

June 2023

Strategic Priorities Fund (SPF)

Interim Impact Evaluation – Main report



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Technopolis, in collaboration with Science-Metrix, Ipsos MORI and CECAN

Notes to the report:

The Department for Business, Energy and Industrial Strategy (BEIS) was dissolved on 7 February 2023, with its functions split into three new departments. Responsibility for R&I passed to the newly created Department for Science, Innovation and Technology (DSIT). The report refers to BEIS, as the department responsible at the time.



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Executive Summary

The Strategic Priorities Fund (SPF)

SPF is an **£831m UK Research and Innovation (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

** Multidisciplinary R&I involves different disciplines working independently on a common problem or question, while interdisciplinary R&I involves disciplines interacting and working collaboratively from the outset.*

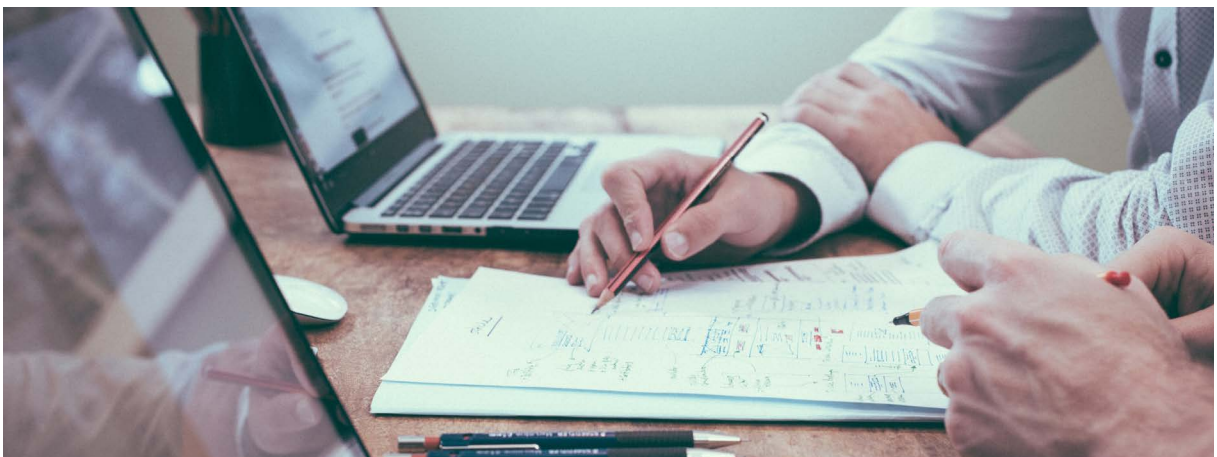
This Evaluation Report

UKRI commissioned Technopolis (with Science-Metrix, Ipsos MORI and CECAN) to undertake a **Fund-level evaluation of the SPF**. The study is taking place in four phases (over 2020–2025), with this report representing the main output from the third phase (**the interim impact evaluation**).

We have looked at the Fund from a Theory of Change perspective, as recommended by the HMT Magenta Book. In the **Baseline and Early findings report** (2021) we focused on SPF's **main intervention mechanisms**, as well as the **outputs emerging from the Fund**. In this interim stage we focus on further development of outputs, plus progress towards **outcomes and impacts** (most of which are only expected to fully materialise after the programmes have ended).

The interim evaluation focuses on assessing increases or changes, via analysis of qualitative information, or via hard metrics (where relevant/possible). It also makes comparisons with benchmarks, for example with business as usual or what could be achieved via other means.

Over 160 stakeholders were consulted during this phase of evaluation via interviews, surveys and workshops (including SPF programme leads, co-leads, partners, Champions, participants and Advisory Board members), covering representatives from UKRI, academia, government departments and agencies, Public Sector Research Establishments, charities and industry.



Main findings of the Interim Evaluation

The Fund's outputs



SPF has established **a portfolio of programmes that align with its high-level objectives** relating to MIDRI, government priorities and system agility (see Section [2.1](#)).

- SPF was designed as a **mechanism to allocate funding** to a portfolio of programmes that align with its overall objectives, with a centralised process for funding allocation (to programmes) and a decentralised process for programme design and implementation.
- It has **supported 34 programmes** across two waves (launched in 2018 and 2019). Each programme coordinates a diverse range of R&I activities and projects at various stages of maturity and from across the broad spectrum of R&I areas. **Each programme addresses at least one of the main objectives of the Fund.**
- SPF programmes are mostly medium in scale (£10m+), thereby addressing a gap for larger, more complex projects. The funding has also fallen between spending reviews, allowing programmes to address **emerging opportunities and priorities** at scale.
- They have gone on to support **767 individual projects** through open competition (to 17 June 2022) – with more expected in future.
- Three of the 34 programmes have finished (as of December 2022).



SPF programmes (and projects) are now progressing in the **delivery of R&I outputs, and at a rate that is in line with the wider UKRI grant portfolio** (see Section [2.2](#)).

- **Good progress is being made in the delivery of R&I outputs**, despite the complex nature of research carried out within these (SPF) programmes, including the involvement of different disciplines and stakeholders (which might reduce or delay output production).
- **Publications (per £m invested) is the one area where the output performance of SPF grants is currently lower** than for the wider UKRI portfolio (and four programmes account for 40% of the SPF publications currently reported). This could be due to:
 - The complex nature of the research and multi-stakeholder involvement, which may reduce or delay output production.
 - SPF programmes prioritising other types of outputs (e.g. policy briefs or synthesis reports) to communicate results to end users such as policy makers (as evidenced in case studies).
- **Citations within policy-related literature are 3x higher for SPF outputs**, compared with other UKRI grants.

The Fund's progress towards outcomes



SPF is helping to **drive an increase in high-quality multi-disciplinary and inter-disciplinary research and innovation (MIDRI) at all stages**, from applications to research teams and publications, through to synthesis and dissemination (see Section [2.3](#)).

- **SPF has enabled a focus on supporting and enabling MIDRI** across much of its programme portfolio by making funding available for:
 - Programmes intended to support MIDRI, with councils retaining autonomy as to how best to execute this objective.
 - Challenge-led programmes that address cross-departmental government priorities and embed participation of different stakeholders across the programme cycle.
 - Programmes that are led in collaboration by more than one Council.
- Most programmes **encouraged MIDRI applications through call text and criteria**, with nearly half making MIDRI a requirement (see Section [2.3.1](#)).
- There are good indications that most SPF programmes have been **successful at attracting MIDRI proposals** (see Section [2.3.2](#)).
- Nearly all programmes have also put in place **processes specifically designed for the assessment of MIDRI**, including many that are considered new or enhanced (57% of programmes) (see Section [2.3.3](#)).
- This has translated into a **high degree of MIDRI-ness among SPF projects** (see Section [2.3.4](#)), and a **high degree of multidisciplinary and intersectoral collaboration in SPF publications** (see Section [2.3.6](#)).
- There are early indications that SPF's MIDRI focus could have **longer term and wider (ecosystem) effects** (see Section [2.3.7](#)), but the relatively small scale of SPF vis-à-vis the UKRI portfolio (~4% of MIDRI grants awarded since 2018) may limit those effects.

RECOMMENDATIONS

The experience in SPF and evidence collected in this evaluation provides some useful **reflections and lessons learnt with regards to supporting and enabling MIDRI** (see Section [2.3.8](#)). In particular, future iterations of SPF or similar future interventions that are aimed at supporting high-quality MIDRI might usefully consider the following:

- The need to standardise processes to further facilitate cross-council collaboration
- Investing time and resources in (new) MIDRI partnerships
- Allowing sufficient time for effective integration of knowledge from different disciplines



SPF is helping to address government R&I priorities, via additional spend, through government department involvement in programmes and projects, and through the dissemination, uptake and use of outputs developed under the Fund (see Section [2.4](#)).

- **SPF has increased UKRI spend in several government R&I priority areas** (see Section [2.4.1](#)), including e.g. in research on productivity, modern slavery, bacterial plant diseases, and mental health.
- SPF has **encouraged programmes to involve government departments and agencies**, both in the design and scoping of programmes, and in their ongoing implementation and governance (see Section [2.4.2](#)).
- It has also **enabled the involvement of Public Sector Research Establishments (PSREs)** in UKRI projects, which has been taken up to a limited extent (see Section [2.4.3](#)). This experience has supported a recent expansion of this PSRE-eligibility policy across UKRI.
- Evidence collected via case study also suggests that **SPF has facilitated stronger collaboration with government departments than was usually possible** across all but one of the 8 examined programmes (see Section [2.4.5](#)).
- **Collaboration with government is also taking place in the production of scientific outputs**, specifically publications (see Section [2.4.4](#)).
- More importantly, **research outputs and insights emerging from SPF programmes (and projects) are helping to inform policy decisions** (from informing plans and strategies to deal with future health and climate crises, to evidence to support design and implementation of programmes in key priority areas) (see Section [2.4.6](#)).
- There is also some evidence of **increased understanding between research councils and government departments** on how to engage and collaborate beyond SPF (see Section [2.4.7](#)).

RECOMMENDATIONS

The evidence collected in this evaluation also provides some **reflections and lessons learnt with regard to addressing government R&I priorities** (see Section [2.4.8](#)), including:

- Building upon the process of identification of priorities used for the second wave of SPF bids
- Planning for and dedicating resources throughout the life cycle of the programme to maintain engagement
- Ensuring strong (and targeted) engagement with government in later phases of projects and programmes, including consideration of the appropriate nature of outputs and dissemination activities to engage with these potential end users

Note that, following our Theory of Change, the interim evaluation focuses on Objectives 1 and 2 (increasing MIDRI and addressing government priorities), where further outputs, outcomes and impacts are expected to continue to emerge over the lifetime of programmes (and beyond). Objective 3 (responding to strategic priorities and opportunities) relates to the set-up of the Fund and the selection of programmes, so the main findings were presented in the Process Evaluation (as part of the Baseline and Early Findings report) and are briefly described in Section [2.1](#) of the current report.

1 Introduction

This report is the main deliverable from the interim impact phase of the Fund-level evaluation of the Strategic Priorities Fund (SPF). This first section provides a brief introduction to the Fund and evaluation, while the remainder of the report presents the main findings.

1.1 Key features of the Strategic Priorities Fund (SPF)

The **Strategic Priorities Fund (SPF)** was announced in the Industrial Strategy White Paper in 2017. It was 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 provided the discovery-led research and innovation to complement more directed or challenge-led elements.¹

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 Review.² 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 the ability to respond quickly and materially to emerging challenges or opportunities.

SPF was committed to fund R&I that addressed each of these aspects and 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- 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

Addressing 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

¹ SPF Business Case (2019).

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

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.)

Responding to Strategic Priorities or Opportunities (Agility)

The Nurse Review argued that a new, collective 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 with little room for new initiatives. It is argued in the Business Case that these budget pressures also translate into underinvestment in mid-scale (£10m–£15m) investments, since larger, more complex projects can bring bigger risks and can 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 was 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 was not an explicit expectation in the design of the Fund.

Note that, following our Theory of Change, the interim evaluation focuses on Objective 1 and 2, where further outputs, outcomes and impacts are expected to continue to emerge over the lifetime of the SPF programmes (and beyond). Objective 3 relates to the set-up of the Fund and the selection of programmes. It was therefore covered in the Process Evaluation (as part of the Baseline and Early Findings report in 2021) and key findings from that stage have been briefly summarised in the current report.

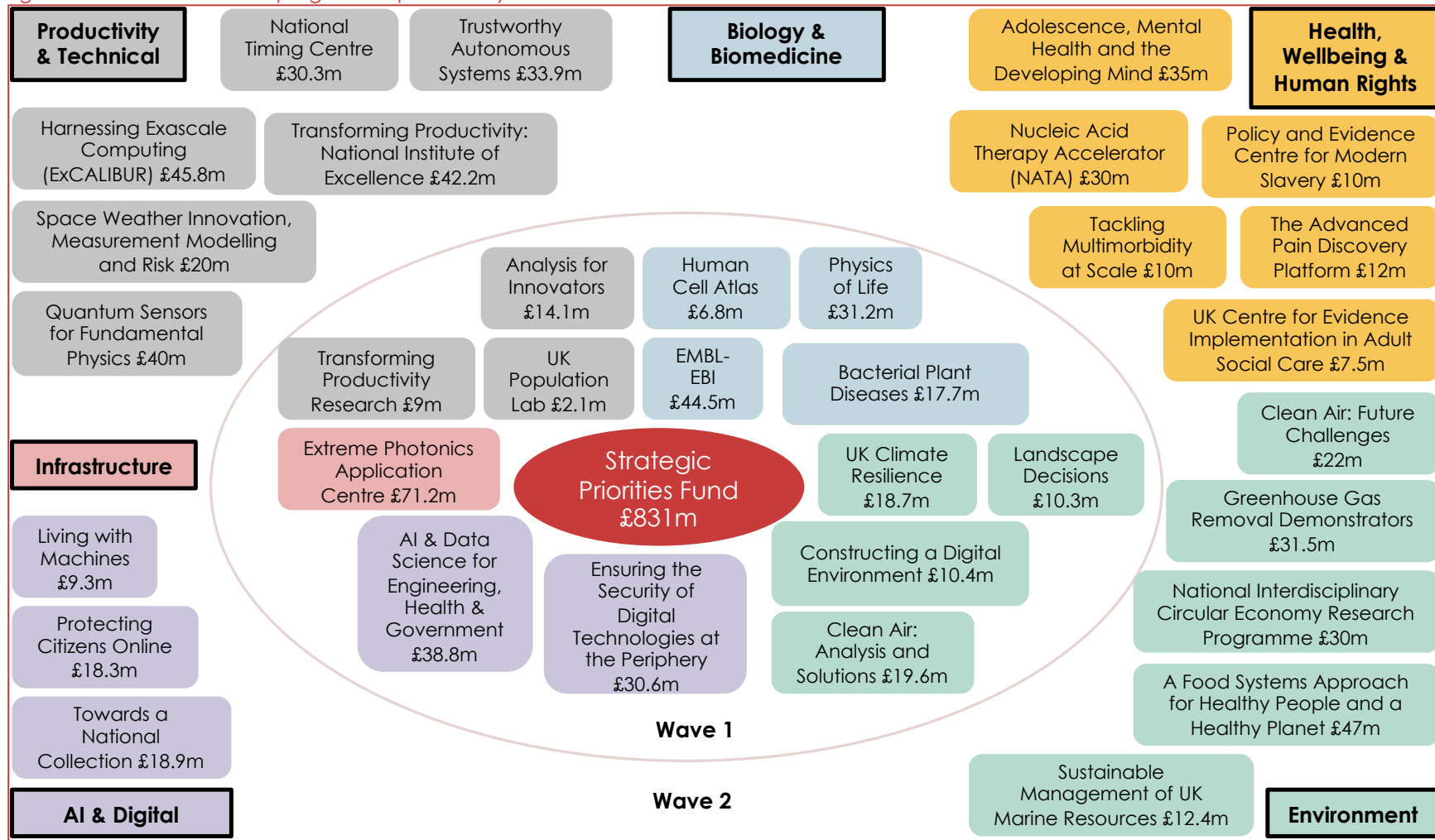
With around £831 m at its disposal, the Fund had the capacity to engage across the UK research and innovation system in these three transformative aspects. It supported 34 programmes across two waves – the first wave (launched in 2018) awarded £334m to 15 programmes, while Wave 2 (2019) awarded £497m to 19 programmes.³ The resulting SPF programme portfolio (see 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 BEIS⁴-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.

⁴ The Department for Business, Energy and Industrial Strategy (BEIS) was dissolved on 7 February 2023, with its functions split into three new departments. Responsibility for R&I passed to the newly created Department for Science, Innovation and Technology (DSIT). The report refers to BEIS, as the department responsible at the time.

