Researchfish

Mapping the impact of UK research:

Selected analysis of 12 years of Researchfish data





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Preface

Researchfish is delighted to bring you our report Mapping the impact of UK research: selected analysis of 12 years of Researchfish data. This report aims to unveil the breadth and depth of the UK research landscape, using data captured through the Researchfish platform. We delve into the data to generate snapshots of the current research landscape, provide meaningful comparisons and hopefully useful insights for funders, researchers and the wider academic community.

We have several motivations for producing this report. We wanted to demonstrate the richness and detail contained within Researchfish data, revealing trends and highlighting the value of a common framework for collecting research outputs, outcomes and impacts. Furthermore, we wanted to inspire our clients and the broader community to unlock the potential of their own data. We hope that this report provides some ideas of ways that research outcome data may be analysed, presented and understood, with the ultimate goal of empowering funding organisations to maximize the impact of their research investments.

Finally, we wish to advocate for the importance of collecting and measuring research outcomes. By understanding and sharing the social and economic impact of research, we can strengthen funding arguments, celebrate successes, and learn from challenges. This report encourages the wider academic community to embrace outcome data as a vital tool for both advancing research and demonstrating its real-world value.

In conclusion, this report is not merely a collection of data; it's an invitation to engage with the UK research landscape in a meaningful way. We hope it sparks interest and discussion, and ultimately contributes to the continued success of UK research.

The Researchfish Team



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EXECUTIVE SUMMARY

Mapping the impact of UK research: Selected analysis of 12 years of Researchfish data

This report analyses research impact data collected within Researchfish between 2012 and 2023, in the UK. It is based on data submitted to Researchfish by researchers and covers an estimated three-quarters of research grants and contracts (by value) in the UK i.e. funding from UKRI, research charities (predominantly medical research charities), NIHR and others. (Full list of clients available here https://researchfish.com/themembers/). Researchfish is an online system that enables research funders to capture and track the impact of their investments, and also provides a platform for researchers to report the outcomes of their work.

In this report we aim to:

- 1. Demonstrate the breadth and depth of the outcomes and impact of the research resulting from UK funding collected in Researchfish, and highlight that publications are only "part of the picture."
- 2. Present three different areas of analysis. Namely, a comparison of government vs. charity funding, a review of outputs by KEF cluster (covering higher education providers in England) and a deep dive into influences on policy.
- 3. Demonstrate the value and utility of data provided to funders through the Researchfish platform, and encourage discussion on further useful analyses in future, perhaps targeting particular areas of current interest.

Over the 12 years, researchers submitted data for 97,734 awards that have generated nearly 3.5 million attributed outcomes. The volume of outcomes by type are highly variable. Publications are very common (with 86% of awards having at least one journal article), as are collaborations and partnerships (47%). Other outcomes are less common, for example, awards linked to film, video and animations. This is to some extent a reflection of Researchfish's funder customer base which is skewed towards the STEM disciplines. Similarly, patents and spin outs are somewhat rarer events in reporting.

It is possible to compare the profile of different research funders and universities by outcome types (again, based on the data held within Researchfish). The report reflects on the differences between government and charitable funding. c88% of awards are from government whilst c12% are from charities. Awards funded by charities report 1.9 times as many medical products, interventions and clinical trials as government funded awards. Charity funded awards report 1.5 times more personal awards or recognition. On the other hand, charity funders have fewer attributions of creative products (0.2), technical products (o.6) or engagement activities (o.7). To some extent, this could be explained by the remit of Researchfish's charity customers.

Universities in England were compared by using KEF clusters; these were chosen as they were developed by Research England specifically to enable like-for-like comparisons of the performance of research organisations with those considered as their peers based on having similar characteristics. There are several interesting inferences to be made from these analyses including relative strengths:

- In creative products for clusters E (large universities with broad discipline portfolio), J (Mid-sized universities with a more teaching focus), M (Smaller universities, often with a teaching focus) and Arts Specialists. Art Specialists have 25-times as many creative products when compared to all other English universities.
- In engagement activities by universities in cluster J (Mid-sized universities with a more teaching focus) and, again Arts Specialists.
- In influencing policy by STEM Biosciences and veterinary universities and STEM Engineering.

A deep dive into policy influence showed that 11,000 PIs had over 55,000 unique influences on policy, reported in Researchfish between 2012 and 2023. These influences were attributed to 80 funders. Two-thirds of the policy influences occur in three subgroups: half of all policy

¹ https://kef.ac.uk/about

influences have been reported as having an impact on healthcare, followed by government, democracy and justice (16%) and education (15%). Again, to some extent, this is a consequence of the composition of Researchfish's funder customer base.

The section in the full report covering influence on policy outcomes illustrates the often-complex nature of the research and supportive funding which is needed to bring about changes in policy. We include several examples where reported influence on policy instances (e.g. citation in a clinical guideline, or development of a practitioner training programme) had contributions from multiple funders, PIs, research organisations and awards.

Overall, this report illustrates the wealth of data that UK funders have amassed over the past decade within Researchfish. It demonstrates Researchfish's broad

coverage of research activity in the UK and its ability to link awards to outcomes, addressing challenges of attribution. Researchfish data also has some limitations (such as data recall and the overstating or understanding of outcomes), meaning that different approaches for assessing outcomes and impact are needed. Taken with other reports — such as the analysis of REF impact case studies — it is clear that UK research makes a sizeable, diverse and meaningful impact to society and the economy through a range of different outcomes.

The analysis also illustrates the power of collecting and using Researchfish data to enable accountability for research funders, to advocate for research & research funding and, in the future, have a better understanding of 'what works' in research funding. If you have any feedback or ideas for future analyses, please let us know on RFInsight@elsevier.com.

CHAPTER ONE

Background—an introduction to Researchfish and the challenges of research assessment

The purpose of this report is to showcase 12 years of data submitted to Researchfish by researchers. Researchfish is an online platform that was developed to help funders capture and track the impact of the research that they fund (See Annex A, page 30, for more detail on the history of Researchfish). It is well documented in the literature that there are a number of enduring challenges to the assessment of research impact. These include, for example, long time lags between investments and impact, the burden of data collection on researchers, and the fact that impacts occur from multiple streams of research and therefore research funding, making attribution difficult.2 To a degree, the importance of these limitations is determined by the motivation for assessing impact as summarised by the 4As framework illustrated in Figure 1.3 For example, if the motivation is purely advocacy, then attribution is probably less of an issue, which may allow a lighter burden of data collection. However, if the aim is to use the assessment of impact as a way to allocate research funding—as is the case with the UK Research Excellence Framework (REF)—then understanding the contribution of specific research organisations to an impact is important to ensure a fair allocation of resources. Similarly, the accurate attribution of inputs to impacts is important for the analysis of 'what works' in research funding and the demonstration of accountability for taxpayer or donor money.

Researchfish addresses a number of these challenges. For example, the fact that outcome data is linked to research awards (research grants, fellowships and studentships) means that the attribution issue is resolved.4 Researchfish reduces the researcher reporting burden in a number of ways, including by providing a standard data structure and third-party data harvesting, which is not only efficient to collect but reduces burden when it comes to funder analysis and reporting.

