms of themes covered, partners involved and Waves (See Technical Report, Appendix B6, for more information on the selection of case studies).

In order to draw comparisons with a benchmark (UKRI), the analysis focuses on the value of grants in competitive calls. Not all SPF Programmes have launched competitive calls (up to 2020) or planned to do so. Further iterations of the analysis could draw comparisons with the total value of the SPF Programmes and UKRI data up to 2023, when most SPF Programmes are expected to conclude.

Further details on the methodology are provided in the Technical Report, Appendix B2.

The analysis shows that UKRI investments in the selected priority areas have been increasing over time (based on the average yearly value of grants) except for "Time infrastructure" (where

²² <https://www.turing.ac.uk/research/research-projects/shocks-and-resilience>

average yearly value of grants has decreased between the period of analysis, and where there is no grant data for the corresponding SPF Programme up to 2020) (see Table 9)²³.

For instance, UKRI investments in areas of (research on) Productivity, Bacterial Plant Diseases, and Cybersecurity have increased by 480%, 155% and 120%, respectively between 2008-2018 and 2019-2020 (based on the average yearly value of grants). Notably, investments in research on Modern Slavery have increased 25 times, reflecting the increased importance (and visibility) of the subject. Across the board, the increase in the average yearly value of grants reflects the increasing importance and focus of those areas, among UK funders and the R&I community.

SPF funding has contributed to this increase across all areas (except for “Time infrastructure”). However, there are only 3 areas where SPF has made a substantial difference (in terms of value of funding): Space Weather, Bacterial Plant Diseases, and Research on Productivity, where SPF explains between 59%-118% of the increase in the average annual value of grants. Additionally, there is also a 25% increase driven by SPF funding in the area of Clean Air.

Note that the implicit hypothesis behind SPF (ToC) is that investments done via the Fund will yield better outcomes (in comparison with a collection of individual grants) given the scale of the funding / concentration of efforts, and range and type of disciplines and stakeholders involved in defining and driving the research agenda and expected results. Based on the analysis shown in the prior sections of the report, this hypothesis may hold true.

Further analysis (in the next stages of the evaluation) will help to test this hypothesis, by comparing outputs and outcomes per £m investment, from UKRI grants versus SPF, for each of those key areas (specifically, publications and uptake of publications in policy documents). One would expect to see that SPF is leading to more intersectoral collaboration in publications across those areas, but most importantly, a higher uptake in policy documents (as a proxy for the relevance of those research outputs to policy makers).

In the next stage, we will also revisit the classification to improve it and provide further validation (in coordination with Programme leads).

Table 9 (Average) yearly value of grants (in £m)

Programme	Area	UKRI	UKRI (excl. SPF)	SPF	Increase UKRI (incl. SPF)	Increase due to SPF
		2008-2018 (Annual average) [1]	2019-2020 [2]	2019-2020 [3]	2008-2018 vs 2019-2020 [2]+[3] vs [1]	2019-2020 [3] vs [2]+[3]
Ensuring the Security of Digital Technologies at the Periphery	Cybersecurity	28.17	58.50	3.38	120%	10%
Space Weather Innovation, Measurement, Modelling and Risk	Space Weather	5.49	4.81	4.35	65%	118%

²³ This is also a category that may need further refinement as it currently includes the broad field of “Horology” as shown in the Technical Report.

Programme	Area	UKRI	UKRI (excl. SPF)	SPF	Increase UKRI (incl. SPF)	Increase due to SPF
		2008-2018 (Annual average) [1]	2019-2020 [2]	2019-2020 [3]	2008-2018 vs 2019-2020 [2]+[3] vs [1]	2019-2020 [3] vs [2]+[3]
UK Animal and Plant Health	Bacterial Plant Diseases	2.16	2.35	3.15	155%	94%
Adolescence, Mental Health and the Developing Mind	Mental Health and Adolescence	3.20	14.76	0.58	379%	5%
Transforming Productivity Research	(Research on) Productivity	6.69	19.93	18.92	480%	59%
The National Timing Centre	Time infrastructure	7.62	6.24	--	-18%	--
Policy and Evidence Centre for Modern Slavery and Human Rights	Modern Slavery	0.15	3.29	0.37	2380%	10%
Clean Air: Analysis and Solutions	Air quality	24.16	36.44	4.20	69%	25%

*To minimise false positives (Research on) Productivity only includes grants provided by ESRC

3.6.4 Current evidence on the influence of SPF on confidence to invest in / apply for MIDRI funding is inconclusive

There was also the expectation that the Fund would encourage confidence to invest in MIDRI amongst SPF partners and encourage researchers and innovators to apply for MIDRI funding.