Figure 1 SPF Wave 1 and 2 programme portfolio by theme



1.2 Our approach to evaluating the Fund

UKRI commissioned Technopolis (with Science-Metrix, Ipsos MORI and CECAN) to undertake a Fund-level evaluation of UKRI's investments in SPF. The **aims of the evaluation** are to:

- Demonstrate what the Fund has delivered for taxpayers
- Help build the evidence base on 'what works' in supporting high quality MIDRI and ensuring R&I responds to strategic opportunities and priorities
- Inform ongoing and future improvements to the Fund

The study is taking place in **four phases** over the period 2020–2025 (see Figure 2), with this report representing the main output from the third phase (the interim impact evaluation).⁵

Figure 2 Evaluation phases and (expected) report publication dates



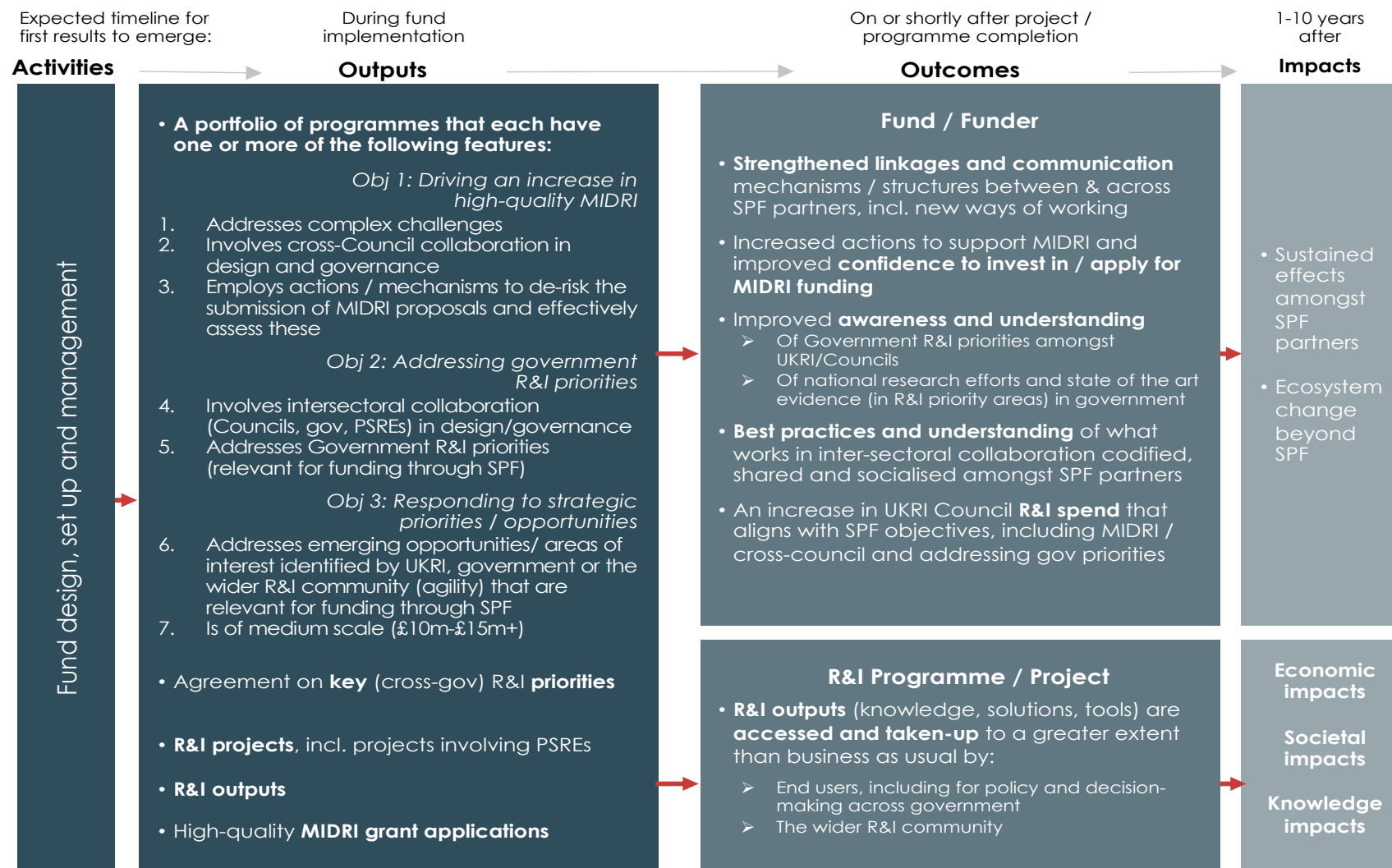
We have looked at the Fund from a **Theory of Change** (ToC) perspective, as recommended by the HMT Magenta Book when evaluating complex interventions. The Theory of Change developed for this evaluation has at its core a Logic Model (summarised in Figure 3) that seeks to capture the outputs, outcomes and impacts that are expected to emerge from the Fund.

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

- Follows a theory-based approach, and combines qualitative and quantitative methods
- Maximises the use of existing information (including the outputs of individual programmes' monitoring and evaluation (M&E) activities, as these emerge)
- Focuses on understanding the extent to which the Fund objectives have been achieved (and how)
- Is intended to be iterative and to evolve as we advance through the phases of the evaluation and as evidence becomes available through programme evaluations.

⁵ Given the stage of development of SPF programmes and progress so far, the Economic Evaluation will be conducted only at the final stage of the evaluation.

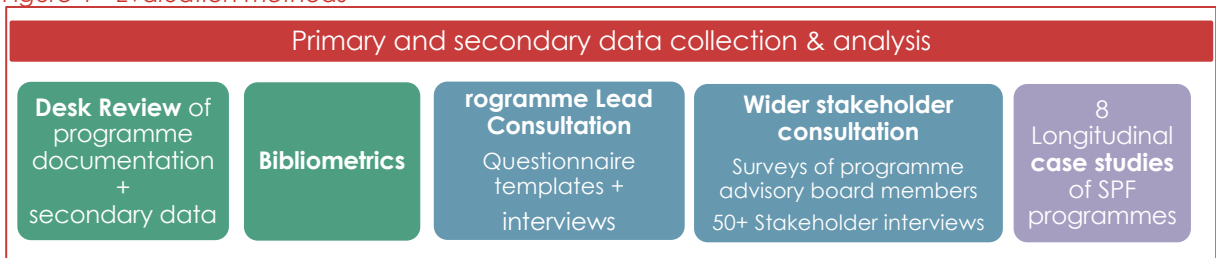
Figure 3 SPF Theory of Change



The evaluation also has a **Fund level focus**, drawing on evidence emerging directly from the design and implementation of the Fund and programmes, as well as projects when relevant (e.g. R&I outputs emerging at project level that contribute to the economic and societal impacts of the Fund). Not all SPF activities are delivered through calls and grants, so the approach focuses mainly at the programme level. However, the analysis of some R&I outputs and the bibliometric analysis relies on grant-based data, as indicated in the text.

The current phase of evaluation is based on seven main groups of data collection and analysis activities (Figure 4), with these taking place between May and November 2022. Over **160 stakeholders were consulted during this phase via interviews and surveys** (SPF programme leads, co-leads, partners, participants and Advisory Board members), covering representatives from UKRI, Academia, government, Public Sector Research Establishments, and industry.

Figure 4 Evaluation methods



The analysis of MIDRI (SPF objective 2) has been approached in a variety of different ways. As Figure 5 summarises, four different methods have been employed to explore the extent of MIDRI in relation to SPF programme composition, proposals, projects, project teams and outputs, as well as the extent to which actions have been taken to support and enable MIDRI.

Figure 5 Overview of methods employed to assess different aspects of MIDRI

Level (x3)	Area of analysis (x8)		Methods (x4)
Programmes	Programme composition (disciplines, stakeholders)	Programme design	<ul style="list-style-type: none"> Self-reported (disciplines involved) Composition of programme governance Self-reported (actions taken to support MIDRI and comparison with BaU)
		Programme governance	
	Actions to attract MIDRI projects and assess them	Calls for proposals	
		Proposal assessment	
Proposals / projects	MIDRI-ness of proposals received	Proposals	<ul style="list-style-type: none"> Field of Research tagging of proposals (SPF vs UKRI)* * self-reported data also collected
	MIDRI-ness of proposals funded	Projects	
		Project teams	
Outputs	MIDRI-ness of outputs emerging from programmes funded	Publications	<ul style="list-style-type: none"> Bibliometrics: MI (diversity of co-authors disciplinary backgrounds) and II (diversity of knowledge) (SPF vs benchmarks)

More information on methodology is provided in Appendix A of the accompanying Technical Report. The case studies are then presented in full in Appendix B, with summaries and analysis of these presented in the current document.

2 Main findings

2.1 SPF has established a portfolio of programmes that align with Fund objectives

SPF was 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 (to programmes) and a decentralised process for programme design and implementation. Councils, PSREs and other partners have a high degree of autonomy in running the programmes, while ongoing Fund-level involvement is light-touch, consisting mainly of oversight from the SPF Oversight Board, Working Group and central 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 had at its disposal to provide the strategic steer** to meet its high-level objectives. This process included the establishment of objectives and bidding criteria (intended to steer or 'nudge' programme bids to align with Fund objectives and intentions), plus a process and guidance for the subsequent review of bids by a panel (to help judge alignment and fit with the Fund and select the best proposals) and the selection of programmes. This initial assessment and selection process should have ensured that the individual SPF programmes and their activities were well aligned with the Fund's overall goals (alongside programme-specific aims).

For the interim process evaluation (January 2022) we undertook 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. Overall, this found that efforts had clearly been made (despite the tight timescales imposed upon the Fund) to achieve **a thorough and transparent process that is purposefully designed to encourage and then select the best possible opportunities for supporting Fund objectives**.

The Fund eventually supported a portfolio of 34 programmes across two waves (2018 & 2019), with each co-ordinating a diverse range of R&I activities. **The portfolio that was established aligned well with the Fund's three headline objectives**, as summarised below:

SPF Objective: Driving an increase in high quality MIDRI

- All selected programmes were bid on the basis that they would address MIDRI, meaning that this was embedded within their design and implementation from the start.
- Most (28/34) selected programmes (82% of the total) were led by multiple Councils, while all programmes involved the participation from different types of stakeholders in their design, governance, and implementation. The baseline evaluation identified 274 representatives on individual programme advisory groups, including individuals representing government departments, UKRI/Councils, PSREs, academia, industry, charities/NGOs, and cultural organisations.
- Programmes have also brought together groups and individuals that might be considered 'non-traditional' participants in research and innovation activities (see box below).

Box 1 Examples of SPF engaging with different communities

- **Tackling multimorbidity at scale:** Patient and public involvement experts have been involved as proposal reviewers and panel members.
- **UK Centre for Evidence Implementation in Adult Social Care:** Organisations in the voluntary, community and social enterprise (VCSE) sector, as well as people with lived

experience of social care, have all been involved in scoping the call and in the review process.

- **Clean Air:** charitable/social enterprise organisations have been more involved than was anticipated in this programme, in part due to the outreach activities of the programme Champion. There has also been successful engagement between the programme and the health community, particularly with primary care and GPs.
- **Adolescence, mental health and the developing mind:** The programme's Research and Stakeholder Advisory Board (RSAB) includes government department representatives, academics, practitioners and third sector stakeholders. In addition, the programme's young person's advisory group (which was also established through the programme) also feeds into the RSAB.
- **Productivity Institute:** The Productivity Institute established 8 Regional Productivity Forums (RPFs), which bring together over 130 people from different sectors (including small and large businesses and policy makers) to ensure that the institute hears from different perspectives and understands the productivity challenges and opportunities of different sectors, roles and regions. This intelligence has then helped drive the Institute's business innovation activities and research and engagement agenda.
- **Modern Slavery and Human Rights Policy and Evidence Centre (MS-PEC):** A key objective of the MS PEC is to build and sustain an inclusive 'network of networks' of producers and users of modern slavery research. The Advisory Group of the Centre comprises representatives from academia, civil society, NGOs, the Home Office, international organisations, and independent members. The Centre has also involved people with lived experiences of modern slavery (PWLE) across call processes, in research projects and in discussions with policymakers and businesses.

Source: Technopolis (2022). Case studies and programme Lead template response

SPF Objective: Aligning with and addressing government priorities

- Most of the selected programmes (32/34) self-assessed at the bid stage as addressing government priorities and policy needs. As a result, 91% of SPF funding went to proposals involving a close partnership with a government department or agency (far surpassing the HMT requirement, which had been at least one-third of funding to such programmes).
- SPF also helped establish a novel process (in Wave 2) for engagement between Councils and government departments to identify, prioritise and co-create relevant programme ideas. This involved a multi-step prioritisation process to identify and then consolidate cross-departmental R&I priorities, resulting in a final list of 18 priority proposals (15 top priority and a further 5 second tier) that was taken into account in the subsequent SPF selection process (with a 'prioritised bid' providing a strong rationale for selection by the panel). 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. There are government departments as formal partners in 30 of the 34 SPF programmes, while 25 departments and agencies are involved in programme advisory boards.
- Six BEIS-funded PSREs (UKSA, UKAEA, NPL, NNL, the Met Office and Go-Science) were eligible to submit SPF programme proposals (as an unusual feature of SPF's design), and of the 34 programmes in the portfolio, 7 (21%) involve a PSRE as a lead/partner.⁶


⁶ 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.

SPF Objective: Responding to strategic priorities and opportunities (agility)

- SPF has mainly (28/34) provided funding for medium-scale programmes (£10m+), helping to address an identified gap in the funding system relating to larger, more complex projects.
- It has done so 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.
- This at-scale (and 'neutral')⁷ funding enabled the design of programmes that address complex challenges, involve multi-stakeholders and take different approaches.

Also, in relation to the last objective, the timing (between Spending Reviews and in a period of tight budgets) and scale of SPF funding, as well as the autonomy given to programmes once selected, all mean that there is also potential for greater agility at the *programme* level (although this was not an explicit expectation in the design of the Fund). The case studies (presented in Appendix B) all include discussion of how these programmes have evolved and adapted to changing needs and opportunities over the course of their lifetime. Most commonly this has been in response to barriers and opportunities posed by COVID-19, but there are also other examples of agility relating to changing user needs and priorities, or learning from the early phases of programme implementation. One such example is shown below.

Box 2 Programme agility – example of the Productivity Institute



Productivity Institute | Wave 2 | Lead Council: ESRC

Recent developments (e.g. the pandemic, geopolitical conflicts, the energy crisis and rising inflation) mean that the macro environment is very different from two years ago when the first investments of this programme were launched. The Institute has been responsive to this changing context, e.g. by conducting research on the impact of COVID-19 on productivity.

The Productivity Institute has also shifted its approach to research from 'bottom up' to a more directed and focused approach with the aim of optimally engaging with business and policy makers. In this regard, the Executive Team has identified 7–8 specific programmes that will be developed over the next three years. It also recognises a demand for short-term flexible projects that can respond to business needs on specific questions. For this, they developed 'Innovation Sandpits', which are short (2 week) collaborations between researchers and businesses to identify and solve a specific problem.

Source: Technopolis (2022). Case studies

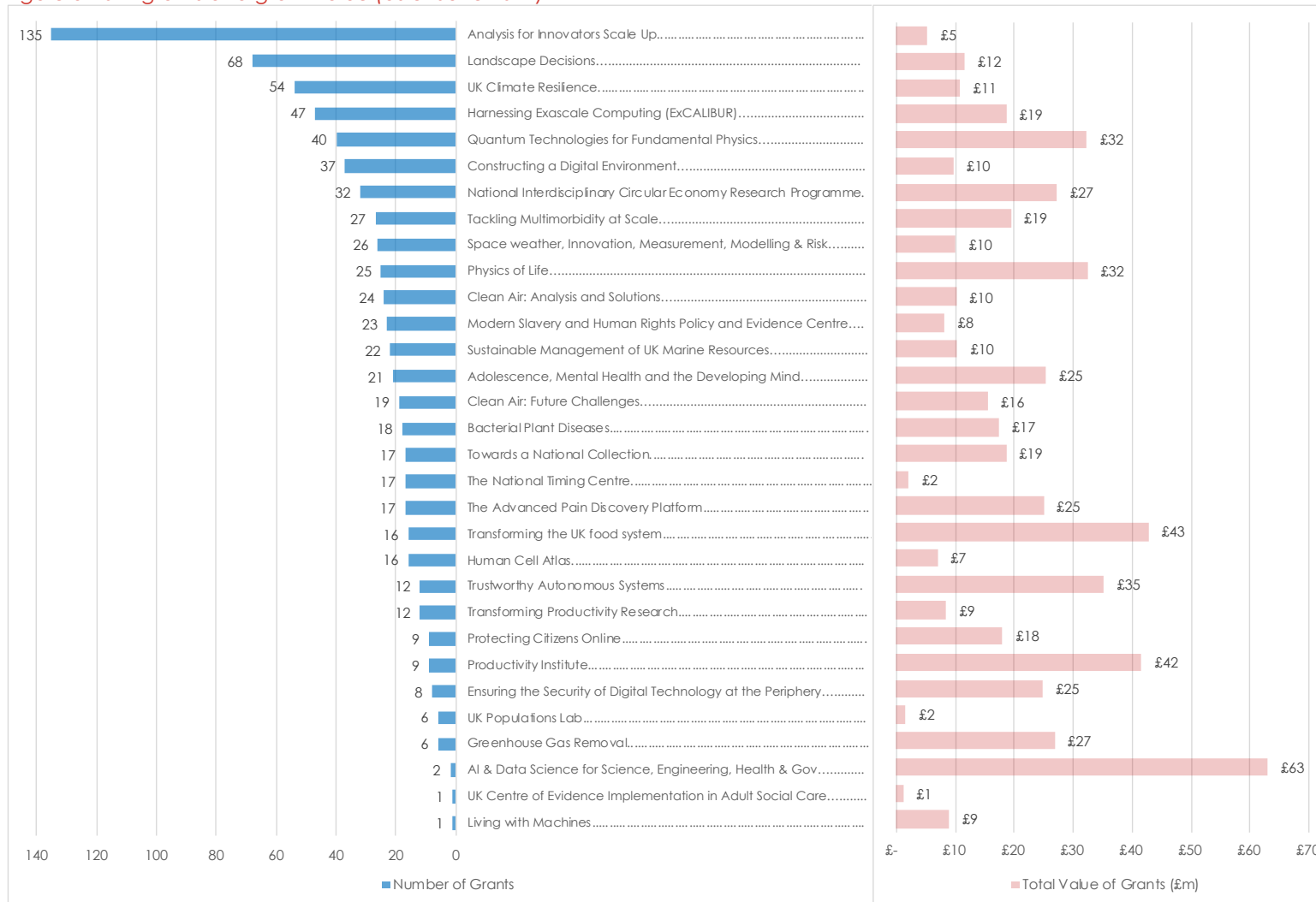
2.2 SPF programmes are generating R&I outputs at the same or a lower rate than the wider UKRI portfolio

SPF has supported 34 programmes, which have then gone on to support **767 individual projects** through open competition up to 17 June 2022⁸ (as well as other investments, such as in research infrastructure). The open competition awards include 578 research grants, 181 Innovate UK projects, 8 fellowships and 1 training grant, all spread across 31 of the 34 SPF programmes. A summary of the number (blue) and value (red) of grants by programme is shown below.