This is not to underplay some of the limitations associated with a platform like Researchfish. For example, a lot of the data submitted to Researchfish is

Figure 1: The 'Four As' of research impact assessment: advocacy, analysis, accountability and allocation



Source: Adams et al (2018)

self-reported by awardees, resulting in potential biases such as recall error and overstating or understating impacts affecting the quality of the data. For this reason, where feasible, a lot of data is 'scraped' from external websites and databases including, for example, publications and datasets. This has the added benefit of reducing the need for the researchers to enter the data themselves and minimises duplication in reporting. Researchfish also integrates with both ORCID and institutional CRIS systems. Also, whilst the focus of this report is largely on quantitative information, there is a lot of qualitative data captured in Researchfish. This provides a rich narrative contextualising different types of impacts. The main reason we have not used this data in this report is to preserve data anonymity.

² Smith et al (2020).

³ Adams et al (2018); Morgan Jones & Grant (2013).

⁴ Although it should be noted that understanding specific contributions of different funding to outcomes, whilst feasible, is analytically challenging.

Figure 2: Researchfish outcome types

Publications	Further Funding	Engagement Activities	Influence on Policy, Practice, Patients & the Public	Research Tools & Methods	Research Datasets, Databases & Models
Book	Research grant (including intramural programme)	A formal working group, expert panel or dialogue	Implement- ation circular/rapid advice/letter to e.g.	Biological samples	Dataset/Database/ Collection of data
Book Chapter	Fellowship	A talk or presentation or debate	Ministry of Health Influenced training	Cell line	Data analysis technique
Book (Edited)	Studentship	A magazine	of practitioners or researchers	Technology assay or reagent	Computer model/ algorithm
Conference Proceeding/	Capital/Infrastructure	or newsletter (print or online)	Citation in clinical guidelines	Model of mechanisms or symptoms: human	Ü
Conference paper	(including equipment)	Event, workshop or similar	Citation in clinical reviews	Model of mechanisms	
Consultancy Report	Travel/small personal	Participation in an open day or visit	Citation in other	or symptoms: mammalian in vivo	
Journal Article/Review		at my research institution/faculty	policy documents	Model of mechanisms or symptoms: in vitro	
Manual/Guide		Media interview, press release, press conference or other	Citation in systematic reviews	Model of mechanisms or symptoms: non-	
 Monograph		response to a media enquiry	Participation in a guidance/advisory committee	mammalian in vivo Physiological	
Policy Briefing Report		Engagement focused website, blog or social	Contribution to a national consultation/	assessment or outcome measure	
		media channel	review	Improvements to research infrastructure	
Scholarly Edition		A broadcast e.g. TV/ radio/film/podcast (other than news/	Contribution to new or improved	Antibody	
Systematic Review		press)	professional practice		
Technical Report					
Technical Standard					

Without subtypes									
Collaborations & Partnerships	Next Destination	SpinOuts	Other Outputs/ Outcomes	Use of Facilities & Resources					

Figure 2: Researchfish outcome types

Intellectual Property & Licensing	Medical Products, Interventions & Clinical Trials	Artistic & Creative Products	Software & Technical Products	Awards & Recognition
Patent/Patent application	Diagnostic Tool: Imaging	Artefact (including digital)	Webtool/Application	Research prize
Trademark	Diagnostic Tool: Non-Imaging	Image	Software	Medal
	Therapeutic Intervention: Drug	Artwork	e-Business Platform	Awarded honorary membership, or a fellowship, of a
	Therapeutic Intervention: Vaccines	Composition/Score	Grid Application	learned society Appointed as the
	Therapeutic Intervention: Cellular	Creative Writing	Physical Model/Kit	editor/advisor to a journal or book series
	and gene therapy Therapeutic Intervention:	Film/Video/Animation	New Material/ Compound	Poster/abstract prize
	Medical Device Therapeutic	Artistic/Creative Exhibition	New/Improved Technique/Technology	Attracted visiting staff or user to your research group
	Intervention: Surgery Therapeutic Intervention:	Performance (Music, Dance, Drama, etc)	Systems, Materials & Instrumental Engineering	NIHR Senior Investigator/Clinical Excellence Award
	Radiotherapy Therapeutic Intervention:		Detection Devices	National honour e.g. Order of Chivalry, OBE
	Psychological/ Behavioural			Prestigious/honorary/ advisory position to
	Therapeutic Intervention: Physical			an external body Personal invitation as keynote or other
	Therapeutic Intervention: Complementary			named speaker to a conference
	Preventative Intervention: Behavioural risk			Honorary Degree
	modification Preventative Intervention: Physical/			
	Biological risk modification			
	Preventative Intervention: Nutrition and Chemoprevention			
	Management of Diseases & Conditions			
	Health and Social Care Services			
	Support Tool: for Fundamental Research			
	Support Tool: for Medical Intervention			
	Products with applications outside of medicine			

Researchfish collects data on over 100 different outcomes. organised across 16 domains

Researchfish is a data platform that collects the outputs, outcomes and impacts of funded research from researchers. Principal Investigators (or any coinvestigators and/or team members to whom they delegate) who have been awarded research funding from a funder who uses Researchfish will be asked to complete an online survey usually once a year. As illustrated in Figure 25, pages 10-11, there are 106 outcome subtypes, organised around 16 domains. The online platform routes researchers through the question set such that only relevant questions are asked. Funders can also add their own questions, but critically the common question set cannot be changed without the agreement of the funder community allowing comparability across the data.

The question set follows a simple logic model of inputs, activities, outputs, outcomes and impacts, reflecting its origins of the payback framework used in the assessment of biomedical and health research.6 However, to simplify the user experience (and based on feedback from funders and researchers) in Researchfish, outputs, outcomes and impacts are aggregated into a single category termed 'outcomes' which is the language used hereon in this report.

Today Researchfish is used globally by funders and universities to track research and evidence impact. At the time of writing this report, over the past 20 years, Researchfish has been used by approximately 75 funders, research centres and institutes worldwide, covering about 215,000 funding awards to 100,000 Principal Investigators totalling around £75bn of research funding, with awards largely from 2006 to 2023.

This report maps the impact of research by UK funded researchers between 2012 and 2023

This report focuses on submissions by awardees of UK funders7 between 2012 and 2023, excluding studentships.8 This accounts for about 84% of the common outcome data (and about 72% of all outcome data including funder specific questions) held in Researchfish and was chosen to allow maximum comparability of the data. Overall, the outputs captured in Researchfish, and reported here, account for an estimated three-quarters of research grants and contracts, by value, in the UK over this time period.9

⁵ Note that the outcome types in this figure are the current dataset, and there are other types which have been retired from the standardised dataset.

⁶ Buxton and Hanney (1996).

⁷ https://researchfish.com/the-members/.

⁸ We excluded studentships because there is a relatively large number of them (65%) and the data collected for studentships is different from other types of funding (e.g. different distribution of outputs).

⁹ This is estimated from HESA data (see: https://www.hesa.ac.uk/support/definitions/finances), with our workings provided in Annex B.