The latter should be captured by the Programme level evaluations (see Technical Report, Appendix C) and incorporated into the Fund evaluation at the interim impact stage.

The former would be captured by this evaluation; however, the initial analysis of Fund outputs provides limited evidence at this stage. The scale and nature of SPF funding ('neutral' resources) has enabled Councils to employ relevant (existing) processes and mechanisms to address MIDRI within their SPF Programmes to a greater extent than is usual. However, it is unclear yet whether this will influence their ability (or confidence) to do so beyond SPF as well. The evaluation will need to continue to explore this with Councils in future phases.

We had also considered looking at University REF2014 submissions to the "Environmental Section" (where they provide details about their strategies, including actions to support inter or multidisciplinary) and see how this changes in REF2021. However, we found that all Universities describe undertaking actions to support MIDRI (via e.g. dedicated Centres, research groups or strategies in place) which will render this analysis meaningless.

3.7 Future expected impacts

➔ **Impacts** (1-10 years after programme / project completion) ➔

- Sustained effects amongst SPF partners, beyond / after SPF (first order impact)
- An ecosystem change (i.e. effects materialise beyond SPF partners (second order impact))

Economic and Societal

- New and improved public policy (e.g. regulation, frameworks, programmes, taxes, subsidies)
- New and improved public services (e.g. infrastructure, health, welfare, education)
- New and improved products and services
- Economic growth, in particular in key industries / gov priority areas
- Increased (high skills) jobs

Knowledge

- UK maintains / strengthens its position at the forefront of R&I across gov priorities (first mover advantage)

Finally, future iterations of the Fund evaluation (the interim and final impact evaluation stages) will look to capture evidence of progress towards impact.

According to the ToC (see figure), these impacts are expected to materialise 1 to 10 years after the completion of SPF Programmes, so they should begin to emerge during the lifetime of the current evaluation (and continue to develop beyond this).

The first set of impacts listed in the figure will be covered by this study by tracking evidence of sustained effects and wider ecosystem changes in relation to the outcomes reported in previous sections.

Economic and societal impacts should then be captured by future Programme monitoring and evaluation activities (see Appendix C of the Technical Report for the guidance provided to Programmes on relevant indicators to capture). This evidence will then be incorporated into the Fund level evaluation via a meta-analysis of results. We (the Fund evaluation) will also continue to capture specific examples of achievements via surveys and interviews.

The knowledge, economic and societal impacts that the evaluation is expecting to capture, directly and via the Programme evaluations, will include:

- New and improved public policy (regulations, frameworks, Programmes, taxes, subsidies)
- New and improved public services (infrastructure, health, welfare, education)
- New and improved products and services

Other impacts are also expected to emerge but given the low involvement of industry in the Programmes these are expected to be limited. This includes:

- Economic growth, in particular in key industries / government priority areas
- Increased (high skills) jobs

Finally, information on Knowledge impacts will be captured via bibliometric data and analysis planned as part of the interim and final impact evaluations.

4 Concluding remarks and recommendations

4.1 Concluding remarks

This first iteration of the SPF fund-level evaluation (baseline and interim process) has found that the implementation of the Fund is progressing well.

The Fund has implemented its main mechanism of influence (the process for the selection and funding of Programmes) and established a portfolio of 34 Programmes that are each aligned with one or more of its three overarching objectives. The consequences of the Programme selection process will become more evident, as the outcomes and impacts begin to emerge.

It is also important to note that the design of the Fund means that the design, implementation, and governance of selected SPF Programmes is largely devolved to the Councils, PSREs and other partners involved, with these organisations retaining a high-level of autonomy as to how best to execute their Programmes in alignment with Fund-level objectives. Ongoing Fund-level involvement is light touch, consisting mainly of oversight from the SPF central Team, Working Group and Board (who monitor progress with implementation/spend, plus emerging results).

Driving an increase in high-quality MIDRI

There is strong consensus amongst those involved in SPF that the Fund is supporting Programmes that address complex and multi-faceted challenges that it would be difficult to fund and address via other means. Tackling those complex challenges requires, in many cases, a multi or interdisciplinary perspective that other funding routes are often not well suited for. The 'neutral' resources offered through SPF facilitate this crossing of boundaries, while the scale of funding on offer is a key enabler to implement a multi- and inter-disciplinary approach.

The focus of SPF on supporting challenge-led Programmes that address cross-departmental priorities, has subsequently embedded the participation of different stakeholders at the design stage of Programmes, in the shaping of research agendas, and in the selection process (for calls), helping to ensure a MIDRI approach to tackling relevant challenges. The degree of involvement of stakeholders at different implementation stages is varied across Programmes, however, and future phases of the evaluation will aim to test the relationship (if any) between these features and the degree of contribution to SPF expected outcomes and impacts.