⁷ A 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.

⁸ Note that a more recent update provided by UKRI (after our analysis was undertaken) shows that as of 29 September 2022 the number of projects had increased further, to 814 grants in total. A small number of grants are 'devolved awards', where the recipient organisation then uses this funding to make subsequent awards.

Figure 6 SPF grants and grant value (as of June 2022)



As expected, SPF programmes (and projects) are now progressing in the delivery of **R&I outputs**. The individual programme evaluations are collecting more granular evidence on the nature and characteristics of those outputs, which will then inform our future assessment of this area.⁹ In this sub-section we present an overview of seven types of outputs as reported in Researchfish data (up to June 2022),¹⁰ which allows us to arrive to a systematic Fund level view. Note that further details on the projects is provided in subsequent sections where we take a deeper dive into their alignment with SPF objectives (see Section 2.3 and Section 2.4).

Our assessment (based on outputs generated per £m invested) shows that SPF programmes (and projects) are generating outputs at a rate that is broadly in line with the overall UKRI portfolio (except for publications, discussed further below). This is despite the complex nature of research carried out in these (SPF) programmes, including the involvement of different disciplines and stakeholders (which might be expected to reduce or delay the production of outputs). The comparison is made against all UKRI grants that started since 2018 (the year when the first SPF grants were awarded), and by value of grants (outputs per £m invested) to further assure comparability (see Table 1).¹¹ Both cohorts (SPF and UKRI) include grants that are closed and ongoing (i.e. different stages of grant/programme development should not affect results).

Similar results are still seen when excluding UKRI grants that focus on supporting the medical, social and policy response to the COVID-19 pandemic.¹² Those grants were expected to deliver R&I outputs faster than usual (and our evidence from the evaluation of the response suggests this was the case). The minimal impact on overall figures from removing these grants is due to the value of COVID-19 grants being relatively small in comparison with the UKRI portfolio overall (0.01% of the total value of UKRI grants in the period 2018–2022).

Table 1 R&I outputs emerging from SPF programmes/projects

	Number of SPF outputs	Number of SPF Grants associated to outputs	Number of SPF programmes associated to outputs	Benchmark (SPF vs UKRI) (per £m)* [ALL]	Benchmark (SPF vs UKRI) (per £m)* [Excluding UKRI C-19 grants]
Publications	1,956	274	28	5.06 vs 15.65	5.04 vs 15.66
Intellectual Property	7	4	4	0.01 vs 0.07	0.01 vs 0.07
Research Databases and Models	1,224	75	22	0.46 vs 0.82	0.46 vs 0.82
Research Materials	1,280	48	17	0.25 vs 0.45	0.25 vs 0.45
Software	679	42	12	0.26 vs 0.31	0.26 vs 0.36
Spin outs	6	3	2	0.01 vs 0.04	0.01 vs 0.04
Engagement activities	3,838	294	28	10.00 vs 11.47	9.87 vs 11.48

Based on SPF grant value: £383,167,423. UKRI figures correspond to grants that started in 2018–2022. Benchmark figures obtained by dividing the number of outputs by the total value of grants. Number of UKRI outputs not shown in the table

⁹ Note that individual programme evaluations are mostly still in progress and evidence emerging from those evaluations will be captured in the final evaluation of SPF (2025).

¹⁰ Researchfish provides comparable information across all grants funded by UKRI (at least those funded by the Research Councils). Researchers are invited to add their outputs to Researchfish, and some may decide not to do so or not to provide complete information. There is no evidence that would allow one to firmly conclude on the completeness of Researchfish, however, even if researchers do not report all outputs, we do not expect this to be a higher or lesser problem with SPF in comparison with the UKRI portfolio more generally, hence comparisons across those two samples should be valid (i.e. results should not be biased for SPF specifically).

¹¹ Since 54% of SPF grants started on 2020 and onwards, we also conducted a similar analysis restricting the timeframe for UKRI benchmark to 2020 onwards, and conclusions remain the same.

¹² These are 791 grants funded under UKRI's response to COVID-19 as reported in the Technopolis 'Impact evaluation of UKRI's COVID-19 response', forthcoming.

Publications per £m invested is the one area where the performance of SPF grants is so far considerably lower than for the wider UKRI portfolio. In addition, just four programmes account for 40% of the publications that are currently reported against SPF. Our evidence from programme case studies indicates that SPF programmes may be prioritising other types of outputs, such as policy briefs and synthesis reports to communicate their results to policymakers (as showcased in the examples below), which may explain the relatively small number of publications. This prioritisation goes in line with the objectives of SPF (i.e. of producing evidence that can inform policy decisions). Additionally, many SPF programmes have allocated considerable resources to organising engagement activities and synthesis workshops. Section 2.3.5 presents an overview of those efforts put in place to support MIDRI-ness and uptake. Finally, our evidence also suggests that uptake of those outputs is high, in line with the expected outcomes from SPF, and this is further discussed in Section 2.4.6.

Box 3 Outputs – example of the MS PEC programme



Modern Slavery and Human Rights Policy and Evidence Centre | Wave 2 | Lead Council/PSRE: AHRC

In addition to academic publications, results from the 36 funded projects and from the in-house research conducted by the consortium members are published in research summaries, interim outputs, policy briefs, blog posts and podcasts. All research teams are asked to co-produce shorter research summaries with the MS PEC team to synthesise findings and make them more accessible to different stakeholders. Policy briefs are particularly tailored for the use of policymakers – not only synthesising research and evidence, but also rating the quality of the evidence, and where relevant, making specific recommendations. The Centre has published six policy briefs¹³ on topics such as impact of COVID-19 on modern slavery, and the effectiveness of forced labour import bans. In addition, the MS PEC has made three written submissions to public consultations¹⁴ based on the findings and evidence in the funded research projects. For example, for the Director of Labour Market Enforcement (DLME) call for evidence on the Labour Market Enforcement Strategy,¹⁵ the Centre's submission drew on findings from a research project on the experiences of Romanian and Bulgarian workers in the UK agriculture industry during the pandemic (among others).

Source: Technopolis (2022). Case studies

Box 4 Outputs – example of the SDTaP programme



Ensuring the Security of Digital Technologies at the Periphery | Wave 1 | Lead Council/PSRE: EPSRC

The programme has put in place 4 synthesis fellows, academics who work across the projects to identify common learning and what can be fed into government policy or practice in industry. They are responsible for collating and disseminating findings from studies to the programme partners, including industry and government. They organised an online database of all research outputs, which are now available on the PETRAS website, and organise knowledge exchange events.

Source: Technopolis (2022). Case studies

¹³ <https://modernslaverypec.org/resources?type=briefing>

¹⁴ <https://modernslaverypec.org/resources?type=submission>

¹⁵ <https://modernslaverypec.org/assets/downloads/Modern-Slavery-PEC-response-to-DLME-Call-for-Evidence-23-24.pdf>

2.3 SPF is helping to drive an increase in high-quality MIDRI, from applications to research and publications, and synthesis and dissemination

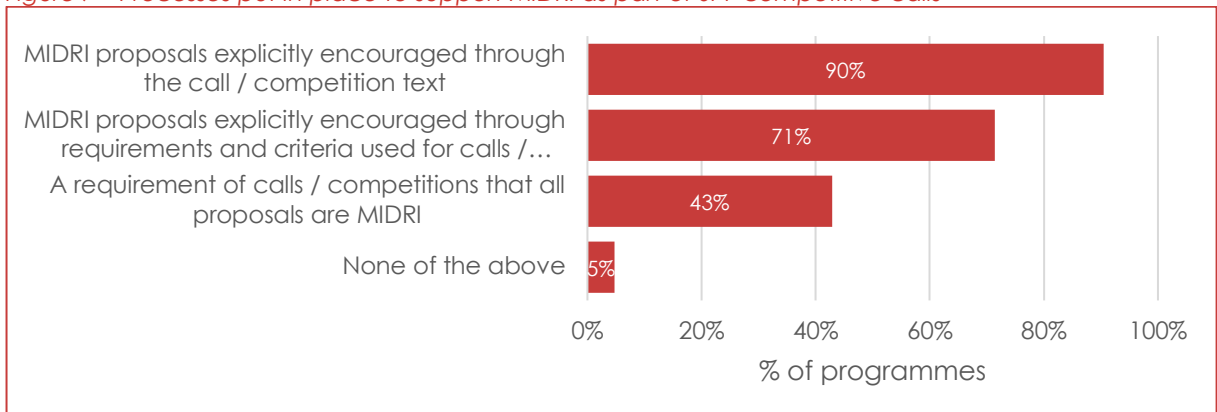
Most SPF programmes have put in place mechanisms or actions to de-risk and assess MIDRI proposals. In most cases these build upon existing mechanisms used by the Councils, rather than representing new approaches and methods. This use of MIDRI-related actions is linked to SPF in so far as funding was made available for programmes intended to support MIDRI, with councils retaining 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.

2.3.1 SPF programmes have actively encouraged MIDRI applications via various means

There have been widespread efforts across the SPF portfolio to encourage MIDRI proposals. Of the 24 programmes that have provided us with information, 21 have launched competitive calls. Nearly all of these have explicitly encouraged MIDRI proposals within the call text, or through the requirements and criteria used for calls (90% have done one or other, or both).

In fact, nearly half (43%) of the programmes have made MIDRI a *requirement* of funding. For example, a call from the Transforming UK Food Systems SPF programme specified that ‘The research must be interdisciplinary and join up healthy and accessible diets, with sustainable food production and supply ... Proposals that do not meet these points will be rejected’.

Figure 7 Processes put in place to support MIDRI as part of SPF competitive calls



Source: Responses from 21 leads of SPF programmes that have run competitive calls or competitions

Beyond the call text and requirements, SPF programmes have also reported a range of other activities that they have undertaken to support and encourage MIDRI proposals, including:

- Pre-programme events to bring different disciplines together before bidding
- Workshops during the application and assessment process to look for further opportunities to bring teams together
- Two stage grants, with the first phase specifically intended to explore and test the MIDRI approach and collaboration
- Knowledge exchange coordinators within grants, who come together regularly to identify areas for future collaboration across teams

The case studies developed for this evaluation provide a deeper exploration of the approaches taken to encourage MIDRI applications in a range of specific programmes. In the box below, we provide an example of the efforts taken within one of these.

Box 5 Efforts to encourage MIDRI applications – example of the AMHDM programme



Adolescence, Mental Health and the Developing Mind | Wave 2 | Lead Council: MRC

The programme has supported a MIDRI approach through the design of its calls, which were informed by all three Councils and the Research & Stakeholder Advisory Board to ensure these were developed with different disciplines in mind and so that they would be applicable and appropriate to a wider group. The calls clearly stated that all three Councils were involved, which was key for encouraging bidders who would not otherwise engage in MRC calls.

The documentation for the call for research programmes included multiple references to MIDRI, for example: *'We welcome applications that draw in non-traditional disciplines to mental health research or combine disciplines or sub-disciplines that have not traditionally collaborated, in order to provide novel insights and approaches. It is expected that programmes will demonstrate structural and intellectual integration of all work packages (no matter the leading discipline in those work packages), such that interdisciplinarity clearly adds value to the research as a whole'*.

The programme team also delivered a webinar in which they promoted a MIDRI approach, supplied an FAQ document that included a response on the level of interdisciplinarity expected, and supported the development of MIDRI research teams in some cases. The programme was clear that successful proposals would demonstrate the value of a MIDRI approach and avoid tokenism.

Interviewees noted that the requirement for a MIDRI approach was more explicit for this programme than previous calls they had been involved in, though they have historically supported MIDRI teams and projects. One interviewee noted that the incentivisation for people to come together early is a significant shift and enabled teams to be more creative, which in turn, added value to the programme.

Given the nature of mental health research (i.e. the nature vs nurture debate), the research community was open and responsive to using a MIDRI approach. One interviewee described how proposal teams were brought together through a shared interest in understanding the interplay of various aspects in young people's lives. Teams developed in different ways – for example, some individuals with existing relationships added to their consortium, while others formed more equal partnerships.

Source: Technopolis (2022). Case studies

Councils have made clear to the study team that **encouraging MIDRI proposals is not new or unique to SPF**. However, the majority of funding elsewhere is single-Council and even cross-Council initiatives can be limited by a lack of neutral funding (within SPF, neutral funding – i.e. not tied to a specific Council or government department budget – has been found to reduce concerns about the balance of grant funding going to different communities). The feedback from programme Leads does suggest that SPF has expanded efforts to encourage MIDRI, and stimulated councils to make this a stronger request (or even requirement) within calls than might otherwise (or has historically) be the case.

2.3.2 SPF efforts have led to a high proportion of MIDRI applications, but in line with wider UKRI activities

The efforts taken within SPF programmes to encourage MIDRI proposals appear to have been largely successful. Of the 19 responding SPF programme Leads (that had received MIDRI proposals to competitive calls), more than half (58%) reported **attracting more MIDRI proposals** than is usual, while more than two-thirds (68%) reported **attracting a sufficient number of MIDRI proposals that were of high quality**. In general, programmes were positive about the response to their efforts to encourage MIDRI teams and projects. For example:

Box 6 Successfully encouraging applications – example of the Clean Air programme



Clean Air | Wave 1&2 | Lead Council/PSRE: NERC and Met Office

It was noted in interviews with programme stakeholders that there was no systematic approach towards embedding MIDRI across the programme, and it was often left to the interpretation of partners, research or project teams. However, from the received applications it was possible to see

that this encouragement for MIDRI permeated through. As an example, there was a consortium between public health academics and an architect collaborating on the delivery of a research project. Similarly, business-led projects have included health expertise from the outset, while others have included usability expertise (end-users) within the social sciences project team, bringing different perspectives into the feasibility and prototype design.

Source: Technopolis (2022). Case studies

However, analysis of application data is less conclusive and further supports the idea that UKRI is active in encouraging MIDRI applications via other means as well (not just through SPF). This analysis looks at the **proportion of applications** to SPF programmes that include **two or more Fields of Research (FoRs)**,¹⁶ as a broad indicator of the level of MIDRI proposal activity that is being generated within the Fund. This suggests that (as of March 2023) nearly half of all applications to SPF programmes can be classified as MIDRI (46%, or 1,320 out of 2,892).¹⁷ This is only slightly higher than the proportion seen across other applications to UKRI, outside of SPF, during the same period (44%). However, there is variation, with higher proportions of SPF applications classified as MIDRI in some areas (see Table 2). For example, 74% of SPF applications tagged against biomedical and clinical sciences are also tagged against one or more other FoRs, while this is true of only 57% of other UKRI applications tagged to this field).

Table 2 Number of SPF and UKRI applications tagged to each FoR, and % also tagged to other FoRs

Fields of Research	UKRI applications tagged to this FoR	% also tagged to other FoR(s) (=MIDRI)	SPF applications tagged to this FoR	% also tagged to other FoR(s) (=MIDRI)
49 Mathematical Sciences	1,097	58%	11	91%
32 Biomedical and Clinical Sciences	17,513	57%	313	74%
50 Philosophy and Religious Studies	1,395	81%	24	96%
40 Engineering	11,967	67%	223	81%
44 Human Society	9,340	65%	340	79%
39 Education	1,684	54%	34	68%
47 Language, Communication and Culture	3,137	83%	21	95%
48 Law and Legal Studies	2,340	81%	177	88%
37 Earth Sciences	4,451	48%	217	55%
38 Economics	855	85%	69	91%
52 Psychology	2,277	75%	65	77%
34 Chemical Sciences	4,226	76%	13	77%
31 Biological Sciences	14,664	63%	249	63%
30 Agricultural, Veterinary & Food Sciences	3,823	72%	182	71%
33 Built Environment and Design	2,429	81%	116	79%
41 Environmental Sciences	5,102	73%	702	66%
42 Health Sciences	8,172	72%	441	66%
43 History, Heritage and Archaeology	2,531	68%	78	60%
35 Commerce, Management, Tourism & Services	2,844	78%	133	68%
46 Information and Computing Sciences	8,052	60%	396	48%
51 Physical Sciences	6,401	48%	281	35%
36 Creative Arts and Writing	3,021	71%	59	58%

Source: Technopolis, based on UKRI data on SPF & other UKRI applications, March 2023. Grey cells indicate SPF or UKRI proportion is larger, with the darker shade indicating a bigger difference. Note that application columns do not sum to the total number of applications, as many are tagged to more than one FoR.