CHAPTER TWO

Mapping the impact of research funding

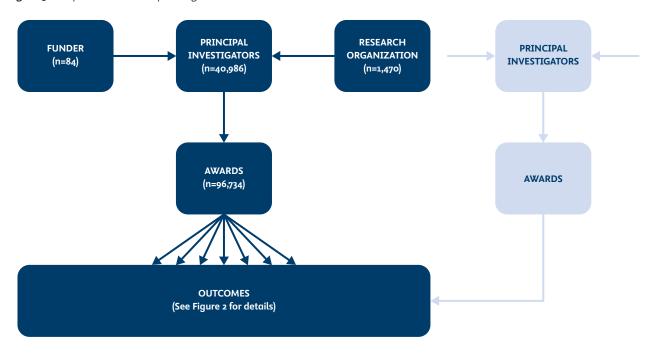
This chapter provides an overview of all the data that has been submitted to Researchfish in the 12-year time frame of this analysis for UK research funders. In interpreting these data it is important to be clear on the nature of the data. As summarised in Figure 3 and in more detail in Annex C, page 33, the key unit for all Researchfish data is the award (i.e. research grant, fellowship etc.). Awards are made by Funders to Principal Investigators (PI) who are affiliated with Research Organisations (ROs) such as universities and research institutes.10

A PI will then 'attribute' their outcomes in Researchfish to one or more awards. This occurs when, for example, a paper is linked to an award. However, this can be a many-to-many relationship; that is, a publication can be linked to a number of awards and an award can have a number of publications. This is illustrated by the lightly coloured boxes and arrows in Figure 3. To avoid double counting (where possible), unique outcomes are termed 'entries'. It should be stressed that this is only definitive

where there are unique identifiers associated with the outcome. For example, for publications: Digital Object Identifiers (DOIs); for spinouts: company registration numbers and such like. For other areas such as influence on policy the primary method for deduplication is making use of 'native' identifiers in Researchfish and making it easy for these entries to be shared and attributed to multiple awards. Despite this additional form of deduplication, if two people were to independently create entries referring to the same output, using different words, then these cannot be programmatically deduplicated.

The majority of the analyses presented in this report are based on attributions as it captures both the relationship between the awardee (PI) and the outcome describing the activities of researchers in generating societal and economic impact. Where we deviate from this, we clearly specify what we are referring to.





¹⁰ Note that the number of Research Organisations is large as it can include institutions of different scale — ranging from departments & centres through to a university

Researchers have submitted data for nearly 100,000 awards that have generated nearly 3.5 million attributed outcomes between 2012 and 2023.

Figure 4, page 15, maps out the full dataset of 96,734 awards made between 2012 and 2023 and the 14011 different outcome types in, what is termed, an 'outcome array'.12 The aim of this array is to provide a visualisation of the outcomes and to highlight their extent and variety; it is not designed for in-depth interpretation. Each column represents a sample of 100 awards (since a line per award would exceed the fidelity of most screens or printed formats) where the average value for the particular outcome type (rows) is used to fill the cell. Source data columns are ordered by funder. Percentile ranks are calculated for each row to account for scale differences across their reported outcome types. Colours are scaled from dark blue (zero outcomes), through orange (50th percentile), to yellow (maximum value). Overall, of the 13,542,760 cells in the figure, 644,188 (5%) have at least one outcome attributed to the award, with a total of 3,529,961 outcomes visualised in Figure 4.

A number of observations can be made from the outcome array in Figure 4. Firstly, as far as we are aware this is the first comprehensive map to visualise research outcomes in the UK for the period under study. As noted earlier, Figure 4 covers 76% of outcomes of research grants and contracts in the UK given the coverage of Researchfish. Secondly, it is clear that there are some more prevalent outcome types such as publications (with 86% of awards having at least one journal article), collaborations and partnerships (47%) and giving keynote speeches (18%). There are also other outcomes that are less common. For example, 3% of awards were linked to film, video and animations, another 3% to

spinout companies, and 2% with a granted patent. Finally, you can infer research discipline associated with funder remit. For example, the is a cluster of outputs (in yellow) for the Artistic and Creative Products towards the right of the figure and two, somewhat less distinct clusters towards the left of the figure for Medical Products, Interventions and Clinical trials. Presumably these reflect funders in the arts and humanities and the biomedical and health sciences respectively.

Many attributed outcomes are for publications, followed by engagement activities

As illustrated in Figure 5, page 16, just under half (50%) of the attributed outcomes are for publications.13 The majority (82%) of these are for peer reviewed journal articles, but other publication types included conference proceedings (8%), book chapters (3%) and preprints (2%). This is followed by engagement activities, which accounts for a fifth of the attributed outcomes and includes talks (41%), participation in a workshop (24%) and a formal working group or equivalents (10%). The remaining 13 outcome types account for around a third of the submissions with 'awards and recognition' (8%), 'collaboration and partnerships', 'further funding' (both 6%) and 'next destination' (4%) being the next most frequent categories used.

The orange boxes describe outcomes that are focused on the research endeavour (such as publications, databases etc.). The remaining outcomes are external facing, with the two green categories on engagement activities and influence on policy, the five blue ones focus on technology transfer — including creative products, spin outs and such like, and the final brown box on reward and recognition (such as prizes and honours).

¹¹ This includes a number of outcome types that are no longer included in the current questions because of changes over time.

¹² This figure was originally developed by Wooding et al (2009), then termed an 'impact array'.

¹³ Note that these data refer to unique outcomes which is different to those present in Figure 4 which describes attributed outcomes for each individual award. Or put another way the data in Figure 5 excludes double counting of, say the same publication being attributed to multiple awards, whilst the data in Figure 4 includes that possibility.

Figure 4: Outcome array, mapping different types of outcomes for research awards

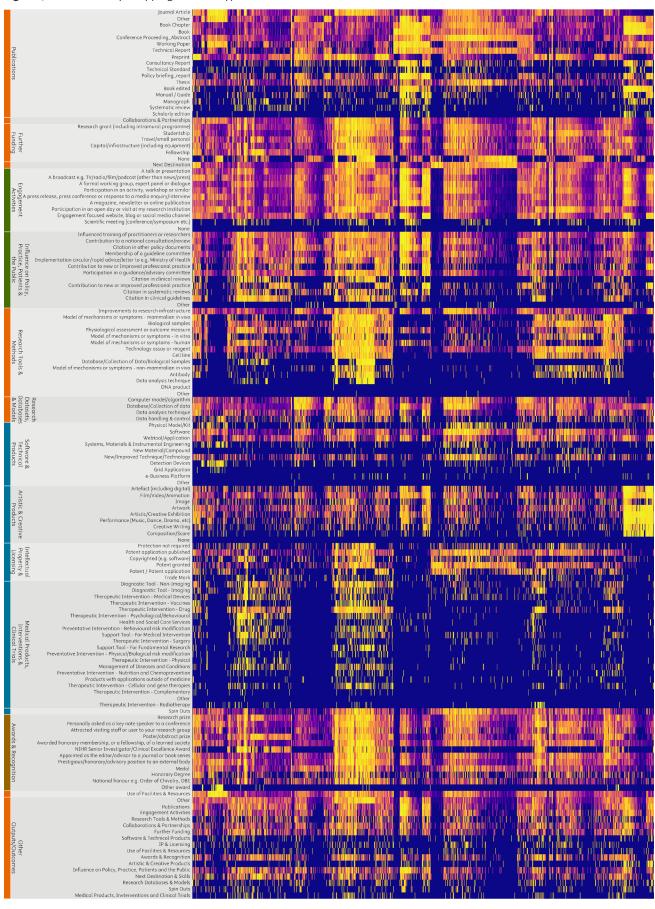
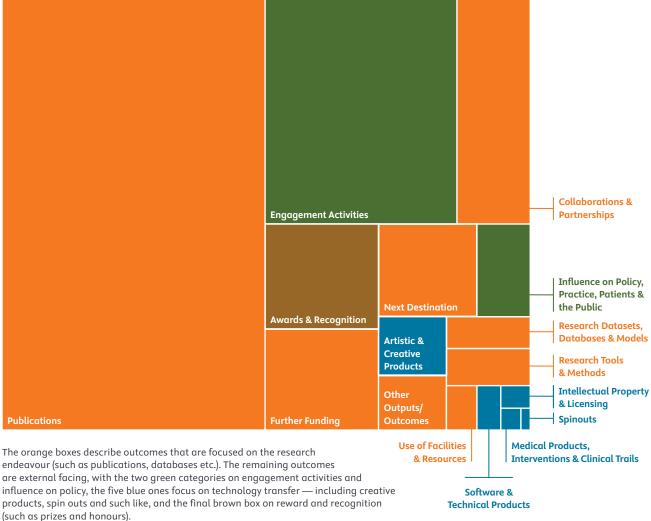