Most SPF Programmes have put in place mechanisms or actions to de-risk and assess MIDRI proposals, usually building upon pre-existing practices. The MIDRI perspective is also flowing through to SPF projects and publications, where there is early evidence of a high degree of multi- and / or inter-disciplinarity compared with baselines and benchmarks in the few projects available for analysis at this early stage. These analyses are preliminary, however, given the stage of maturity of SPF Programmes, and their accuracy and robustness will increase over time (as more data becomes available).

Addressing government priorities

As intended, SPF has helped (in Wave 2) to establish a novel centralised process for engagement between Councils and government to identify and prioritise relevant Programme ideas, which have then gone on to be supported. This has also caused additional efforts to improve government ARIs, which is expected to further increase cross-government co-ordination of priorities and improve join-up and consensus in future, beyond SPF.

Most SPF Programmes (32 of 34) are addressing government R&I priorities and policy needs, and most (30 of 34) include one or more government departments, agencies, or devolved administrations as formal partners (alongside Councils, PSREs and other organisations).

SPF has successfully encouraged some participation and input from government departments to the initial development of Programme ideas, and over half of Programmes secured a letter of support from a government CSA for inclusion within their bid. However, the degree of government input and involvement at this stage varied and there would be scope for closer and earlier communication and engagement between Councils and government in future.

Government involvement in subsequent Programme governance and implementation also varies, but appears more widespread, with the majority of Programmes reporting input to call definition and support to other key processes. We have also identified a wider set of 50+ government representatives sitting on Programme advisory boards (19% of total membership), providing additional guidance and steer to the ongoing implementation of Programmes.

SPF has also enabled the participation of BEIS Public Sector Research Establishment (PSREs) as formal partners in seven of the funded Programmes, where they have been significantly involved in the development of the original Programme idea and ongoing implementation. Not all eligible PSREs are participating, but it is not clear if this was expected.

In addition, SPF also allows a wider set of PSREs (supported by other departments) to bid for competitive funding through Programmes. This represents a widening of the standard eligibility criteria and provides an opportunity to test how involvement in UKRI grants could work. The SPF Business Case does not set clear expectations for the extent or scale of PSRE involvement, so it is difficult to judge success. However, the Fund has expanded eligibility, and this has enabled PSREs to bid (7 PSREs involved in 39 SPF grants so far). The incidence of PSRE involvement (8% of all SPF projects) is also much higher than for UKRI grants more generally, demonstrating that eligibility is unusual (though not unique) and that there is appetite for this type of collaboration. However, with the Fund's wider intention to support ecosystem change, and the scale of PSRE project activity so far, the influence of SPF (above and beyond other activities) may be limited.

Responding to strategic priorities and opportunities

Most of the funded SPF Programmes are medium scale (£10m+ in size), helping to address a gap in the current funding system that was identified within the SPF Business Case. In fact, the scale of funding has been singled out by the R&I community involved in SPF as the single most important added value of the Fund (in so far as it has enabled the results above). Importantly also, this funding has been made available in between spending reviews, at a time when R&I budgets are constrained and with existing funding mostly already committed, leaving limited room for new initiatives. It has therefore provided funding to address current cross-council/departmental priorities that might otherwise have been missed or under-addressed.

Progress towards outcomes

It is too early to draw firm conclusions in relation to the achievement of intended outcomes, which are only expected to fully materialise after completion of the Programmes. However, early assessment shows that SPF is making some progress towards achieving outcomes related to strengthening linkages among relevant stakeholders and increasing awareness of R&I priorities and capabilities. There is more limited evidence of the relevance, dissemination, and uptake of R&I outputs among policymakers, as is to be expected at this stage. However, some early examples of positive outcomes have already been identified. There is also some early evidence that SPF has already increased UKRI spend in certain government priority areas, although this will need to be further tracked as the Programmes progress.

Similarly, wider impacts are expected to materialise 1 to 10 years after the completion of SPF Programmes, and so should start to emerge during later phases of the Fund evaluation (and continue to develop beyond this). This includes economic and societal impacts, which are expected to be captured by the Programme evaluations that are currently in development.

4.2 Recommendations

Based on this assessment of the baseline and early progress, as well as the conclusions drawn from the interim process evaluation, the evaluation team has put forward a series of recommendations for the current Fund and any potential future iterations, as well as for the monitoring and evaluation efforts of SPF and the Fund evaluation team.