¹⁶ Based on 22 high-level Fields of Research that Dimensions uses and to which UKRI grant applications are mapped and using the 2020 Australian and New Zealand Standard Research Classification (ANZSRC) classification.

¹⁷ This analysis excludes grants that are not tagged to a field of research (this includes all IUK grants).

A more stringent test looking at the proportion of applications that include three or more FoRs reduces the percentages considerably (3.5% for SPF and 4.4% for UKRI), with SPF slightly below the UKRI average. Applications with this breadth of disciplines are therefore very rare (both within SPF and beyond it).

This 'simple' approach of identifying applications tagged to multiple fields of research needs to be taken with some caution as it does not account for the *distance* between the fields (i.e. the extent to which they have collaborated historically), the diversity of the teams' academic backgrounds, or the diversity of the knowledge they bring to bear in their projects, all of which is tackled in our bibliometric approach (see Sections 2.3.4 and 2.3.6).

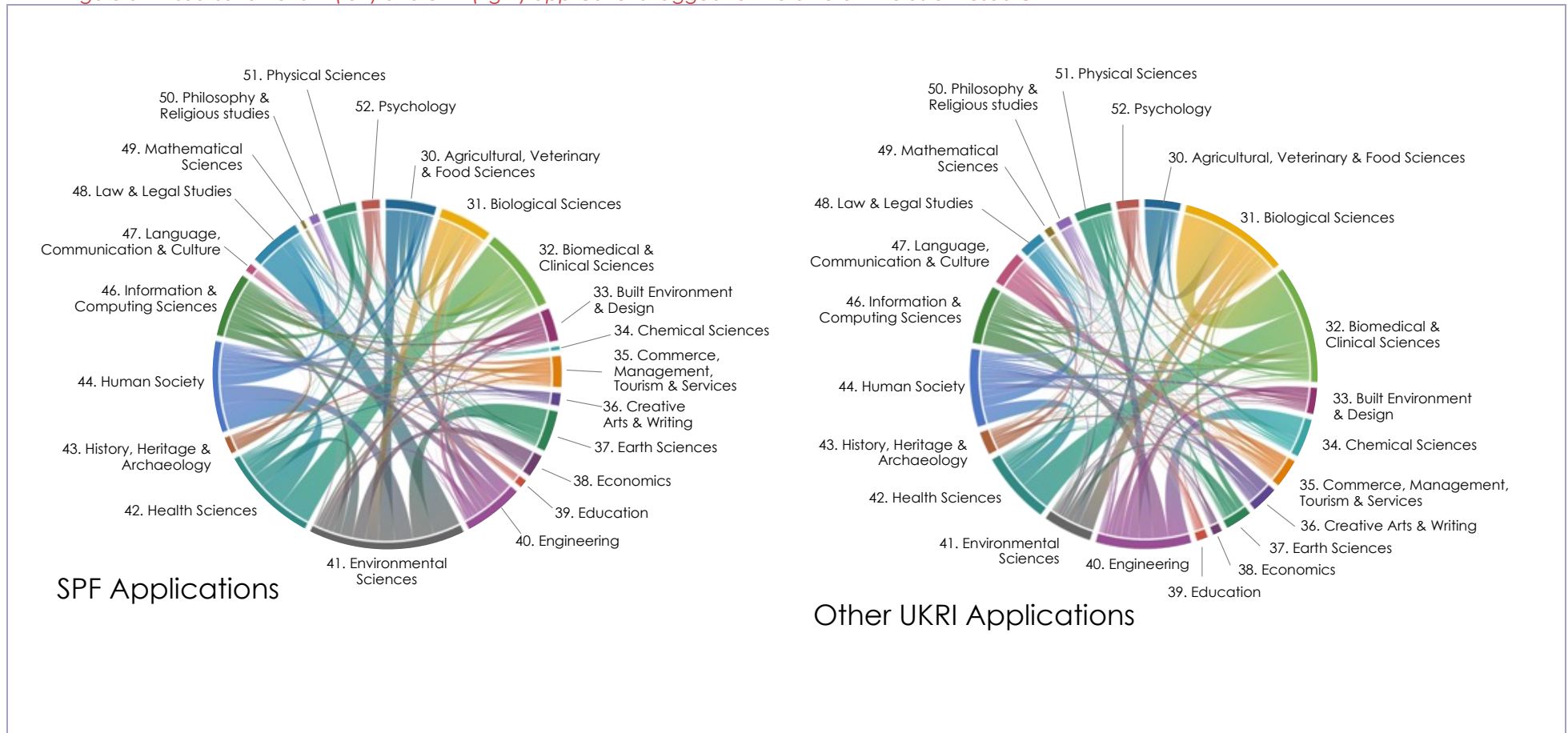
Figure 8 (left-hand graph) presents a visual summary of the different 'pairings' between fields that occur within SPF applications, based on the tagging of grants against FoRs. (The different pairings for other UKRI applications is shown on the right-hand side for comparison).

The figure shows a wide variety of different interlinkages between different disciplines, with the most common within SPF applications being:

- Health Sciences < - > Biomedical & Clinical Sciences (109 applications)
- Law & Legal Studies < - > Environmental Sciences (88 applications)
- Human Society < - > Health Sciences (72 applications)
- Earth Sciences < - > Environmental Sciences (72 applications)
- Human Society < - > Environmental Sciences (63 applications)

These pairings suggest that in many cases the disciplines coming together in SPF may already have long-standing experience of collaboration and consequently are not too 'distant' from one another. This is further tested with the more sophisticated approach developed with the bibliometric data later in this section.

Figure 8 Visualisation of SPF (left) and UKRI (right) applications tagged to two different Fields of Research

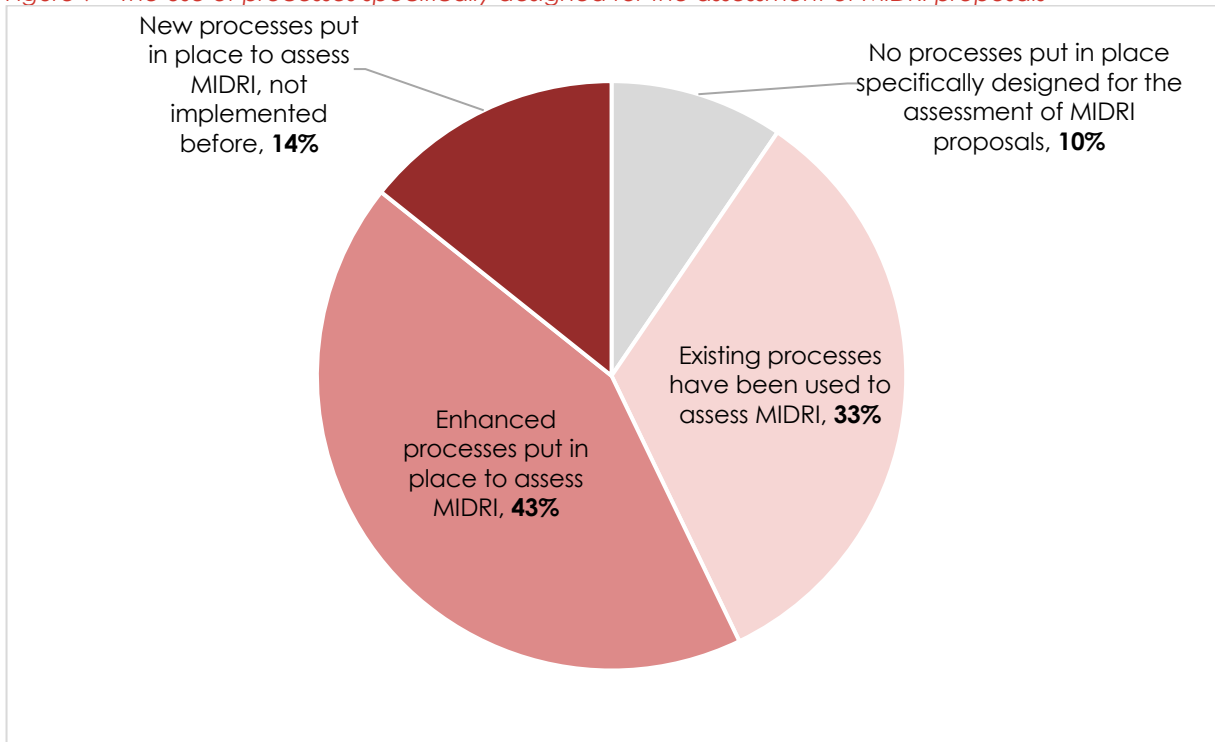


Source: Technopolis, based on UKRI data on SPF & other UKRI applications, March 2023. Only applications tagged to 2 or more FoRs are shown (n=1,320 SPF applications and 36,346 UKRI applications). An application may appear more than once (i.e. represented by more than one line), where it is tagged against 3+ FoRs (and therefore has 2+ bilateral links).

2.3.3 A majority of SPF programmes have employed new or enhanced processes to assess MIDRI

When it comes to the assessment of competitive calls and competitions, nearly all SPF programmes (90%) have put in place processes specifically designed for the assessment of MIDRI. This includes more than half (57%) that have employed new or enhanced processes.



Figure 9 The use of processes specifically designed for the assessment of MIDRI proposals




Source: Technopolis (2022) based on responses from 21 leads of SPF programmes that have run competitive calls or competitions. Note that some programmes indicated a mixture of new, enhanced or existing processes at different stages within the programme. The figure shows only their most different to business as usual position

Commonly, the MIDRI-specific processes have involved one or more of the following elements:

Box 7 Example of enhanced mechanisms to assess MIDRI applications

<p>Ensuring a mixture of disciplines are represented amongst reviewers and panels</p>	<p> Example: Each proposal was reviewed by a mix of natural science and socio-economic reviewers and the panel consisted of a mixture of members across all relevant disciplines with introducers from across the disciplines assigned to each proposal.</p> <p><i>Sustainable Management of UK Marine Resources programme</i></p>
<p>The inclusion of MIDRI-specific assessors amongst reviewers and panels</p>	<p> Example: The programme sought to appoint panel members with an appreciation of MIDRI research (not just experts from different disciplines). This was in recognition of MIDRI applications being at the interface of disciplines, and that is where the novelty lies. This was a shift from past approaches (to MIDRI), where the focus was on having discipline experts reviewing sections of a proposal and assessing the proposal on its merit against their discipline of expertise.</p> <p><i>Clean Air programme</i></p>

<p>Specific criteria and guidance for the assessment of MIDRI proposals</p>	 <p>Example: The guidance to reviewers stated: 'Use your expert knowledge in your area to comment on the assumptions, methodologies and feasibilities set out in the proposal, however please also try to judge the project as a whole and the transformation it is trying to achieve, recognising that interdisciplinary proposals do not necessarily need to be world-leading and/or excellent in every discipline to be excellent as a whole and/or to have impact'</p> <p><i>Transforming UK Food Systems programme</i></p>
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Source: Technopolis (2022). Case studies and programme Lead template responses

These additional and enhanced efforts have not come without challenges. Programme leads identified a number of issues and difficulties that had been faced in implementing processes to effectively and efficiently assess MIDRI, which can be summarised into three main areas:

- **Finding reviewers:** Finding sufficient MIDRI assessment specialists or reviewers with MIDRI experience. Linked to this is an issue of potential reviewers declining to contribute because they are not experts in *all* relevant fields (suggesting a need for explicit clarifications when approaching individuals, such as that presented in the box above).
- **Assessing MIDRI-ness:** Identification of appropriate and genuine indicators of MIDRI (e.g. defining where one discipline ends and starts and therefore whether/the extent of MIDRI that is represented in a proposal), or achieving consensus on what a strong MIDRI proposal looks like. Also, assessing at the proposal stage if true interdisciplinary partnerships have been established – or whether bids are just written with good intentions.
- **Efficiency of process:** Larger panels (covering multiple disciplines) ensure fully informed decisions, but can be less efficient at ranking and making funding recommendations.

2.3.4 The multidisciplinary and intersectoral nature SPF programmes are flowing through to topics covered in SPF projects and the composition of research teams

As discussed above, analysis of data (and feedback from programme Leads) suggests a high rate of (good quality) MIDRI applications within SPF programmes. This naturally translates into a high degree of MIDRI-ness among projects. Indeed, 87% of programme leads said that their programme 'to a large extent' or 'entirely' involves disciplines that do not tend to work together (n=24).

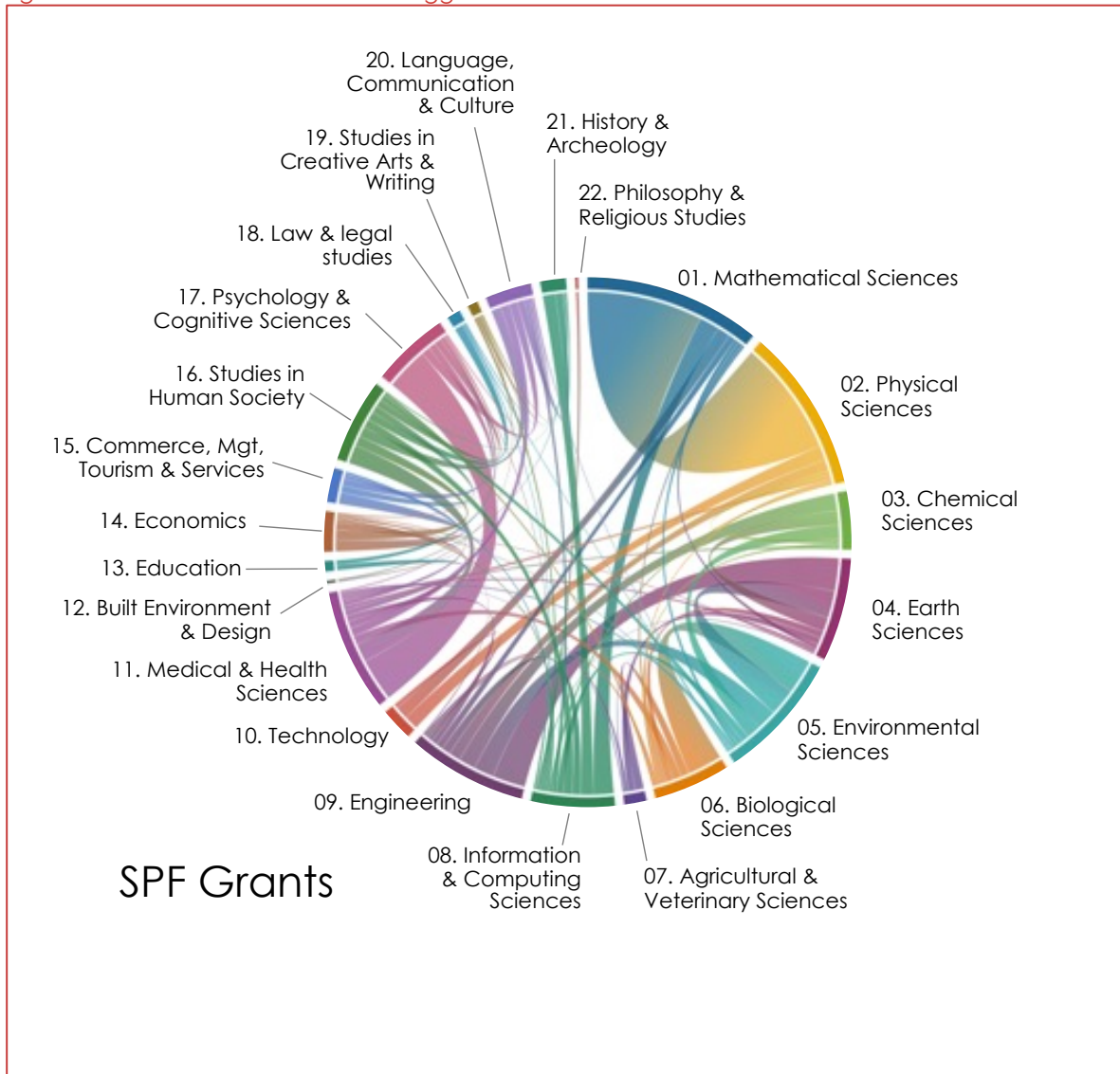
Figure 10 presents a visual summary of the different 'pairings' between fields that occur within SPF grants, based on on the tagging of grants against FoRs¹⁸. The figure shows a wide variety of different interlinkages between different disciplines, with the most common within SPF being:

- Physical Sciences < - > Mathematical Sciences (81 grants)
- Psychology & Cognitive Sciences < - > Medical & Health Sciences (30 grants)
- Biological Sciences < - > Environmental Sciences (24 grants)
- Engineering < - > Earth Sciences (23 grants)

As with applications, these pairings suggest that in many cases the disciplines coming together in SPF may already have long-standing experience of collaboration and consequently are not too 'distant' from one another. This is further tested with the more sophisticated approach developed with the bibliometric data later in this section.