Figure 5: Distribution of unique common outcomes for all UK non-studentship agreements, 2012 to 2023



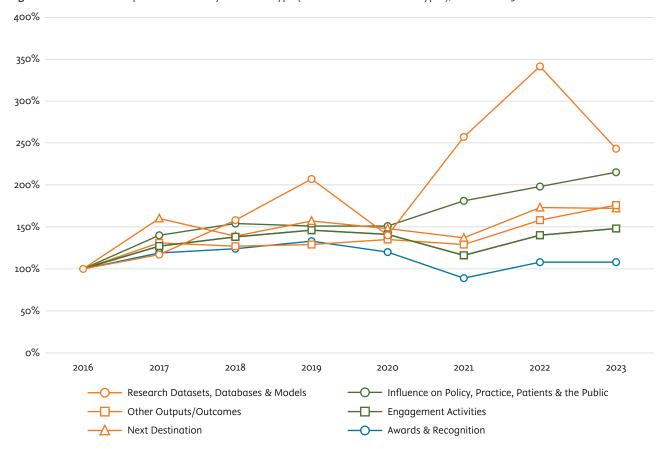
There have been large relative increases in numbers of attributions of Artistic and Creative Products. Research Datasets. Databases and Models and Influence on Policy, Practice, Patients & the Public

Figure 6, page 17, shows some of the trends in attribution by year for six of the common outcomes, and how they have changed relative to 2016. A table showing the number of attributions by all common outcomes and attribution year across the whole period covered by this report is located in Annex D, page 35. 2016 is chosen as the start of the year-on-year comparisons as the previous years saw large numbers of funders join for the first time and then realign submission period timelines resulting in a 'short' reporting year and a 'long' reporting year containing activity for less and more than one year respectively. In each case there has been a very large relative increase in the number of new attributions made each year, ranging from just under a 50% increase for Engagement Activities to over a 250% for Artistic and Creative Products. These changes in the volume of data reported in these sections could be driven by a number of factors. Spikes in policy influence occurred over Covid, and surges in Research Datasets, Databases and Models, and Artistic and Creative Products (particularly video and images) took place following data integrations to enable automatic or easier reporting of these outputs. The Research Datasets, Databases and Models section had fewer attributions added in 2023 than 2022, and had a drop between 2019 and 2020, but the overall trend is still up significantly and it will be interesting to see what happens with this section in 2024.

Not all output types have increased during this period; for example the number of Spin Outs has stayed fairly consistent. Interestingly, when we compared these data with those reported by the Higher Education Statistical Agency (HESA), the numbers are remarkably similar

providing some validation on the data quality. For example, in financial year 2021/22 HESA reports 387 university spin-off and start-up companies14 compared to 381 from Researchfish for 2022.

Figure 6: Number of Outputs Attributed by Outcome Type (for 6 Selected Outcome Types); 2016 to 2023



⁴ https://www.hesa.ac.uk/data-and-analysis/providers/business-community/chart-1; Note this includes social enterprises but excludes student start-ups

CHAPTER THREE:

Mapping the impact of research by funders, universities and other research organisations

The preceding chapter maps all the data in Researchfish for the last 12 years submitted by Principal Investigators (PIs) who have received awards from UK funders. This chapter drills into this data by looking at it from two perspectives; the type of funder and the type of research organisation. The funder analysis is split into two groups. The first is government funders such as UK Research & Innovation, National Institute for Health and Care Research (part of the Department for Health and Social Care) and the Chief Scientist's Office (Scottish Government), and second charities, which include non-profits such as Cancer Research UK, Kennedy Trust, The Alan Turing Institute and The Academy of Medical Sciences.15

The taxonomy used for research organisations is a bit more complicated. To ensure like-for-like comparisons, for this analysis clusters from the Knowledge Exchange Framework (KEF) are used.¹⁶ KEF clusters were developed by Research England to provide the context for the performance of individual research organisations compared to their peers. The clustering is based on characteristics such as the scale of research undertaken in an organisation and the degree of specialisation. There are nine clusters in total, five are for broad-based research organisations and four are for specialist ones. The five clusters for broad based research organisations are summarised in Box 1, page 19. The four specialist clusters are STEM17 – Agriculture (e.g. the Royal Agriculture College), STEM – Bioscience and veterinary (e.g. the Institute of Cancer Research), and STEM -Engineering (e.g. Cranfield University). The Arts and Design cluster includes specialist organisations such as Norwich University of the Arts and the Royal Academy of Music.¹⁸ Finally, it should be noted that as KEF only applies to England this analysis is focused on that subset of the data in Researchfish.19

Government and charitable funders of research have different impact portfolios

Figure 7, page 20, presents the same data as Figure 4, page 15, but for the consolidated 16 outcome types, split between government funders and charity/nonprofit. As with Figure 4, each row represents a sample of 100 awards where the average value for the particular outcome type (columns) is used to fill the cell. Percentile ranks are calculated for each column to account for differences across reported outcome types. Colours are scaled from dark blue (zero outcomes), through orange (50th percentile), to yellow (maximum value).

As can be seen in Figure 7, 88% of the awards come from government funders and 12% from charities. There are some clear differences in these two profiles with, for example, the government funders more likely to have awards linked to creative products than the charity funders. Given the dominance of medical research charities in the charity sector this is not surprising.

To help to make comparisons between the two funder groups easier, Figure 8, page 20, presents the same source data relative to the whole dataset. The 'spokes' in each 'outcome wheel' represent the 16 outcome types that have been grouped by colour. The eight orange spokes describe those outcomes that are focused on the research endeavour (such as publications, databases etc.) and are somewhat inward looking. The remaining eight spokes are external facing, with the two green spokes on engagement activities and influence on policy, the five blue spokes focused on technology transfer — including creative products, spin outs and such like, and the final brown spoke on award and recognition (such as prizes

¹⁵ See https://researchfish.com/the-members/ for full list of Researchfish users.

¹⁶ https://kef.ac.uk/about

¹⁷ STEM = Science, Technology, Engineering and Mathematics.

¹⁸ See Ulrichsen (2023) https://www.ifm.eng.cam.ac.uk/uploads/UCI/knowledgehub/documents/Ulrichsen_KE_clusters_update_2023_vFinal.pdf, for details on how the clusters are created.

¹⁹ Which is about 86% of the total attributions in the set of data being analysed and about 71% of the awards.

Cluster E (for example, Manchester Metropolitan University and Sheffield Hallam University)

- Large universities with broad discipline portfolio across both STEM and non-STEM excellent research across all disciplines.
- Many academics have both a teaching and research focus or teaching only focus.
- Significant amount of research funded by government bodies/hospitals (cluster average 45%); 9% from industry and 12% from charities.
- Large proportion of part-time undergraduate students. Smaller postgraduate population dominated by taught postgraduates.

Cluster J (for example the University of Sunderland and the University of Northampton)

- Mid-sized universities with a more teaching focus (although research is still in evidence).
- Academic activity across STEM and non-STEM including other health, computer sciences, social sciences and humanities.
- eRsearch activity funded largely by government bodies/hospitals (41%) and charities (20%); 9% from industry.