For the ongoing implementation of the current SPF Fund, we recommend that:

- UKRI and the Fund evaluation team continue to disseminate emerging results from the Fund evaluation to SPF programmes (to feed into their own activities and thinking).
- UKRI (with the support of GO-Science and individual Programmes) undertake further efforts to raise awareness of the opportunities for PSREs to bid for competitive funding through SPF Programmes. A targeted approach to the ~20 originally identified PSREs (that have not yet been involved in an SPF grant) may be an appropriate starting point.
- UKRI provide opportunities for SPF Programme leads to come together to share experiences and learn from one another in relation to the particular challenges of implementing SPF Programmes (e.g. around multi-stakeholder working or approaches to encouraging and supporting high-quality MIDRI applications / projects).
- UKRI consider supporting dissemination events across NPIF investments, where there are related challenges being tackled across different Funds (including SPF). This might include for example events focused on greenhouse gas removal, the future of food, or quantum technologies (which are areas also covered, to some extent, by ISCF Programmes). This could help create critical mass to further encourage end-user (e.g. policy maker) engagement with ongoing work and emerging outputs. It might also aid cross-learning and linkages between these different investments.

For any potential future wave of SPF (or similar) funding

It is unclear at this stage what the options are for the future of SPF (including funding availability for any future waves). However, we provide a series of suggestions that might support any future iteration of SPF or another similar Fund. We recommend that:

- UKRI clearly establish and explain Fund objectives and intentions to potential bidders and those involved in assessing and selecting Programmes. This could help to improve the transparency and efficiency of the process. Additionally, focusing on one core objective (e.g. addressing government priorities, or encouraging MIDRI) might also be considered, in order to apply a clearer and stronger steer to the whole process.
- UKRI improve guidance for CSA letters of support to provide greater, more relevant and consistent information, which will then provide more evidence to make strategic decisions, improving the efficiency of the process.
- UKRI establish a scoring process to support the selection process. This could help to improve the transparency of decision-making, which was a key indicator for the Fund, as set out in the SPF Business Case (“Improved efficiency and transparency in the decision-making process for new and emerging Programmes”).

If a future Fund / Wave were to maintain an objective to encourage Programmes that address cross-departmental priorities, then we recommend that:

- UKRI facilitate earlier engagement between government departments and councils to improve efficiency of the process and ensure alignment with priorities (e.g. ARIs) / strategic focus (i.e. an enhanced version of the Wave 2 process)
- UKRI encourage programmes to ensure that government departments are involved in idea / bid development and in governance structures in a meaningful and effective way, in order to maximise the probability of delivering on such objective

- UKRI improve guidance / visibility of opportunities for PSRE involvement, at the Programme and project level (as mentioned above) to maximise opportunities for involvement

For future phases of the Fund evaluation, we recommend that:

- UKRI (with the support of the Fund evaluation team) continue to provide support to Programmes for their own evaluation activities. This includes sharing plans for future evidence collection (to avoid unnecessary duplication of efforts) and providing further encouragement to address questions and indicators that need to be answered at the Programme level, but which will support the answering of Fund-level evaluation questions (building on guidance already provided by the Fund evaluation team – see Technical Report, Appendix C). There also remains some lack of clarity over the intended timings of the Programme evaluations and it would be useful to obtain an updated view from across the portfolio, to ensure that the Fund evaluation is best positioned to be able to draw on any relevant evidence being collected by Programmes.
- The Fund evaluation team focus the next iteration of data collection tools on information that could help to feed into the Qualitative Comparative Analysis. Note that this will also be informed by Programme level evaluations.
- Increase the focus within case studies on understanding how /if involvement of government departments have evolved over the life of the Programme (since their involvement is key in achieving some of SPF intended outcomes), as well as on R&I outputs & uptake. The case studies should also explore further how / if government departments are preparing for the uptake of those results, and how / if they are championing and disseminating them
- The Fund evaluation team increase engagement with CSAs. We experienced some difficulties in getting CSAs to respond to our survey and so in the next stage of the study we should seek to increase interest in the study by presenting our results, while also working harder to engage with key individuals from an early stage.
- The Fund evaluation team do a rapid assessment of Programme level evaluations at the beginning of next phase (or at least ~8 months ahead of delivery of the Interim report (which is due in December 2022) and before the fieldwork starts, to decide how they could be used and if changes in the methodology are needed to address potential gaps.
- The Fund evaluation team analyse information on R&I outputs and outcomes by characteristics of the implementation, but also by Wave to test whether the enhanced processes of W2 have led to better outcomes (incl. relevance of R&I outputs and uptake).

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