¹⁸ Based on 22 high-level Fields of Research that Dimensions uses and to which UKRI grant applications are mapped and using the 2008 Australian and New Zealand Standard Research Classification (ANZSRC) classification.

Figure 10 Visualisation of SPF Grants tagged to two different Fields of Research



Source: Technopolis, based on UKRI data on SPF grants, September 2022. Only grants tagged to 2 or more FoRs are shown (n=296). A grant may appear more than once (i.e. represented by more than one line), where it is tagged against 3+ FoRs (and therefore has 2+ bilateral links).

We also explored the extent to which SPF is supporting multi- and inter-disciplinarity at the project level 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. This complements the analysis above as it focuses on the disciplinary background of researchers, rather than the topics covered in the research projects.

Box 8 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 normalised 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, Section 1.3. (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** (based on participants' disciplinary background) **in some SPF projects**, in particular those funded through Quantum Technologies for Fundamental Physics, Physics of Life, Transforming UK Food Systems, Clean Air: Future Challenges, Constructing a Digital Environment, and National Interdisciplinary Circular Economy Research programme, which include projects that are 2.5 to 6.7 times the world average (=1).¹⁹ Note that the index has not been expanded to provide an aggregate value (for the SPF overall) because of the relatively small number of SPF projects that can be included within the analysis (218 out of 725).²⁰

Table 3 Multidisciplinary of selected SPF projects (Top 20 based on MI)

Project Title	Programme	MI of research teams		
		MI ^P	Number of researchers	Number of researchers in Scopus
Quantum Sensing for the Hidden Sector (QSHS)	Quantum Technologies for Fundamental Physics	6.7	7	7
A network of clocks for measuring the stability of fundamental constants	Quantum Technologies for Fundamental Physics	4.6	10	9
Quantum Sensing for the Hidden Sector (QSHS)	Quantum Technologies for Fundamental Physics	3.0	3	3
Health assessment across biological length scales for personal pollution exposure and its mitigation (INHALE)	Physics of Life	2.9	9	9
Healthy soil, Healthy food, Healthy people (H3)	Transforming UK Food Systems	2.8	29	28
Air Pollution Solutions for Vulnerable Groups (CleanAir4V)	Clean Air: Future Challenges	2.7	10	10

¹⁹ Important to note is that some of the most multidisciplinary SPF projects relate to the programme 'Quantum Technologies for Fundamental Physics'. This is probably because multidisciplinary may not be very present in other projects classified in the same GtR research topics such as Condensed Matter Physics, Direct Dark Matter Detection, Cosmology. As a result, projects in these subjects may be able to reach higher disciplinary scores after the normalisation process (as detailed above) compared, for example, with projects in other research topics where disciplinary research is more frequent. It illustrates the relevance of the normalisation procedures adopted to compute these scores so research projects could have their multidisciplinary levels assessed against the reference provided by other projects in similar topics.

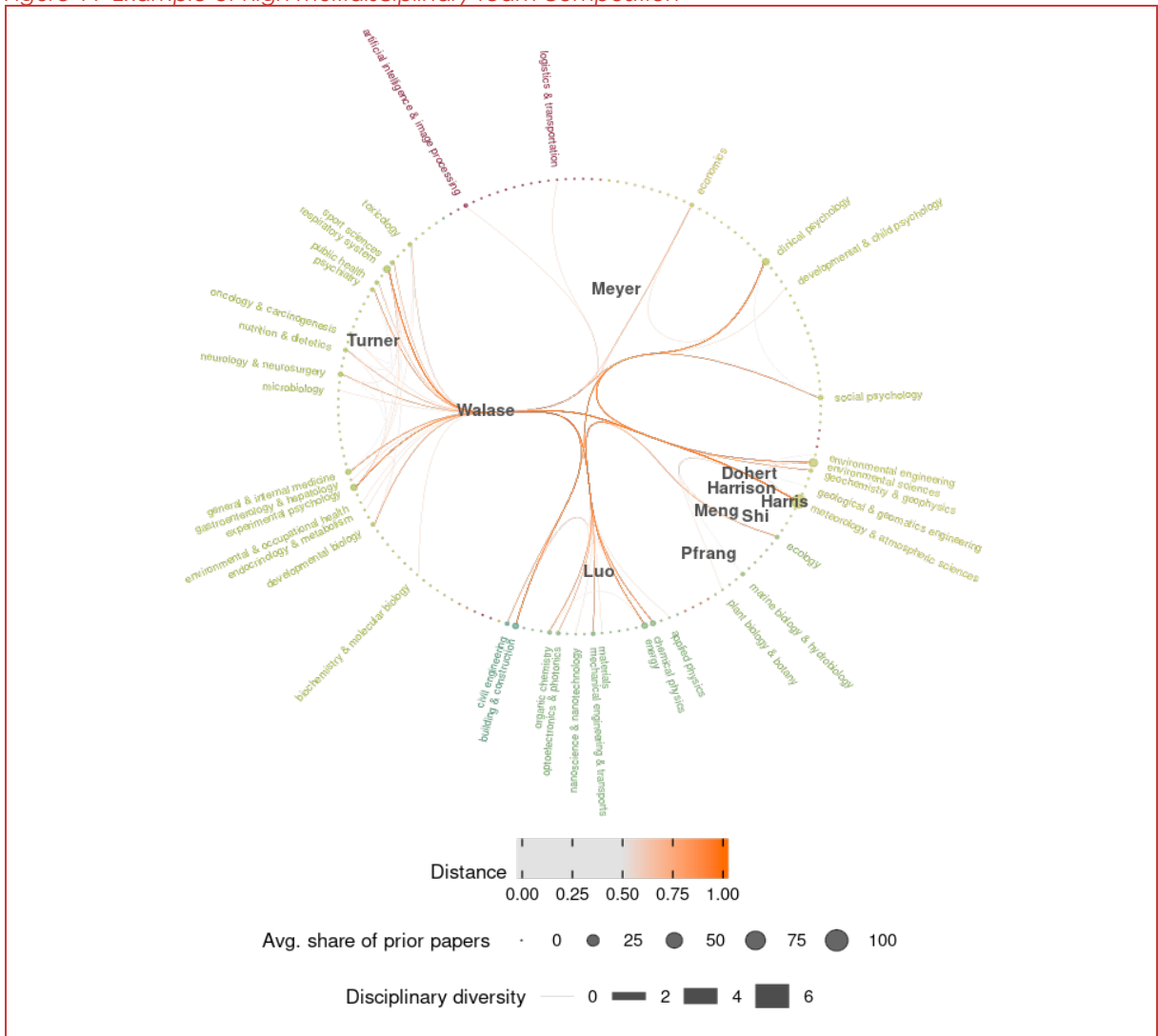
²⁰ This is mainly because the analysis draws comparisons between the composition of teams across GtR data, many of which only include one researcher. To improve comparability we only focus on projects (both in SPF and GtR) that included at least 3 researchers and for which information on researchers is found in Scopus.

Project Title	Programme	MI of research teams		
		MI ^P	Number of researchers	Number of researchers in Scopus
Landslide Mitigation Informatics (LIMIT): Effective decision-making for complex landslide geohazards.	Constructing a Digital Environment	2.5	4	4
UKRI Interdisciplinary Circular Economy Centre for Technology Metals (TechMet)	National Interdisciplinary Circular Economy Research programme	2.5	23	20
OpenGHG: A community platform for greenhouse gas data science	Constructing a Digital Environment	2.5	7	7
Tackling Air Pollution at School	Clean Air: Future Challenges	2.4	18	18
GGR Directorate CO2RE Hub	Greenhouse Gas Removal	2.4	19	18
UKRI Trustworthy Autonomous Systems Hub	Trustworthy Autonomous Systems	2.3	37	35
UKRI Interdisciplinary Circular Economy Centre for Textiles: Circular Bioeconomy for Textile Materials	National Interdisciplinary Circular Economy Research programme	2.2	19	17
UKRI Trustworthy Autonomous Systems Node in Functionality	Trustworthy Autonomous Systems	2.2	6	6
Living with Machines	Living with Machines	2.2	10	8
Quantum-enhanced interferometry for new physics	Quantum Technologies for Fundamental Physics	2.1	3	3
APEX: An Air Pollution Exposure model to integrate protection of vulnerable groups into the UK Clean Air programme	Clean Air: Analysis and Solutions	2.1	10	10
Space Weather Instrumentation, Measurement, Modelling and Risk: Ionosphere (SWIMMR-I)	Space weather, Innovation, Measurement, Modelling & Risk	2.0	3	3
Financial risk and the impact of climate change	UK Climate Resilience	2.0	6	5
UKRI Trustworthy Autonomous Systems Node in Security	Trustworthy Autonomous Systems	2.0	11	10
Quantum Enhanced Superfluid Technologies for Dark Matter and Cosmology	Quantum Technologies for Fundamental Physics	2.0	6	6

Source: Computed by Science-Metrix using Scopus and GtR data (2022)

As a mode of example, Figure 11 represents the multidisciplinary of the research team from the project 'Air Pollution Solutions for Vulnerable Groups (CleanAir4V)'. The most common subfields in prior publications from the researchers in this project are represented around the edge of the main circle. Researchers are then positioned inside the main circle close to subfields of their prior publications. For example, Neil Harris has most past publications in 'Meteorology & Atmospheric Sciences'. Researchers with a publication background that is not so concentrated in a single subfield are positioned more towards the centre of the circle. This showcases that this research team is composed of researchers with backgrounds distributed in many fields of research that are not otherwise found combined together in peer-reviewed publications, resulting in a multidisciplinary index of 2.7 (170% higher than other comparable research teams).

Figure 11 Example of high multidisciplinary team composition



Source: Computed by Science-Metrix using Scopus and GtR data (2022)

The case studies developed for this evaluation provide a range of other qualitative snapshots of the range of disciplines that have been brought together to address particular challenges being tackled by SPF programmes. The following box highlights just one example.

Box 9 The MIDRI composition of SPF research teams – example of the SDTaP programme



Ensuring the security of digital technologies at the periphery | Wave 1 | Lead Council: EPSRC

The funded projects involve collaboration between a wide range of disciplines, including data science, law, physical sciences, social sciences, psychology, engineering, computer science, design, and the arts. Some of the technical fields such as engineering and computer science have much experience of working together in the field of Internet of Things. However, the challenges that SDTaP seeks to address, which include issues of data protection, privacy, online safety and regulation, an understanding of human behaviour, and projections about imagining the future, to cite a few, require the contribution of other fields of knowledge that do not tend to work together.

The problems explored in the projects are unique in the sense that they are neither purely technical nor purely behavioural, but socio-technical. This demands a strong network of experts coming from various fields to address this complexity. The size of the funding available through SPF enabled the lead Centre to partner with more institutions and across more disciplines, which impacted positively on their capacity to address more complex and multi-faceted challenges than would normally be the case.

An example of this would be the Living Room of the Future exhibitions that were installed at the Tate Modern and the Victoria & Albert museums.²¹ This exhibition emulated a living room where several appliances are connected to the Internet and to each other, some of them which are currently technically possible and others which were products of artists imagination. The exhibition also collected information on how people would use and understand the implications of those technologies. This example shows the incorporation of site design fiction into technical projects in partnership with behavioural sciences, which demonstrates the high level of coordination between different fields of knowledge that do not tend to collaborate.

Source: Technopolis (2022). Case studies

2.3.5 *SPF programmes have also put in place mechanisms to bring together knowledge/insights from across their projects and activities*

In the sections above we have considered the extent to which SPF applications and projects involve multidisciplinary and intersectoral teams. In this section we consider the extent to which MIDRI is also being enabled through cross-project (i.e. programme-level) activities. Our consultation with SPF Leads suggests that most programmes are undertaking (or planning to undertake) such activities that bring together knowledge and insights from across different projects, work packages or research activities. This includes:

- **Internal coordination workshops** – to raise awareness and understanding across the programme (75% of programmes are planning/undertaking such activities). This includes regular meetings between programme PIs (all PIs, or sub-sets in the form of cross-project 'special interest groups' or 'communities of practice'), mid-programme workshops, annual cross-programme symposia and 'showcase events' to share the results of individual projects.
- **Synthesis workshops, seminars or other activities** – to combine insights or knowledge from the programme for external audiences (71% of programmes). This includes calls for specific projects to deliver synthesis activities, as well as centralised programme activities to combine learning from across projects (see examples below).

²¹ <https://imagination.lancaster.ac.uk/update/living-room-of-the-future-at-tate-modern/>

Box 10 Programme activities to synthesise R&I outputs – example of the SDTaP programme



Ensuring the security of digital technologies at the periphery | Wave 1 | Lead Council: EPSRC

The programme is currently focusing on synthesising the research outputs, ensuring that all research projects create societal impact, gathering evidence of impact that has already happened, and carrying out outreach and engagement activities. To support these activities, SDTaP has four synthesis fellows who are collating evidence of the outputs and outcomes, for publication by the end of the programme.

The four synthesis fellows are academics who work across the projects to identify what is the common learning and what can be fed into government policy or practice in industry. Each fellow is responsible for a different sphere of the programme: ethics, cybersecurity, artificial intelligence, and public outreach. They are responsible for collating and disseminating findings from studies to the programme partners, including industry and government. They organised an online database of all research outputs, which are now available on the website, and have set up a number of knowledge exchange events.

Source: Technopolis (2022). Case studies

Box 11 Programme activities to synthesise R&I outputs – example of the MS PEC



Modern slavery and human rights policy and evidence centre | Wave 2 | Lead Council: AHRC

The Modern Slavery PEC policy impact team has developed Policy Briefs as a distinctive output. These Policy Briefs are tailored for policy audiences and synthesise research and evidence on a particular topic, drawing on research funded by the Modern Slavery PEC, and evidence reviews produced through the Modern Slavery PEC consortium. The Policy Briefs rate the quality of the evidence, and where relevant, make specific recommendations for policymakers. Where relevant, the Modern Slavery PEC convenes workshops of funded project teams to support the development of the Policy Briefs. As of July 2022, the Modern Slavery PEC has published six Policy Briefs on policy-relevant topics, including the impact of Covid-19 on modern slavery, the effectiveness of forced labour import bans and the effectiveness of mandatory human rights due diligence.

Source: Technopolis (2022). Case studies

2.3.6 These efforts seem to translate into a high degree of multidisciplinary and intersectoral collaboration in SPF publications

We also looked at the degree of MIDRI and intersectoral collaboration in publications. 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).^{22,23}

More recently, Science-Metrix has also shown a similar link between multidisciplinary research and uptake of research findings in the policy-relevant literature²⁴ (and this last point is discussed in Section 2.4.6).

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

²² 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.

²³ 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.

²⁴ 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 12 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 2.3.4) and are a proxy for multidisciplinary. They are:

- The Multidisciplinarity Index (MI) (as described in Section 2.3.4), 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%)²⁵

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)²⁶
- 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 2021. Note that the parallel papers group may include SPF papers not correctly identified as such in GtR or in Scopus acknowledgements
- 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.

²⁵ 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.

²⁶ Note that the group SPF prior papers includes publications from 2018–2021. 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.

In this section we focus first on the **multidisciplinarity of papers** (while intersectoral collaboration at paper level is presented in Section 2.4.4). Using the approach described above, we found that:

- Papers from SPF projects/programmes (SPF Papers in Table 4, Panel A) have a degree of multidisciplinarity, MI (diversity of authors' disciplinary background) that is above the world average (1.35 vs 1), and above rates for UKRI and UK papers (1.11 and 1.16 respectively).
- SPF papers also have similar MI scores to the two groups of SPF researchers' other publications (prior and parallel to SPF). 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, and SPF may have helped to sustain their multidisciplinary activity. Further analysis shows that SPF has attracted researchers with varying degrees of experience of producing multidisciplinary papers, with 33% of them having produced one paper or more with a low degree of multidisciplinarity in the 5 years prior to SPF involvement, 24% with a medium degree of multidisciplinarity and 44% with a high degree of multidisciplinarity.²⁷ This further confirms that SPF is attracting researchers that are active (to varying degrees) in multidisciplinary work.
- In contrast, Interdisciplinarity, II (diversity of knowledge integration) is similar for SPF papers in comparison with the benchmarks (UK and UKRI) and the baselines (SPF prior papers and parallel papers) (Table 4, Panel B). Note however that some time may be required between the beginning of a multidisciplinary project and the publication of its most interdisciplinary outputs. It is possible that the interdisciplinarity of SPF future publications increases as new partnerships formed under SPF projects have more time to effectively work together and publish with higher interdisciplinary content. As above, further analysis shows that SPF has attracted researchers with varying degrees of experience of producing interdisciplinary papers, with 23% of them having produced one paper or more with a low degree of interdisciplinarity in the 5 years prior to SPF involvement, 20% with a medium degree of interdisciplinarity and 57% with a high degree of interdisciplinarity.²⁸
- Unrelated to SPF, but interesting to note, the data below also shows a slight increase in the multidisciplinarity of UK and UKRI papers over time with respect to the world average (=1) – from 1.09 and 1.13 to 1.11 and 1.16 respectively. In contrast, interdisciplinarity has remained mostly the same (at around 1.02).