Cluster M (for example Falmouth University and the University of West London)

- Smaller universities, often with a teaching focus. Few research-only academics
- Academic activity across disciplines, particularly in other health domains, social sciences and humanities.
- Research activity typically funded by non-UKRI sources, covering government bodies/hospitals (38%) and industry (27%); 14% from charities.

Cluster V (for example the University of Cambridge and Newcastle University)

- Very large, very high research intensive and broad-discipline universities undertaking significant amounts of excellent research.
- High proportion of research-only academic staff.
- Research funded by range of sources including UKRI (34%), other government bodies (26%), charities (24%) and industry (11%).
- Significant activity in clinical medicine and STEM disciplines.
- Student body includes significant numbers of taught and research postgraduates.

Cluster X (for example the Keele University and University of York)

- Large, high research intensive and broad-discipline universities undertaking a significant amount of excellent research.
- High proportion of research-only academic staff.
- High proportion of research funded by UKRI (45%); 29% from other government bodies; 8% from industry and 12% from charities.
- Discipline portfolio balanced across STEM and non-STEM although less or no clinical medicine activity.
- Large proportion of taught postgraduates in student population.

Source: Ulrichsen (2023)

and honours). The size of the spoke is the relative number of outcomes for funder group compared to the whole dataset. So a value of 1 would indicate that the number of outcomes is similar to the dataset as a whole, a figure greater than 1 would indicate that there are relatively more of that outcome type and less than 1 that there are relatively less. In the outer circle, the relative value of each of the outcome types is provided.20

The Government 'outcome wheel' provides a reference point given its relative size with the majority of spokes being close to 1. However, when compared to the

charitable funders (the lower panel) it is evident that charities are more likely to support awards that report products or interventions and awards and recognition. For example, awards funded by charity/non-profit report 1.85 times as many medical products, interventions and clinical trials as government funded awards. Similarly, charity funded awards report 1.47 times more personal awards and recognition. In contrast, and as noted above, charity funders have fewer attributions of creative products (0.16), technical products (0.55) or engagement activities (0.72).

²⁰ In Figure 7 the outcome types are ordered by the way that Researchfish users enter the data (i.e. similar to the order in Figure 1). The same data are presented in Annex E, ordering the impact wheels by colours i.e. the internal vs external facing outcomes.

Figure 7: Outcome array, mapping different types of outcomes for research awards; 16 outcome types comparing government and charity/non-profit funders

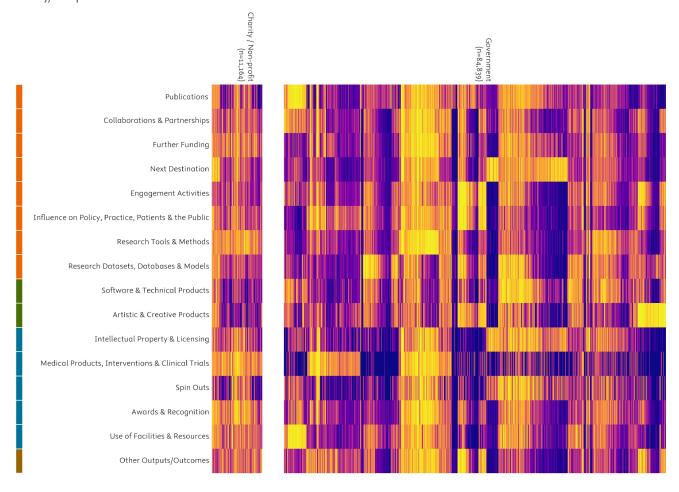


Figure 8: Outcome wheels for government and charity/non-profit funders



Different universities exhibit different outcome portfolios

In Figure 9, a series of outcome wheels are provided for each of the nine KEF clusters. Recall that these are for England rather than the UK, and that a several clusters involve a small number of institutions, as indicated by the 'n' in the figure. As before, a value of 1 would indicate that the number of outcomes for that KEF cluster is similar to the dataset as a whole, a figure greater than 1 would indicate that there are relatively more of that outcome type for that KEF cluster and less than 1 that there are relatively less. In the outer circle, the relative value of each of the outcome types is provided. For example, for the first outcome wheel, Cluster E (large universities with broad discipline portfolio), the relative value for publication is 0.62 indicating that this group of universities has less of this outcome type relative to all universities. Conversely, however, creative products have a relative value of 1.30 indicating a relative strength for this outcome type.

Unsurprisingly, the largest cluster is V (very large research-intensive universities), which has over 50,892 awards in it, or 74% of the English sample. This provides a natural reference point for the other clusters with the

relative values being near one for all 16 outcome types, as illustrated in Figure 9. There are many interesting inferences to be made from these outcome wheels including relative strengths:

- In creative products for clusters E (large universities with broad discipline portfolio), see below; J (Midsized universities with a more teaching focus), see below; M (Smaller universities, often with a teaching focus), page 22; and Arts Specialists, page 23. In fact, as one would expect, the Art Specialists have 25-times as many creative products when compared to all other English universities.
- In engagement activities by universities in cluster J (Mid-sized universities with a more teaching focus), see below; and, again Arts Specialists, page 23.
- In influence on policy by STEM Biosciences and veterinary universities and STEM Engineering, page 23.

It is also interesting to note that the specialist clusters — with the exception of STEM Agriculture, which has a small number of awards — have strengths across a number of the outcome types when compared to comprehensive universities.

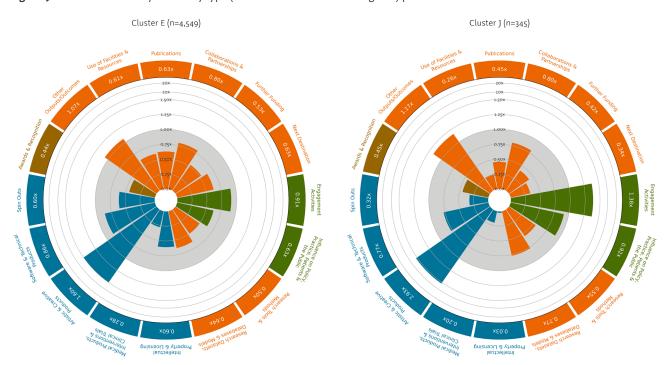
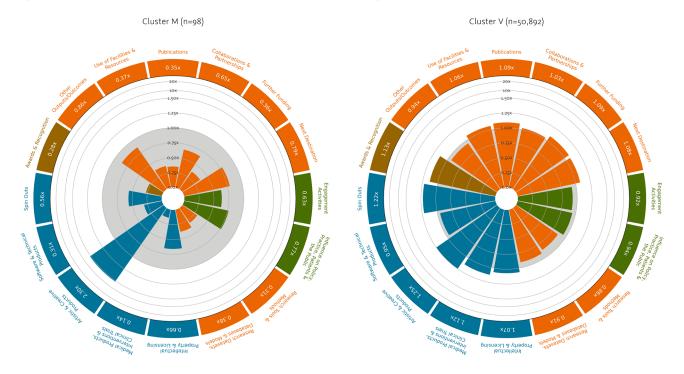


Figure 9: Outcome wheels by university type (based on KEF clusters in England) profit funders

Figure 9: Outcome wheels by university type (based on KEF clusters in England) profit funders



Cluster X (n=10,735)



Figure 9: Outcome wheels by university type (based on KEF clusters in England) profit funders



CHAPTER FOUR:

A deep dive on policy influence

Much has been written about the influence of research on policy and practice. This literature can be traced back to the 1970s (if not before), with early scholars such as Carol Weiss identifying different models by which research translates into public policy. Her groundbreaking work was updated a quarter of a century later by Steve Hanney and colleagues as summarised in Box 2.21 The importance of the 'social interaction' model was reinforced by Jonathan Lomas in the early 2000s, when he identified the importance of knowledge brokers and policy entrepreneurs in a model he called 'Linkage and Exchange'.22 The point being that there were individuals in both the research and policy domains who had the skills, experience and insights to cross into each other's professional spaces facilitating the flow of ideas and knowledge between the two communities.