The results above need to be taken with caution as they are still based on a relatively small sample of SPF projects that have produced publications (25%). However, they are consistent with results from the Baseline and Early findings report.

²⁷ Low multidisciplinarity corresponds to researchers that have any paper scoring 2.5% or less than the top 10% most multidisciplinary at the world level, Medium multidisciplinarity to those that have papers scoring 13% or less than the top 10% most interdisciplinary at the world level, and High multidisciplinarity to those that have any paper scoring more than 13% than the top 10% most interdisciplinary at the world level. A similar distribution of researchers in each category (low, medium and high multidisciplinarity) is observed for 11 or more papers (i.e. percentage of researchers with 11 or more papers that have low multidisciplinarity scores in comparison with the world average). More information is provided in Appendix A.3.

²⁸ Classification has followed the same logic as the one described above for multidisciplinary.

Table 4 Multi and interdisciplinary research indicators (MIDRI) of SPF papers and comparators

Panel A							
	Publications			MI		HMP _{10%}	
	2006-17	2018-21	trend	2006-17	2018-21	2006-17	2018-21
UK papers	1,798,619	772,354		1.09	1.11	1.17	1.25
UKRI papers	293,731	163,060		1.13	1.16	1.27	1.38
95% stability interval				1.13 - 1.13	1.15 - 1.16	1.26 - 1.28	1.36 - 1.40
SPF prior papers	80,254	22,134		1.34	1.34	1.74	1.81
95% stability interval				1.34 - 1.35	1.33 - 1.35	1.72 - 1.77	1.76 - 1.86
SPF parallel papers	0	19,014		N/C	1.38	N/C	1.93
95% stability interval					1.37 - 1.40		1.87 - 1.98
SPF papers	0	899		N/C	1.35	N/C	1.88
95% stability interval					1.27 - 1.43		1.62 - 2.13

Panel B						
	II		HIP _{10%}		SSA (%)	
	2006-17	2018-21	2006-17	2018-21	2006-17	2018-21
UK papers	1.02	1.01	1.12	1.12	16.0	10.6
UKRI papers	1.02	1.02	1.10	1.14	5.0	3.4
95% stability interval	1.02 - 1.02	1.02 - 1.02	1.09 - 1.12	1.13 - 1.16	4.9 - 5.0	3.3 - 3.4
SPF prior papers	1.09	1.09	1.36	1.39	3.1	1.6
95% stability interval	1.09 - 1.10	1.08 - 1.09	1.33 - 1.38	1.34 - 1.43	3.0 - 3.2	1.4 - 1.8
SPF parallel papers	N/C	1.08	N/C	1.38	N/C	1.2
95% stability interval		1.07 - 1.08		1.33 - 1.43		1.1 - 1.4
SPF papers	N/C	1.07	N/C	1.52	N/C	3.4
95% stability interval		1.03 - 1.10		1.28 - 1.78		2.3 - 4.7

Source: Computed by Science-Metrix using Scopus and GtR data (2022). Number of publications and trends, multidisciplinary index (MI), highly multidisciplinary publications 10% (HMP10%), interdisciplinary index (II), highly interdisciplinary publications 10% (HIP10%), share of single-author publications (SSA). Shading (white to green) is used as a visual aid to identify lowest to highest results in a column. Grey cells have not been calculated as information does not exist (e.g. there are no SPF parallel papers in 2006–17)

Similar to the results presented in the Baseline and Early findings report, **the degree of multidisciplinary of SPF projects is in many cases 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 the first two iterations 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 (for SPF and any MIDRI programme).

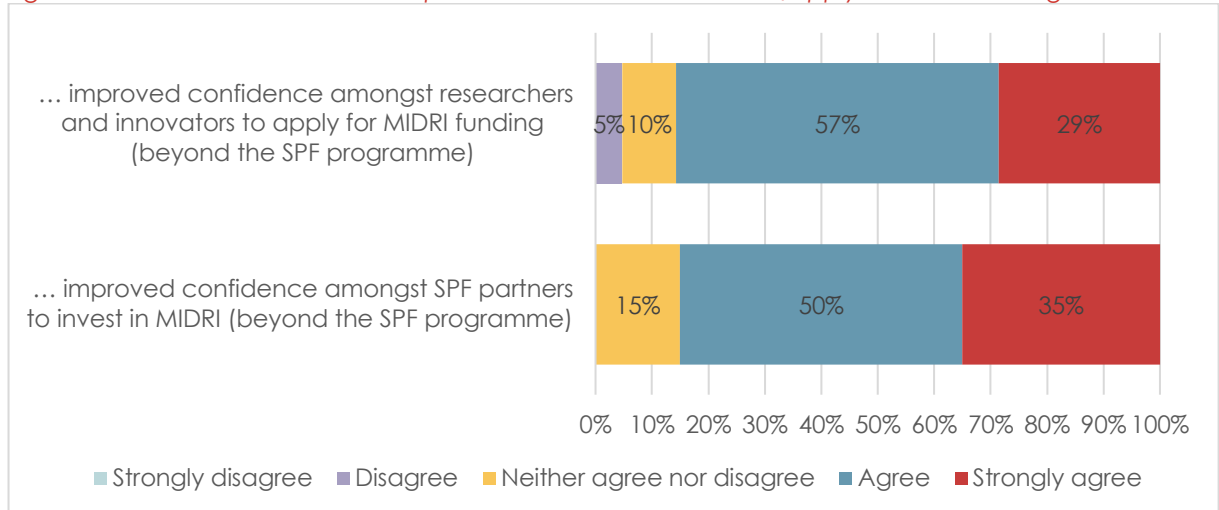
Finally, it is important to highlight that the multidisciplinary computed at paper-level for individual research projects are, in most cases, based on very few papers and results need to be taken with caution.

2.3.7 *There are early indications that SPF's MIDRI focus could have longer term (ecosystem) effects, but given the scale of activities supported by SPF this is likely to be limited*

While most SPF programmes are ongoing, we asked the programme Leads to consider the longer-term impact of the MIDRI-focus of SPF for how different groups perceived MIDRI funding.

Specifically, the great majority of these Leads (85%) agreed that the experience had improved confidence within their organisation (and their programme partners) to invest in MIDRI beyond this specific programme (i.e. outside of SPF). The same proportion (85%) also agreed that SPF had improved confidence amongst researchers and innovators to apply for MIDRI funding in future.

Figure 12 Extent to which SPF has improved confidence to invest in/apply for MIDRI funding



Source: Technopolis (2022) based on responses from 21 leads of SPF programmes (which excludes those who responded 'don't know')

Qualitatively, they went on to explain that SPF has helped increase attention and interest in MIDRI, re-enforcing a wider momentum that was seen before and alongside SPF activities. For instance, one programme Lead (Constructing a Digital Environment) noted that 'having multiple concurrent MIDRI SPF programmes has helped the wider community (funders and the UK research community) understand UKRI's ambitions in this area'.

For most programme leads consulted, it was too difficult, or too early, to discern practical examples of this SPF influence on wider ecosystem activities. However, a small number (see quotes below) were already able to point to specific examples of approaches to other programmes and calls that had been influenced by SPF (MIDRI) learning, or to early plans for possible further programmes with a MIDRI focus (that had in some way been encouraged by the SPF experience).

We are using findings from our programme evaluation to inform our support for MIDRI in future funding calls. The programme has also been crucial in showing the benefits of MIDRI between the arts & humanities and data science to internal stakeholders. We now have two staff focused on further partnership and strategy development.
(Living with Machines programme Lead)

Knowledge Exchange Coordinators were set up for each of the SPF-funded projects in order to drive knowledge exchange activities. The inclusion of such roles now forms part of our planning and thinking for future programmes.
(ExCALIBUR programme Lead)

A future MIDRI marine research programme is now under development.
(Sustainable Management of UK Marine Resources programme Lead)

Other interdisciplinary programmes being developed or delivered elsewhere in my team have benefited from some of the thinking and insights from SPF programmes, for example in considering the evaluation approaches that help to assess MIDRI.
(Greenhouse Gas Removal Demonstrators programme Lead)

For the thematic investments call [of this Wave 2 programme], the MIDRI criteria were formulated through internal discussions at the ESRC based on other SPF calls that had already been run.
(Productivity Institute programme Lead)

As noted above, the overall contribution of SPF to UKRI MIDRI activity is small, due to the relatively small scale of SPF and the breadth of other MIDRI-related efforts already underway across the Councils. This means, in practice, that even if some specific examples can be found across programmes, the likelihood of SPF (alone) driving an ecosystem change is also relatively small. As such, current evidence on the influence of SPF on confidence to invest in and apply for MIDRI funding (one of the sub-objectives of SPF) is inconclusive. The contribution of SPF would be better understood in the context of the various efforts that UKRI has in place to support MIDRI.

2.3.8 *The experience in SPF and evidence collected in this evaluation provides some useful reflections and lessons learnt with regards to supporting and enabling MIDRI*

Future iterations of **SPF or similar future interventions** aim at supporting high-quality MIDRI may consider the following:

- **The need to standardise processes to further facilitate cross-council collaboration.** Programme leads highlighted the importance of multiple Councils working together closely from the start, and throughout programme implementation, to ensure scoping is done with these different perspectives in mind and that the communication and promotion of opportunities is appropriately wide (and widely applicable). Even seemingly minor biases in implementation (e.g. using the lead Council's formatting, questions or procedures within calls), can act as a barrier or disincentive – dissuading other communities from applying or making this more difficult.
- **Investing time and resources in (new) MIDRI partnerships.** Programme leads have emphasised that it is important to allow sufficient time for 'MIDRI partnerships' to form and respond, in particular if the desire is to bring in communities that do not usually collaborate. In some cases, it has been possible to integrate this learning within the SPF programme itself. For example, based on feedback from the first wave of Clean Air funding, the programme provided more time and opportunities for MIDRI partnerships to form during the second wave (including through scoping workshops, webinars and networks).
- Programme leads have also suggested that funding for networks/seed funding could be beneficial to bring together different communities and explore new ideas.
- **Allowing sufficient time for effective integration of knowledge from different disciplines.** The grants themselves may also need to be longer, to account for the greater challenges faced in working across disciplines. For example, the Living with Machines programme Lead noted

the learning during the programme that methodological approaches needed to be developed iteratively within projects because of the challenge in bringing people from very different cultural backgrounds with different working practices together.

It is also **important not to lose momentum**:

- There are new communities of practice that have been created as part of SPF, but it is unclear if they will be able to identify appropriate mechanisms to fund their activities going forward (see example below). This may contradict the view (and evidence) that Councils do support MIDRI regularly, but could highlight the importance of mechanisms such as SPF (that operate at scale and cross-council), as well as clear statements of long-term ambition.
- Some councils have, for instance, found it challenging to set up appropriate peer review processes, but lessons have been learnt that can be taken forward in future if MIDRI continues to be a central ambition. There is also the opportunity to learn from Councils that have more experience supporting MIDRI (e.g. BBSRC, MRC)

Box 13 *The importance of momentum and continued support – example of the Productivity Institute*



Productivity Institute | Wave 2 | Lead Council: ESRC

Before SPF, a weakness in UK productivity research and policy landscape has been that there are no durable institutions around it, and questions and solutions are scattered across different research institutes and government departments. While there have been many great ideas and high-quality research on productivity in the UK, the long-term problem has been the execution of these ideas in collaboration with research community, policy makers and businesses. This programme is the first-time that different needs, priorities and research outputs are brought together under one institution. The SPF funding has enabled setting up the Institute and establishing its place among the research community, businesses, and policy makers. Within the five-year period, it is possible to get people involved and build stable relationships between partners, but that is only a beginning.

Source: Technopolis (2022). Case studies

It is also important to note that there are **wider framework conditions** that may create barriers to multidisciplinary research, some of which may fall outside of what an individual Fund may deliver and may require a system level change. This includes:

- A lack of wider funding, incentives and training/mentoring for MIDRI
- A (perceived) difficulty in publishing and getting sufficient academic/career recognition for MIDRI work (see example below)

Box 14 *The importance of wider framework conditions – from the LwM mid-term evaluation*



Living with Machines | Wave 1 | Lead Council: AHRC

[Extract from the programme mid-term evaluation]

Nearly all respondents [to the evaluation] made reference to the difficulty that academics, especially early career academics, experience when applying for jobs if their CV consists of mainly interdisciplinary outputs. This is because the job market is structured around more 'traditional' academic single disciplines and not interdisciplinary research. This point aligns with the evaluation baseline, which identified changes to the REF as a key mechanism for de-risking MIDRI.

The LwM team have made a conscious decision to address this problem head-on by publishing work in 'traditional' single-discipline publications because there are not many interdisciplinary or multidisciplinary jobs; after the conclusion of the project, people will probably be returning to departments with traditional structures. One interviewee noted that the evolution of UKRI over the last ten years towards supporting and encouraging interdisciplinary work has not followed through into the culture of research groups in most universities.

Source: Living with Machines programme mid-term evaluation (2022)

2.4 SPF is helping to address government R&I priorities, via additional expenditure, and through government department involvement in and use of research developed under the Fund

2.4.1 SPF has increased UKRI spend in government R&I priority areas

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 15 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 seven areas that correspond to seven of our 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 B, for more information on the case studied programmes). The research covered by the National Timing Centre has not been included in the analysis since NPL is the national agency responsible for advancing knowledge on this area, and consequently UKRI does not tend to support grants in this area.

We have also relied on an automated approach using an algorithm that applies Natural Language Processing to classify text (from grants) into our selected research areas.²⁹ This approach was needed to be able to systematically classify 5,000+ grants from the UKRI portfolio for the period of analysis. As such, this analysis should be taken as an 'approximation' to UKRI's spend in those research areas.

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 2022) 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 A.

The analysis (shown in Table 5) shows that UKRI investments in all the selected priority areas have been increasing over time (based on the average yearly value of grants). UKRI investments in areas of (research on) Mental Health and Adolescence, Productivity, and Bacterial Plant Diseases have increased by 336%, 324%, and 92% respectively between 2008–2018 and 2019–2022 (based on the average yearly value of grants). Notably, investments in research on Modern Slavery have increased almost 35 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. In particular, there are 4 areas where SPF has made a substantial difference (in terms of average value of funding): Bacterial Plant Diseases, Space Weather and Research on Productivity, where SPF explains 56%–75% of the overall increase in the average annual value of grants.

Additionally, there is also a 23%–35% increase across all the other four research priorities driven by SPF funding.

²⁹ <https://www.textrazor.com/technology>. TextRazor has been used in academic papers to arrive to classifications of text, including for instance, Bicchielli, Chiara & Biancone, Noemi & Ferri, Fernando & Grifoni, Patrizia. (2021). BiOnto: An Ontology for Sustainable Bioeconomy and Bioproducts. Sustainability. 13. 4265. 10.3390/su13084265.