This largely theoretical work was subsequently confirmed by a literature review by Kathryn Oliver and others who, in reviewing 145 papers from 59 countries, identified a series of barriers and facilitators associated with the translation of research into policy.²³ These included a range of issues such as effective communication, timely messaging, access to research literature and interactions between research and policy makers. It is this latter evidence that has led to a number of initiatives — from governments, funders and universities — that aim to blur the boundaries between research and policy including the Royal Society's Policy Associate scheme,²⁴ UKRI's Policy Fellowships²⁵ and policy and engagement institutes within universities.26

Interestingly, however, there has been relatively little data on the scale of interaction between academic

Box 2: Different models explaining how research is translated into policy influence

Enlightenment model:

Gradual 'sedimentation' of ideas.

Political model:

Research used as ammunition in an adversarial system.

Tactical model:

Research is response for action by policy maker.

Knowledge-driven:

Research generates knowledge that impels action.

Identification of problem 'customer' who requests solutions from research.

Social interaction:

Iterative interactions between researcher and policy maker; exposed to each other's worlds.

Source: Hanney et al (2003)

research and policy. Exceptions to this include the analysis of the 2014 Research Excellence Framework (REF) impact case studies which, through a natural language processing approach known as topic modelling, illustrated that the 20% of c7,000 case studies had an impact on policy,27 and more recently and analysis of Overton that links policy documents with academic papers.^{28,29}

One source of data that has not been explored in depth is that contained in Researchfish. As already noted, policy influence is one of the 16 outcome types in Researchfish, including 10 subtypes. This chapter therefore undertakes a 'deep dive' into the influence that research has on policy.

²¹ Weiss (1979); Hanney et al (2003).

²² Lomas (2005a); Lomas (2005b); Lomas (2007).

²³ Oliver et al (2016).

²⁴ https://royalsociety.org/grants-schemes-awards/policy-associate-scheme/

²⁵ https://www.ukri.org/opportunity/ukri-policy-fellowships-2023/

²⁶ See: https://www.upen.ac.uk for list of such institutes.

²⁷ King's College London and Digital Science (2015)

²⁸ Overton platform that allows users to discover more than 9.3 million policy documents and their links to each other, to academic papers and to relevant people and topics. See: https://www.overton.io/about/.

²⁹ Szomszor and Adie (2022).

Figure 10: Number of 'unique entries' reported by researchers to Researchfish, 2012-2023, for different subtypes of policy influences



There were 55,000 unique influences on policy, associated with 11,000 Principal Investigators, and 80 funders. Two thirds of the policy influences were attributed to three subtypes

For the 12 years analysed, there were 55,300 unique influences on policy coming from 17,602 (18%) of the awards in this analysis.30 These influences are associated with 80 funders and 11,000 PIs. As with the majority of Researchfish outcome types, there are a set of subtypes that respondents can choose, giving greater specificity in the data. As illustrated in Figure 10, for policy influence, there are 10 subtypes, with the most common set of unique entries being: influencing training of practitioners or researchers (n=13,211; 24%); participation in a guidance/advisory committee (n=12,794; 23%); and contribution to a national consultation/review n=9432; 17%).

Over half of the attributed policy influences were associated with healthcare

Once a type of influence has been selected by respondents, they are they asked to for more detail including the sector or sectors that it has impacted. As can be seen in Figure 11, page 26, half (n=27,434) of all policy influences have been reported as having an impact on healthcare, followed by 'government,

democracy and justice' (n=8755; 16%) and education (n=8265; 15%). It should be noted, however, that the dominance of healthcare is not surprising given that just under half of the awards in Researchfish are from funders whose primary focus is supporting biomedical and health research.

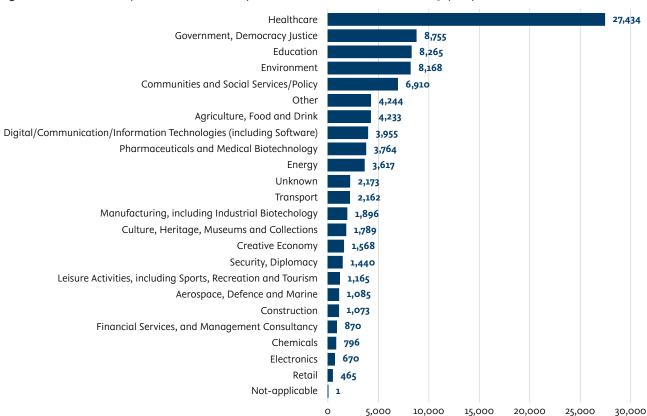
One in seven policy influences have attributions from multiple funders, Principal Investigators and awards

Behind each of the data attributions by researchers for a policy influence lies a story. It is likely that the specific influence that is captured in Researchfish has been the result of a series of interactions over time and that any specific policy influence is the result of multiple research inputs. This, at least, is what the literature summarised in the introduction would suggest. Indeed, this is confirmed when Researchfish data is interrogated.

Table 1, page 27, provides some actual examples based on anonymised data. For avoidance of doubt this includes all the charity and government funders as detailed earlier. In Table 1, the first column illustrates the policy influence. For example, membership of a guideline committee or in the case of the final three examples, specific clinical guidelines. The code POLINF_4712 is the anonymised ID used in this report which for the purposes of explaining the data has been kept in the table. The second column are the funders, the third PIs, the fourth Research organisations and the final column the number of awards. Taking the first example — Membership of a guideline committee

³⁰ As already noted, the number of attributions describes the times an outcome is linked to a unique award. If PIs link an outcome to more than one award, then the number of unique outcomes will be less than the number of attributions. In this report data is presented as unique within a given aggregation e.g. Funder Sector, KEF Group, which will produce different counts based on the level of aggregation.





(POLINF_4712), two different research funders have supported 12 PIs, who have worked in 7 Research Organisations and collectively been awarded 16 grants or fellowships.31

The schema in Figure 12, page 27, describes of the web of linkages between various elements of the data in Researchfish. With this illustration based on the second case in Table 1 — POLINF_7751 Influenced training of practitioners or researchers. At the top of Figure 12, there are five funders who have supported 6 Pls. 4 of the PIs have received awards from a single funder, 1 PI from 3 funders, and 1 PI from 4 funders. These PIs have worked in three different universities (i.e. Research Organisations). Across their careers they have had 14 different research awards from the five funders, all of which have contributed to single policy influence at bottom of Figure 12.

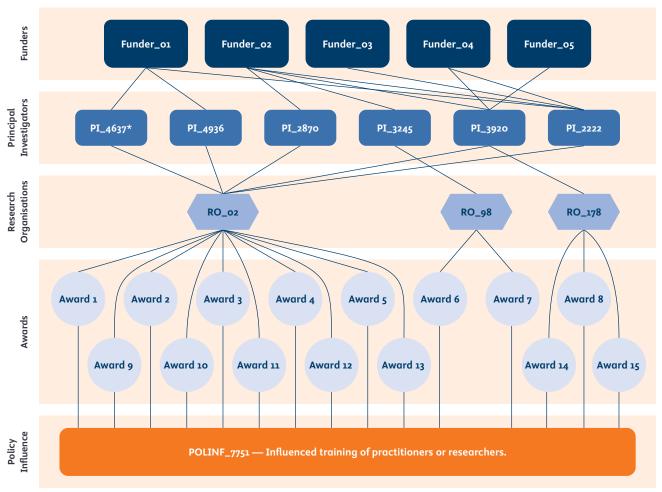
The key takeaway from this analysis is that each of the policy influences have multiple inputs from a range of different PIs who have affiliations with different funders and research organisations. As noted in Chapter One, an enduring challenge associated with research evaluation and assessment is the issue of attribution. That is; how do you relate funding to a specific impact? One of Researchfish's strengths is that it addresses this issue by making the award the unit of analysis and linking outcomes (and other characteristics such as funder and research organisations) to that. So, in being able to make these attributions it is revealing to see how complex and overlapping pathways to impact are in practice.

³¹ As with all the analyses in this report, studentships have been excluded.

Table 1: Examples of the relationship between different policy influences, funders, Principal Investigators (PIs), Research Organisations (Ros) and Awards

Policy Influence	Funders (N)	PIs (N)	ROs (N)	Awards (N)
POLINF_47120 Membership of a guideline committee	2	12	7	16
POLINF_7751 Influenced training of practitioners or researchers	5	6	3	14
POLINF_5419 Participation in a guidance/advisory committee	3	9	4	16
POLINF_23664 Citation in clinical guidelines	2	1	2	5
POLINF_19447 Citation in clinical guidelines	4	2	2	4
POLINF_10138 Citation in clinical guidelines	3	3	2	3

Figure 12: Schematic illustration of how various data elements in Researchfish can illustrate the way in which research influences policy



CHAPTER FIVE:

Concluding reflections

The data presented in this report demonstrate that the impact of UK research funding is large and diverse, with multiple pathways that contribute to research and wider society. The 3 million outcomes recorded by Principal Investigators of nearly 100,000 awards over the past 12 years support both the broader research endeavour, including through publications, and beyond academia, such as influencing policy and spinout companies.

There are two unique advantages to the data collected in Researchfish. The first is that it provides a view of the majority of publicly funded research activity in the UK (as illustrated in Figure 4, page 15). This complements other approaches, such as REF impact cases studies. As a result, it is possible to estimate the 'incidence' of impact. So, for example, we know that just under 400 spinout companies are formed each year arising from grants and fellowships from UK funders. The data is therefore validated between two sources — Researchfish and HESA. But uniquely with Researchfish data, we know that this occurs from 3% of research projects. Similarly, as noted in the previous chapter there are over 55,000 unique policy influences recorded in Researchfish, and these are concentrated in 18% of awards.

The second unique characteristic of Researchfish data is the ability to attribute inputs (funding) to impacts (outcomes). It is this linkage that then allows different groups of funders and universities to be compared and contrasted, as illustrated in Chapter Three. Here it is clear that different funders and universities have different outcome profiles illustrating the strength of plurality in the UK research system. For example, it is interesting how the charity/non-profit funders make a particular contribution to products and interventions, whilst the government funders are relatively stronger in influencing policy and practice. Similarly, the role that non-research-intensive universities play in generating creative products is clearly of importance to UK society in both economic and social terms.

It should be stressed, however, that Researchfish data provides one of many ways to track and analyse the characteristics of research impact. Whether through impact case studies, the tracking of research citations on policy documents or through the attribution of research awards to outcomes. Each approach has its own strengths and weaknesses and that is why it is important to take a multi-method approach to research impact assessment.32 Elsevier, the organisation which acquired Researchfish in 2022, has recently developed an Academic Evaluation Framework in collaboration with the global research community. This framework is intended to be used to support and enable improved research assessment practices; the details of the framework may be found in Annex F, page 39.

Whilst the strengths of Researchfish have been described above, as noted in the introduction there are limitations around self-reporting and the possible over or under-reporting of outcomes. However, when taken alongside other approaches to research impact assessment, it is possible to build up a nuanced understanding of how research, and specifically research funding, makes an indisputable contribution to the economy and society.

This is the first time that a detailed analysis of Researchfish data has been presented and published, and in doing so a limited number of analyses were selected. There are, clearly, other analyses that could have been chosen and these will be the focus of subsequent studies. As such, we are very interested in hearing views and reflections on this report as well as ideas for future iterations; we welcome such contributions! If you have any feedback or idea for future analyses, please let us know on RFInsight@elsevier.com.

³² Adams et al 2018

References

- Adam P et al. (2018). ISRIA statement: ten-point guidelines for an effective process of research impact assessment. Health Research Policy and Systems 16, 8. https://doi.org/10.1186/s12961-018-0281-5.
- Buxton, Martin and Steve Hanney. How Can Payback from Health Services Research Be Assessed? Journal of Health Services Research & Policy 1, 35 - 43. https:// journals.sagepub.com/doi/10.1177/135581969600100107
- Hanney S et al. (2003). The utilization of health research in policy-making: concepts, examples and methods of assessment. Health Research Policy and Systems 1, 2. http://www.health-policy-systems.com/content/1/1/2
- King's College London and Digital Science (2015). The nature, scale and beneficiaries of research impact: An initial analysis of Research Excellence Framework (REF) 2014 impact case studies. Bristol, United Kingdom: HEFCE. https://www.kcl.ac.uk/policy-institute.
- Lomas J (2005a). Using Research to Inform Healthcare Managers' and Policy Makers' Questions: From Summative to Interpretive Synthesis. Healthcare Policy 1(1), 55-71. https://www.ncbi.nlm.nih.gov/pmc/ articles/PMC2585236/
- Lomas J (2005b). Using research to inform healthcare managers' and policy makers' questions: from summative to interpretive synthesis. Health Policy Sep, 1(1), 55-71. https://www.ncbi.nlm.nih.gov/pmc/ articles/PMC2585236/
- Lomas J (2007). The in-between world of knowledge brokering. BMJ, 334, 129 https://www.bmj.com/ content/334/7585/129.

- Szomszor M and Adie E (2022). Overton: A bibliometric database of policy document citations. Quantitative Science Studies 2022; 3 (3), 624-650. https://direct.mit. edu/qss/article/3/3/624/112760/Overton-Abibliometric-database-of-policy-document
- Morgan Jones M & Grant J (2013). Making the Grade. Methodologies for Assessing and Evidencing Research Impact. 7 Essays on Impact. DESCRIBE Project Report for Jisc. University of Exeter / Dean et al. (eds.) (Exeter, UK: University of Exeter, 2013), p. 25-43. https://www. rand.org/pubs/external_publications/EP50298.html
- Oliver K et al. (2014). A systematic review of barriers to and facilitators of the use of evidence by policymakers. BMC Health Services Research, 14:2. https://bmchealthservres.biomedcentral.com/ articles/10.1186/1472-6963-14-2
- Research Councils UK (2006). Report of the Research Councils UK Efficiency and Effectiveness of Peer Review Project. Swindon UK: Research Councils.
- Smith et al. (2020). The Impact Agenda. Controversies, Consequences and Challenges. Polity Press, Bristol.
- Wooding et al. (2009). Mapping the Impact: Exploring the Payback of Arthritis Research. RAND Europe, Cambridge (MG-862-ARC). https://www.rand.org/ pubs/monographs/MG862.html

ANNEX A:

The History of Researchfish

2008

RAND/ARC Impact Scoring System (RAISS)

RAND and the Arthritis Research Campaign develop a tool to map and analyse the returns and outcomes associated with their funding, building an initial outcomes categorisation. https://www.rand.org/pubs/ monographs/MG862.html

2009

Users able to use searchers within system to enter information.