Table 5 (Average) yearly value of grants (in £m)

Programme	Area	UKRI (prior to SPF)	UKRI (excl. SPF)	SPF	UKRI (incl. SPF)	Increase UKRI (incl. SPF)	% of increase due to SPF
		2008– 2018	2019–2022	2019– 2022	2019– 2022		
		[1]	[2]	[3]	[4]	[(4)/([1])]- 1)	[3]/([4]-[1])
Ensuring the Security of Digital Technologies at the Periphery	Cybersecurity	28.10	38.86	3.80	42.66	52%	26%
Space Weather Innovation, Measurement, Modelling and Risk	Space Weather	5.59	7.34	2.32	9.66	73%	57%
UK Animal and Plant Health	Bacterial Plant Diseases	2.40	2.95	1.66	4.61	92%	75%
Adolescence, Mental Health and the Developing Mind	Mental Health and Adolescence	3.20	10.18	3.78	13.96	336%	35%
Productivity Institute	(Research on) Productivity	6.69	16.19	12.16	28.35	324%	56%
Policy and Evidence Centre for Modern Slavery and Human Rights	Modern Slavery	0.14	2.93	2.02	4.95	3,436%	23%
Clean Air: Analysis and Solutions	Air quality	16.70	34.94	5.43	40.37	142%	26%

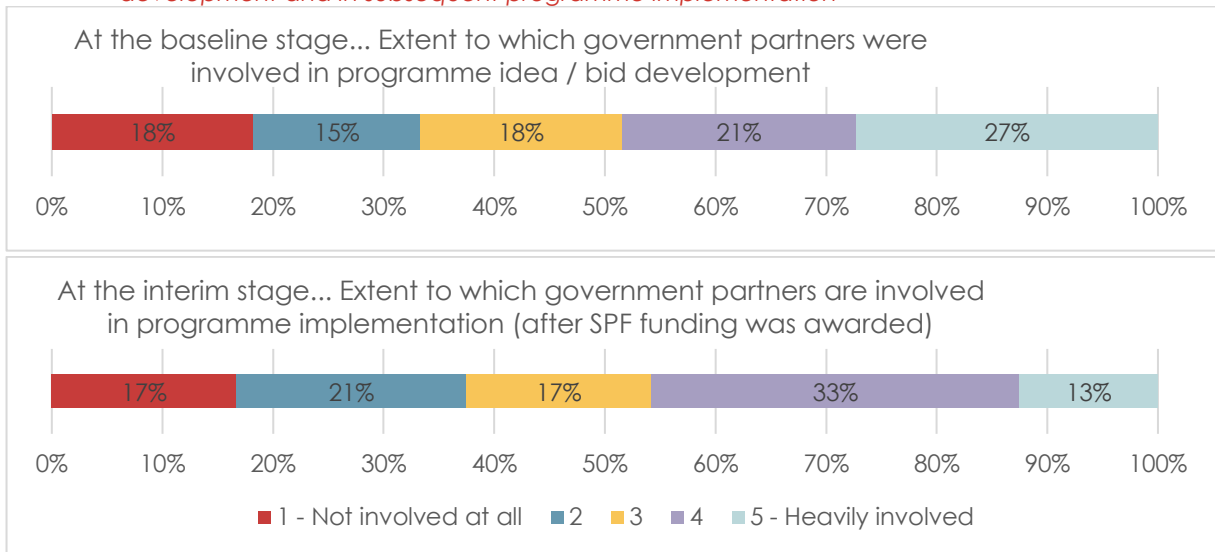
Source: Technopolis (2022) based on GtR data *To minimise false positives (Research on) Productivity only includes grants provided by ESRC

2.4.2 There is ongoing involvement of government across SPF programmes

For the Baseline and Early findings report, we consulted SPF programmes (in 2021) on the involvement of government departments and agencies in the formation of programme ideas and in the development of the original SPF programme bids (see top graph in the figure below). This found that most programmes (27/33 or 82%) had had some degree of government involvement in these preparatory stages, with nearly half (48%) reporting strong government involvement (a score of 4 or 5 in the ratings shown below).

In consulting with programme Leads again a year later (2022) we find that this breadth and depth of government involvement has been maintained, with 83% of programmes reporting some involvement during programme implementation and 45% reporting strong involvement. This is despite challenges that were also noted by many of the programme Leads relating to changes to personnel over time (in government departments and within lead partner organisations) and the competing demands on the time of government representatives (where programmes were often engaging at quite a senior level at the bid stage).

Figure 13 Extent to which government partners were involved in SPF programme ideas/bid development and in subsequent programme implementation



Source: Technopolis, based on responses from 33 leads of SPF programmes (baseline evaluation, 2021) and 24 leads of SPF programmes (interim evaluation, 2022). Given the slightly different portfolio of programmes that have responded at these two points in time, one should not draw strong conclusions in comparing the specific proportions reporting each answer option at the two different stages

A selection of specific examples of government involvement in the ongoing implementation of SPF programmes is shown in the box below.

Box 16 Ongoing government involvement in programme implementation – examples

- Bacterial Plant Diseases:** The programme refined a strategy that had already been adopted in intersectoral programmes before. It involved having DEFRA and the Scottish Government rating the applications separately from the peer reviewers according to their fit to government strategic priorities. Considering the short timeframe, the coordination team was positively surprised to see that the ones rated best for scientific excellence were also strategically relevant to the partners.
- Transforming UK Food Systems:** Government departments were asked to comment on the relevance of project proposals to key policy priority areas throughout the call assessment and funding decision processes.
- Protecting Citizens Online:** Call scoping and call delivery has included stakeholders across UKRI councils, academia, government and industry.
- Greenhouse Gas Removal Demonstrators:** There has been a strong personal interest from Defra and BEIS Chief Scientific Advisors, plus increasing government priority in this area, helping drive government agency engagement.
- Sustainable Management of UK Marine Resources:** Including policy representatives within project advisory groups and on the programme advisory and executive boards has ensured that they remain closely engaged (and that the projects remain aligned with policy needs). The Welsh Government and Northern Ireland Executive (although not official programme partners) have provided comments on the policy relevance of potential projects, which was fed into the moderating panel to aid in their decision making.
- Constructing a Digital Environment:** Defra were heavily involved in the call proposals and created a 'statement of need' to help facilitate dialogue with bidders on proposal design.
- Modern Slavery and Human Rights Policy and Evidence Centre:** For a recent call we ran a pre-panel meeting which invited policymakers and people with lived experience of Modern Slavery to review and offer feedback on submitted proposals, and this feedback was then shared by a representative from the group within the main panel meeting.

Source: Programme Lead template responses and Case Studies

2.4.3 PSREs involvement in SPF projects is higher in comparison with other grants funded by UKRI, and has increased over time, but the overall scale of activities is still limited

SPF set out to achieve one of its overarching objectives (on linking up UKRI's investments with government priorities) by allowing government departments' Public Sector Research Establishments (PSREs) to be eligible to bid for competitive funding, alongside universities, businesses, and research establishments.

In addition to BEIS PSRE involvement as programme partners (see Section 2.1) 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 represented a widening of the standard eligibility criteria, following the precedent set by the Global Challenges Research Fund. In this way, SPF provided an opportunity to further test how the involvement of PSREs in UKRI grants could work in practice. A similar opportunity to bid was introduced in 2020 for a Covid-19 call and the policy was then expanded to all UKRI grants from April 2021.

There is no agreed definition or definitive list of PSREs. However, in 2019, UKRI (with the support of BEIS and Go-Science) developed a preliminary (non-exhaustive) list of 26 that were potentially eligible to bid for Research Council grants under 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 17 organisations that have been deemed eligible (14 from the original list of potentially eligible organisations, plus 3 extra). This is four more than at the time of the last iteration of the evaluation (which was based on figures for June 2021). Although some of these organisations may have applied for eligibility because of the Covid-19 call or the subsequent expansion of the policy across UKRI (rather than being driven by opportunities within SPF).

Analysis of GtR data shows that 17 PSREs have collaborated on SPF grants so far, between them accounting for 69 of the 767 grants awarded (9%).³⁰ This represents an increase compared with early findings (2021) where only 7 PSREs had collaborated on SPF grants and their participation accounted for 8% of the grants (see Table 6).

Table 6 Number of SPF grants involving collaborators from Public Sector Research Establishments

	Early findings (2019-2021)	Interim position (2019-2022)
Number of PSREs have been awarded SPF grant	7	17
Number of grants	39	69
Number of grants (as percentage of SPF grants)	8%	9%

Source: Technopolis (2022) based on GtR data

The top 5 PSREs (based on number of grants) are then shown in Table 7. These organisations account for 66% of the SPF grants with PSRE involvement.

³⁰ Note that being listed within GtR as a collaborator on a grant does not necessarily mean that the organisation has received grant funding.

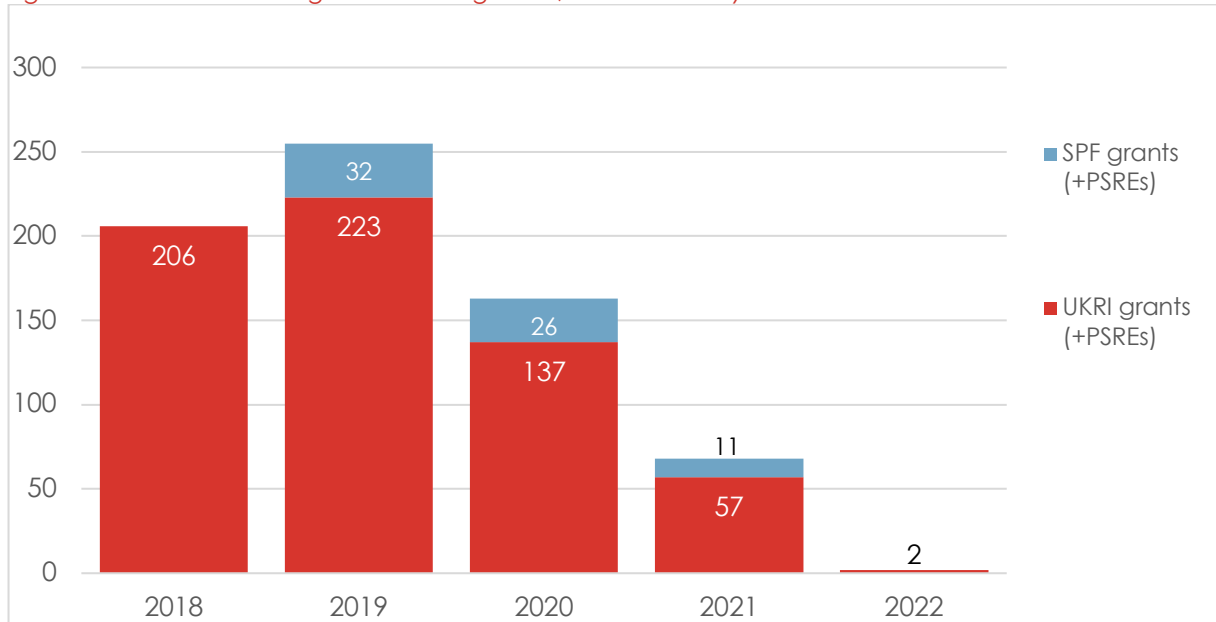
Table 7 Top 5 Public Sector Research Establishments involved in SPF grants

PSRE	SPF grants (2019-22)
Environment Agency	16
Laboratory of the Government Chemist (LGC Ltd)	13
Natural England	13
Met Office	10
Defence Science and Technology Laboratory	7

Source: Technopolis (2022) based on GtR data

In relative terms, PSRE involvement in SPF grants compares well with other UKRI grants awarded over the same period (2019 to 2022), where 1% of the 49,316 total involved a PSRE participant (compared to 9% for SPF). However, the volume of activity within SPF (69 grants with PSRE involvement) is still quite small in absolute terms, when compared to the 419 UKRI grants with PSRE involvement over the same period) (see Figure 14). Note that in 2021, PSRE eligibility was extended to all UKRI grants and we expect to see this reflected in the data at the time of the final iteration of this evaluation.

Figure 14 Number of UKRI grants involving PSREs, within and beyond SPF



Source: Technopolis (2022) based on GtR data

2.4.4 There is also early evidence of increased collaboration (with government and PSREs) in SPF publications

There is evidence that signals that SPF publications include more intersectoral collaboration, in comparison with benchmarks. Results still need to be taken with caution at this stage, but are consistent with or, in some cases, even better than findings reported in the early findings report.

We have estimated intersectoral collaboration in publications. As above (in Section 2.3.6), 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.

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 899 SPF papers, contain a much greater contribution from authors affiliated to UK government (4.41) than UK (1.00, benchmark) and UKRI papers (1.25). This is also substantially higher in comparison with SPF prior and parallel papers (1.73 and 1.97 respectively). This suggests that some researchers involved in SPF tended to collaborate with government-affiliated authors before SPF (to a greater extent in comparison with UK and UKRI grants more generally). However, the degree of collaboration is considerably higher within SPF. This may mean that the Fund is both increasing the depth of engagement amongst those already collaborating with government, as well as increasing the pool of researchers that collaborate with government (Table 8, Panel A).
- Contribution from authors affiliated to UK PSREs (2.82) is also higher than UKRI (1.33), but also higher than prior and parallel papers for SPF authors (1.98 and 1.96 respectively), while the opposite was true in the first iteration of this analysis.
- There is also higher contribution from authors affiliated to government, PSREs or 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 (0.92 vs 1) and similar for SPF papers in comparison with baseline and benchmarks.

We stated in the early findings report that since many SPF programmes were still ongoing 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.

We find in this iteration of the analysis that the results have remained stable in the case of co-publication with government and industry, but have been reversed (positively) in the case of co-publication with PSREs. The stability intervals remain large, however, which means the scores for SPF-supported papers still need to be taken with caution. 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, presented earlier, the results are more stable).

At this point, these results are useful to inform what to expect (in terms of analysis) in the final stage of the evaluation.

Table 8 Share of intersectoral co-publications between academic sector and other sectors

	UK Government		UK PSRE		UK RC	
	2006-17	2018-21	2006-17	2018-21	2006-17	2018-21
UK papers	1.00	1.00	1.00	1.00	1.00	1.00
UKRI papers	1.01	1.25	1.08	1.33	3.08	2.89
95% stability interval	0.95 - 1.09	1.16 - 1.37	1.00 - 1.17	1.21 - 1.45	3.02 - 3.14	2.81 - 2.99
SPF prior papers	1.55	1.73	1.71	1.98	2.71	2.76
95% stability interval	1.39 - 1.70	1.44 - 2.08	1.49 - 1.95	1.58 - 2.44	2.62 - 2.81	2.51 - 3.02
SPF parallel papers	N/C	1.97	N/C	1.96	N/C	2.94
95% stability interval		1.74 - 2.19		1.48 - 2.49		2.74 - 3.15
SPF papers	N/C	4.41	N/C	2.82	N/C	3.17
95% stability interval		2.79 - 6.23		1.06 - 5.07		2.31 - 4.13

	UK Gov PSRE RC		Private		Other	
	2006-17	2018-21	2006-17	2018-21	2006-17	2018-21
UK papers	1.00	1.00	1.00	1.00	1.00	1.00
UKRI papers	2.29	2.14	0.85	0.92	0.88	0.89
95% stability interval	2.26 - 2.33	2.10 - 2.18	0.84 - 0.86	0.91 - 0.94	0.88 - 0.89	0.88 - 0.89
SPF prior papers	2.35	2.35	1.13	1.19	1.05	1.04
95% stability interval	2.28 - 2.42	2.21 - 2.50	1.10 - 1.16	1.14 - 1.24	1.04 - 1.07	1.01 - 1.06
SPF parallel papers	N/C	2.54	N/C	1.23	N/C	1.10
95% stability interval		2.42 - 2.67		1.17 - 1.29		1.08 - 1.12
SPF papers	N/C	3.76	N/C	1.21	N/C	0.92
95% stability interval		2.99 - 4.59		0.95 - 1.49		0.81 - 1.04

Source: Computed by Science-Metrix using Scopus and GtR data (2022). 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

2.4.5 SPF adds value in efforts to address government priorities

Evidence collected via case study suggests that SPF has facilitated stronger collaboration with government departments across all 8 programmes, and that SPF additionality (i.e. the degree to which results would not have been achieved via other means) is high in almost all cases.

Table 9 Analysis of SPF additionality – case studies

Case study	Partners	SPF additionality
Bacterial Plant Diseases (Wave 1)	BBSRC (Lead), NERC DEFRA and Scottish Government	Funding has allowed coordination team – which in turn has enabled dissemination of outputs Funding has allowed different partners to come together and co-design priorities, balancing the time required to undertake robust research and the speed with which answers are needed
Ensuring the Security of Digital Technologies at the Periphery (Wave 1)	EPSRC (Lead), AHRC, ESRC and IUK DCMS, GCHQ/NCSC and the Home Office	Funding has allowed the continuation of Privacy, Ethics, Trust, Reliability, Acceptability and Security National Centre of Excellence for IoT Systems Cybersecurity (PETRAS).
Clean Air (Wave 1&2)	NERC & Met Office (Lead), EPSRC, ESRC, IUK, MRC, NPL Defra, DfT, DHSC, Scottish Government, Welsh government	Funding has allowed a wide set of stakeholders to be brought together and closer coordination than would have otherwise been possible
Productivity Institute (Wave 2)	ESRC (Lead), IUK HMT, BEIS, DWP	Thanks to SPF funding, this is the first-time different needs & priorities from different stakeholders (academia, industry, gov) and research outputs are brought together under one institution

Case study	Partners	SPF additionality
Modern Slavery and Human Rights Policy and Evidence Centre (Wave 2)	AHRC (Lead), ESRC Home Office	Funding (scale) has allowed the setting up of a 'network of networks', with PEC also mediating new partnerships (e.g. PWLE, businesses and the Home Office)
Space Weather, Innovation, Measurement, Modelling and Risk programme (Wave 2)	STFC (Lead), NERC & Met Office BEIS, MoD and DfT	Funding has allowed close working with the Met Office – with academic work being adapted so it can be more easily implemented in Met Office's forecasting tools
Adolescence, Mental Health and the Developing Mind (Wave 2)	MRC (Lead), AHRC and ESRC DfE, DCMS and the Welsh government	Ability to fund more complex and multi-levelled research projects in this area, at a greater scale, and with more cross-Council working than usually possible through previous/existing mechanisms
National Timing Centre (Wave 2)	NPL (Lead), IUK MoD, BEIS and DfT	Partners were already well connected and collaborating before SPF, but the scale of SPF funding has allowed them to address this particular national need in a timelier and coordinated manner

Source: Technopolis (2022). Case studies

2.4.6 There is also early positive evidence of uptake by government

We analysed the degree of citation of publications emerging from SPF programmes (and projects) within policy-related literature (PRL) (see Table 10) and found a higher uptake of SPF publications in policy documents in comparison with the benchmarks (UK & UKRI) (3.05 vs 1.00 and 1.18 respectively). Comparison with SPF researchers (prior and parallel papers) shows that those researchers already had a good track record in being cited in policy-related literature.

As with similar analysis presented earlier, these results need to be taken with caution since they include publications from only 25% SPF projects. Additionally, there is a lag in the citation of publications. In fact, only around 30% of citations are accrued in the 2 years following the publication of a paper.³¹ Having said so, prior papers from SPF researchers already show a slightly higher uptake in the SPF period in comparison with the baseline which included a longer time frame (1.74 vs 1.63).

We also tested the extent to which the degree of multi and interdisciplinarity of SPF papers leads to higher uptake in PRL, but the results were not statistically significant. More specifically the top 10% multi and interdisciplinary papers do not have higher odds of citations in PRL in comparison with the rest (90%). Similarly, papers with cross-sectoral collaboration (academia with government, PSREs or RCs) do not have higher uptake than the rest. Again, results need to be taken with caution as they may change as more publications emerge, and more importantly as citations increase over time. However, they indicate that other characteristics of SPF, presumably the alignment with government R&I priorities and involvement of government departments in the design and implementation of programmes (rather than the degree of MIDRI or publications patterns) explain the high uptake in PRL.

³¹ Based on internal analysis done by Science-Matrix.

Table 10 Total number of publications and share cited in PRL

	Publications		Share of papers cited in PRL	
	2006-17	2018-21	2006-17	2018-21
UK papers	1,798,619	772,354	1.00	1.00
UKRI papers	293,731	163,060	1.07	1.18
95% stability interval			1.05 - 1.10	1.12 - 1.24
SPF prior papers	80,254	22,134	1.63	1.74
95% stability interval			1.57 - 1.69	1.58 - 1.93
SPF parallel papers	0	19,014	N/C	2.05
95% stability interval				1.81 - 2.32
SPF papers	0	899	N/C	3.05
95% stability interval				1.54 - 5.61

Source: Computed by Science-Metrix using Scopus, Overton and GtR data (2022)

Qualitative evidence collected via case studies shows concrete examples on how research outputs and insights emerging from SPF programmes (and projects) are helping to inform policy decisions (see Table 11). This concrete evidence was found in four case studies, while in the other cases there was no clear evidence of uptake so far, and projects are still ongoing.

Many programmes are now moving into the output and dissemination phase, so we would expect to see stronger evidence of uptake going forward.

Table 11 Uptake of programme research outputs – case studies

Case study	Partners	Progress towards outcomes (uptake)
Bacterial Plant Diseases (Wave 1)	BBSRC (Lead), NERC DEFRA and Scottish Government	<ul style="list-style-type: none"> Preparedness for <i>Xylella fastidiosa</i> – protocol to address disease available in LAs around the country, and better understanding of the disease
Ensuring the Security of Digital Technologies at the Periphery (Wave 1)	EPSRC (Lead), AHRC, ESRC and IUK DCMS, GCHQ/NCSC and the Home Office	<ul style="list-style-type: none"> Policy recommendations related to cybersecurity and IoT – including, for instance, on the ethics of using IoT sensors in public places – adopted by DCMS and DfT in official position papers
Productivity Institute (Wave 2)	ESRC (Lead), IUK HMT, BEIS, DWP	<ul style="list-style-type: none"> Mechanisms established to continue intersectoral collaboration: the Regional Productivity Forums, the Policy Commission, and the Productivity Lab Presentations to DLUHC and reference to research findings in Levelling Up White Paper³² Contributions to 'Jobs, growth and productivity after coronavirus' report³³ published by the House of Commons Treasury Select Committee, plus oral evidence to committee Evidence to inform government programmes (e.g. BEIS' Help to Grow)

³² <https://www.gov.uk/government/publications/levelling-up-the-united-kingdom>

³³ <https://committees.parliament.uk/publications/23031/documents/168790/default/>

Case study	Partners	Progress towards outcomes (uptake)
Modern Slavery and Human Rights Policy and Evidence Centre (Wave 2)	AHRC (Lead), ESRC Home Office	<ul style="list-style-type: none"> Following the publication of the policy brief on the effectiveness of forced labour import bans,³⁴ an invitation from DIT to give an expert contribution to a technical discussion with G7 partners focused on addressing forced labour in global supply chains Submission to the JCHR call for evidence on the Nationality and Borders Bill cited in parliamentary debates and in the JCHR's report on the Bill Contributed extensively to the revision of the UK government's Modern Slavery Strategy, invited by the Home Office to co-host a round table to inform considerations in the new strategy, and approached for feedback on the strategy's research annex

Source: Technopolis (2022). Case studies

There are also examples that emerged in the earlier phase of the evaluation, which are listed below for completeness.

Box 17 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). Also, the Met Office is currently using some of the tools and methods developed in the programme.
- Transforming UK Food Systems 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 policy makers to make better informed decisions.³⁵
- 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).

³⁴ https://modernslaverypec.org/assets/downloads/ImportBans_briefing-updated-final.pdf

³⁵ <https://www.turing.ac.uk/research/research-projects/shocks-and-resilience>

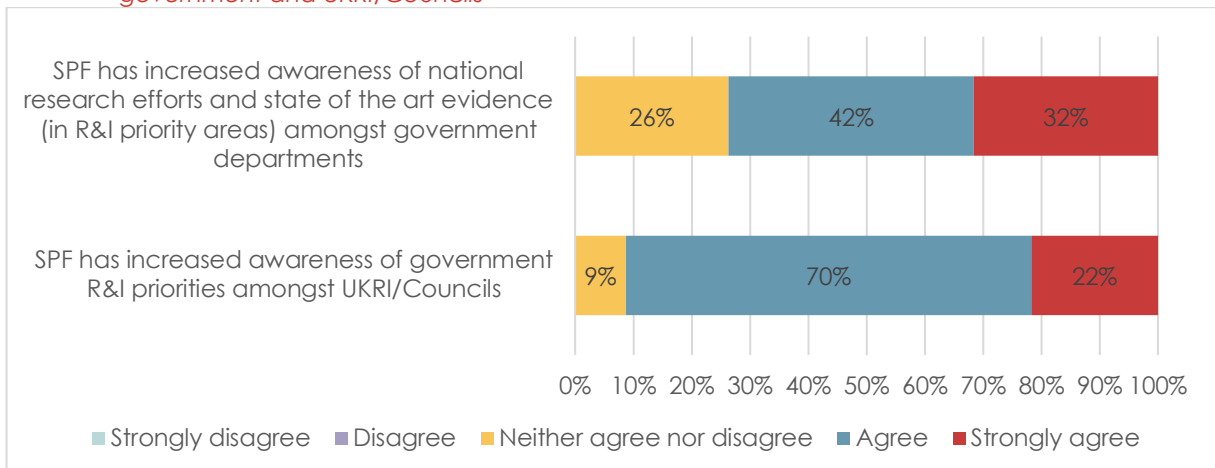
2.4.7 *There is some evidence of increased understanding between research councils and government departments on how to engage and collaborate beyond SPF*

One of the expected outcomes of the Fund is to strengthen linkages and communication mechanisms / structures between and across partners (Councils, PSREs, government departments) involved in SPF programmes, including through new ways of working or collaborating between these partners. Collaboration between such organisations is not new, but SPF was expected to create a broader spectrum of sustained connections within the programme and across Councils and government departments so that e.g. government can turn to UKRI to support their R&I objectives.

As documented in Sections 2.1 and 2.4.2, **most SPF programmes involve government departments and agencies** and have **implemented different ways of engaging** with these representatives (inputting to business cases or programme design, participating in project selection and/or sitting on advisory boards), and to an extent that is not normally seen. Box 16 in particular cited a number of specific examples where SPF programmes have introduced **new or enhanced mechanisms to involve government departments** and agencies within implementation processes (e.g. helping to draft calls or providing accompanying government 'statements of need', or co-rating and commenting on proposals alongside peer reviewers).

Through these interactions, it was hoped the Fund would lead to **increased understanding and awareness** between government and research funders, and according to programme leads this has largely been achieved (see figure below). Specifically, three quarters agreed that the SPF experience had increased awareness of national research efforts and state of the art evidence amongst government departments, while even more (92%) believed that Councils had increased their awareness of government R&I priorities. There is a reasonably strong correlation between the more positive responses to these questions and the reported level of government department/agency involvement during programme implementation (seen in Figure 13). However, there are exceptions. There is no obvious alignment between the particular departments involved and the ratings given across the programmes.

Figure 15 *Extent to which government SPF has increased awareness and understanding between government and UKRI/Councils*



Source: Technopolis, based on responses from 23 leads of SPF programmes (2022)

The following quotes from programme leads provide some specific examples of this:

SPF gave the government departments a stronger role in specifying research. This experience has increased their knowledge and engagement with UKRI and given them more understanding of what is possible.

(Clean Air programme Lead)

We are developing a series of policy seminars for government departments, which will trial a means of increasing awareness of the research. However just working together in partnership on this programme has already helped.

(Transforming UK Food Systems programme Lead)

There has been a step-change in the engagement by government departments during programme commissioning and delivery, which should help ensure the programme delivers its objectives and meets the expectation of government partners. There is increased awareness in ESRC (and AHRC) now of marine R&I priorities within governments.

(Sustainable Management of UK Marine Resources programme Lead)

The Fund was also expected to lead to a **better understanding of what works** in inter-sectoral/cross-discipline collaboration, and for this to be codified, shared and socialised amongst partners in some shape or form to further facilitate sustained effects or an ecosystem change.

The great majority (92%) of SPF programme leads (strongly/) agreed that the experience has **demonstrated how to effectively work and collaborate together** with partners (through new or enhanced ways of working/collaborating), while a similar proportion (96%) also believe that this had **demonstrated the benefits of working and collaborating together**. Wider impacts from this (in terms of **wider ecosystem change**) are mainly expected beyond the life of the SPF programmes, but there are already a number of examples emerging at this stage (shown in the box below).

Box 18 *Examples of learning that have or could inform future collaboration experiences*

- **Constructing a Digital Environment:** The 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 learnt. Also note the Group of Champions across SPF programmes discussing and sharing lessons learnt (but not all programmes have champions).
- **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 UK Food Systems:** Government departments (especially DEFRA) have been heavily involved in the design and then the implementation of the programme.
Also, 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.

- **National Timing Centre:** This programme has allowed NPL to understand much more deeply how to interact with partners in government to secure and deliver large programmes. This learning has then contributed to our success in being in the position to be part of consortiums for programmes which aim to address large, game-changing government priorities.
- **Sustainable Management of Marine Resources:** SPF mechanism has been crucial to engage policy officers from Defra, Marine Scotland, and the Welsh and Northern Ireland governments in the programme and integrate their R&I priorities. The inclusion of policy opinion on each of the SMMR proposals in the SMMR review process to help inform the review panel's final funding recommendations has now been adopted by the ECOWind research programme (NERC/Crown Estate) as it also needs to deliver strong policy-relevant end-user impact by the end of 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.
- **Modern Slavery PEC:** The mechanisms and approach developed in the MS PEC for commissioning research that addresses longer term policy challenges has informed AHRC's discussions with other government departments regarding future investments. Particularly, AHRC seeks to replicate the processes for the ways in which different stakeholders are involved in research commissioning and the research process itself, as well as how government departments are involved in the governance structure so that independence of academic research is maintained but also government needs are expressed. Discussions are ongoing, e.g. with DCMS regarding a policy and evidence centre for galleries, libraries, archives, and museums, where such processes could be implemented.
- **Clean Air:** This has led to approaches from teams in other government departments wanting to understand how they could develop a collaborative programme using the same model as used in this programme.

Source: Programme lead interviews and template responses at the baseline and interim evaluation stage

2.4.8 *The experience in SPF and evidence collected in this evaluation provides some useful reflections and lessons learnt with regards to addressing government R&I priorities*

Future iterations of **SPF or similar future interventions** addressing government R&I priorities may consider the following:

- **Building upon the process of identification of priorities:** The process in wave 2 to identify government priorities should be maintained in future initiatives. Further use of the ARIs – which account for medium to long term needs – may also help to minimise issues relating to the shifting nature of government priorities, which can pose challenges for (re) engagement with research results towards the end of research programmes
- **Planning for and dedicating resources through the life cycle of the programme to maintain engagement:** Building relationships with relevant policymakers and similar end users requires dedicated resource, time and focus over time. Going forward, any similar mechanism that aims to address government priorities should (like SPF) ensure engagement at the programme design stage and during ongoing implementation, as well as provide the resources needed for extra coordination efforts
- In particular, we have found evidence that maintaining user engagement throughout the lifetime of a programme can be a challenge (with some examples of government and industry involvement 'dropping' in the middle of the 'design – implementation – output/uptake' cycle, e.g. due to lower availability). Consequently, efforts are needed to **ensure re-engagement in later phases, including a special focus on the nature, style and focus of outputs and dissemination activities** (e.g. developing synthesised policy briefs rather than/in addition to individual academic publications)

3 Conclusions

This section summarises the main findings presented above in line with the outcomes identified in the ToC for SPF.

Outcome: 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.

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

Components	Assessment/ Test	Conclusions
Composition	The programme involves intersectoral collaboration (between Councils, OGDs and PSREs) in its design and implementation (including governance)	Composition analysis of programmes shows that this has been achieved Additionally, evidence from programme leads suggest that involvement of government departments has been sustained over time (even if keeping this engagement can sometimes be challenging)
Focus	The programme addresses government R&I priorities that would not have been funded otherwise	Evidence on spend and on uptake of research results shows that SPF has enabled addressing government priorities. Other sources of funding are available that address many of the same areas, but stronger collaboration through SPF, as well as uptake of research outputs in policy documents in comparison with what is usually the case
Demonstration and/or codification	The programme has demonstrated new or enhanced ways of working/collaborating between the partners involved A written assessment has been made of the approach to, and experience of, inter-sectoral/cross-discipline collaboration through the programme	Evidence collected via programme leads template, workshops and case studies shows that programmes have tested enhanced ways of working/collaborating between the partners. but it is unclear if this has been disseminated more widely Anecdotal evidence of experiences being codified and shared
Uptake	The lessons from the programme (about ways of working/collaborating) are being implemented outside the programme	Some preliminary concrete examples, but such wider ecosystem change is mainly expected beyond the life of SPF programmes

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

Components	Assessment/ Test	Conclusions
Council awareness	The programme has led to increased awareness of government R&I priorities amongst UKRI/Councils (1)	92% of programme leads believed that Councils had increased their awareness of government R&I priorities as a result of their SPF experience
OGD awareness	The programme has led to increased awareness of national research efforts and state of the art evidence (in R&I priority areas) among OGDs (2)	Three quarters of programme leads agreed that their SPF programme had increased awareness of national research efforts and state of the art evidence amongst government departments

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

Focus on MIDRI pathway

Components	Assessment/ Test	Commentary
Composition 1 [Programme]	The programme involves intersectoral collaboration (between Councils, OGDs and PSREs) in its design and implementation (including governance)	Composition analysis shows that this has been achieved
Composition 2 [Programme]	The programme involves two or more disciplines (that tend not to collaborate with each other)	Composition and bibliometric shows that this has been achieved
New or enhanced mechanisms apply and tested [Projects]	Programme put in place new or enhanced processes to assess Multi- and Inter-Disciplinary Research and Innovation (MIDRI) proposals for competitive calls/competitions	Evidence collected via programme leads template, workshops and case studies shows that programmes have tested enhanced put in place new or enhanced processes to assess MIDRI
High quality MIDRI applications attracted [Projects]	Calls have been able to attract high quality MIDRI proposals	Analysis of grant applications shows that SPF has attracted a high number of MIDRI applications (but this is relatively small in comparison with UKRI portfolio)
Outcomes [Projects & programme]	MIDRI nature of the programme has led to MIDRI publications	Bibliometric data suggest proportionally high number of MIDRI publications emerging from SPOF (in comparison with UKRI and UK benchmark)
Uptake (Councils)	Learning from the programme (related to MIDRI processes) has been taken into account elsewhere (outside the programme)	Some examples but no substantial evidence yet
Uptake (Users)	R&I outputs emerging from the programme are being used, taken-up and/or implemented by end-users (incl. government departments/decision makers)	Bibliometric data show high uptake in policy documents, and evidence from case studies showcase concrete examples. Bibliometric data suggest higher uptake may not be explained by MIDRI-ness of publication, which in turn implies other characteristics of SPF (e.g. intersectoral collaboration) may be explaining results

More generally

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)	Strong alignment across most programmes with government priorities, as well as widespread ongoing involvement of government in development and implementation of programmes helps to ensure the relevance of research activities and outputs.
Access	R&I outputs emerging from the programme have been disseminated among end-users (incl. government departments/decision makers)	Various mechanisms put in place to facilitate synthesis and dissemination
Uptake	R&I outputs emerging from the programme are being used, taken-up and/or implemented by end-users (incl. government departments/decision makers)	(as above) Quantitative (bibliometric analysis) and qualitative evidence (case studies) show evidence of uptake



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