To reduce the time taken to report, and increase accuracy of the data collected, RF introduced functionality to enable users to access/search existing databases and transfer the data to their RF return, this began with publications, but today this is done in 12 of the 16 sections.

Outputs Data Gathering Tool (ODGT)

The MRC developed and launched an early prototype system to collect information directly from researcher on the outputs, outcomes and impacts of the research funded by MRC, to better enable them to understand and track the activities and impact from the research funded. This new system replaced the previous 'Achievements' and 'Publications' exercises and planned to replace final reports too in due course.



Using the learning from all aspects of the ODGT (e.g. the system, processes, data collected and so on) a more robust system called MRC eVal was developed with third party software developers Firmstep. The first collection period gathered information in time for use in the 2010 government spending review.

2015

First international clients

Universities able to upload data on behalf of researchers

Functionality was introduced to enable research organisation to upload outcomes (which have unique identifiers and a link to an award reference) on behalf of researchers to reduce the need to report in two places.



Acquired by Interfolio

Interfolio provide a suite of products which have served the academic community for over 20 years putting the researcher first.

2010

CSO eVal, STFC eVal & WT eVal

Multiple organisations approached the MRC (and Firmstep) to obtain their own version of MRC eVal, and three other versions were developed. Each had a lot of similarities but also some subtle differences in the questions asked, and the processes followed.

2011

Federated system pilot and Researchfish Ltd established.

Pilot of a 'federated' version of eVal with 10 biomedical funders, to test the feasibility for one researcher could report to multiple funders at the same time. Following this Researchfish Ltd was established as a spin out from Firmstep.

System harvests and prepopulates data for researchers.

RF started harvesting data from systems such as PubMed and entering this into RF on behalf of the researcher, we now harvest from many different sources covering publications, datasets, software, audio, video, and images.



Researchfish system launched

The Researchfish platform was launched, and initially used by approximately 18 funding organisations.



UKRI start using RF

The remaining UK research councils (UK Research & Innovation) moved to join MRC and STFC in using the Researchfish platform. The question set was also developed and expanded to cover all disciplines, enabling all funders to use a single common question set.



Acquired by Elsevier

Natural fit with Elsevier to enable the research community to gather high quality, structured and rich data, and the provision of analytics to enable decision making.

Today

75 funders 75 subscribing research organisations(75 non-paying ones) 40 international clients 130k awards 120k researchers using the system £60bn of funding tracked

ANNEX B:

Estimating the Coverage of Researchfish in the UK

HESA data³³ was used to estimate the coverage of grants and fellowships

in Researchfish, as summarised in the table below. For each line of all 'research grants and contracts' finance data from HESA, an estimate Researchfish coverage was made. Note all

non-UK funding (eg lines 8 onwards from the analysis) was removed to estimate coverage of around 76%. That is $\pounds 4,136,423/\pounds 5,464,385 = 76\%$.	Thousands (£)	Estimate percentage of value captured in Researchfisl	Value of data captured in Researchfish (
1a Biotechnology and Biological Sciences Research Council (BBSRC)	223,445	100%	223,445
1b Medical Research Council (MRC)	524,849	100%	524,849
1C Natural Environment Research Council (NERC)	163,209	100%	163,209
1d Engineering and Physical Sciences Research Council (EPSRC)	739,446	100%	739,446
1e Economic and Social Research Council (ESRC)	190,900	100%	190,900
1f Arts & Humanities Research Council (AHRC)	91,997	100%	91,997
1g Science & Technology Facilities Council (STFC)	139664	100%	139,664
1h UK Research and Innovation	98,821	70%	69,175
ıi Other	184,754	20%	36,951
2 UK-based charities (open competitive process)	1,146,585	80%	917,268
3 UK based charities (other)	149,702	80%	119,762
4 UK central government bodies/local authorities, health and hospital authorities	1,312,816	70%	918,971
5 UK central government tax credits for research and development expenditure	1,634	0	-
6 UK industry, commerce and public corporations	417,932	0	-
7 UK other sources	78,631	1%	786
Total UK	5,464,385		
8 EU government bodies	676,526		-
9 EU-based charities (open competitive process)	10,863		-
10 EU industry, commerce and public corporations	114,397		-
11 EU (excluding UK) other	49,977		-
12 Non-EU-based charities (open competitive process)	185,144		-
13 Non-EU industry, commerce and public corporations	204,444		-
14 Non-EU other	262,299		-
Total Other	4,610,950		
Total	6,968,035		4,136,423

³³ https://www.hesa.ac.uk/data-and-analysis/finances/table-5

ANNEX C:

Methodological Notes and FAQs

Data Selection

The data used in this report is based on first defining a set of awards, and then looking at the outputs attributed to those awards.

Which awards are in scope?

The data used in this report is limited to funders geographically based in the UK, using funding (awards) with a start year between 2012 and 2023. The data excludes any awards classified by those funders as being studentships as these typically do not have any funding information tracked, have policies which make reporting outputs non-mandatory, and include few outputs when reports are made. The remaining award classifications included in the data are Capital/infrastructure (including equipment), Fellowship, Research grant (including intramural programme), Travel/small personal, and Other.

When was the data pulled?

The report uses "live" data as of October 2023. This includes 96,734 awards. Note that in the future funders could add new awards within the 2012-2023 time span by backfilling awards and new funders joining RF might also choose to add awards within this time period. Other funders might leave RF and their data would be removed as part of the off-boarding process.

Which outputs are in scope?

The 96,734 awards have ~3.6 million attributions to ~2.5 million unique entries that are common outcomes as of October 2023. There are additional funder specific outcomes that are attributed to these awards, but they are out of the scope of this report.

How is uniqueness determined for outputs?

Researchfish is designed to enable researchers to very easily enter and reuse information, when reporting to the many funders. This enables a very good understanding of the connections between funding and different outputs. It is not uncommon for a single output (entry), e.g. a publication or policy influence, to be linked (attributed) to more than one award. An output is unique at the level of the award, but in any group of awards a single entry may be attributed to more than one award.

In Researchfish there is a strong focus on unique identifiers, e.g. DOIs which enables unambiguous identification and deduplication. However Researchfish also enables users to collaborate and share outputs when they have been working on something jointly. This means that even if an output has no external unique identifier, internal unique identifiers can be used to understand where an output has been shared. For example in Figure 11, page 26, the policy influence has no DOI or equivalent but has been created by one person and shared between all of the people working on those awards. In reality there may be the same output reported using different words and not shared in Researchfish as well, or other awards contributing to the same output that are outside of Researchfish.

If the outcomes are unique, why do the numbers change throughout the report?

In this report there are a number of different analyses at different levels of aggregation, e.g. the whole group level, the individual award level, the funder sector level, the KEF cluster level, the reporting year level, etc. The analysis focuses on uniqueness at each of these levels of aggregation, which may differ. For example one single publication could be attributed to 4 different awards (1 publication at the level of the whole group, 4 attributions at the level of the individual awards). In the analysis on KEF clusters each of those awards might be in a different KEF cluster, so would count as 1 publication in each cluster, but if 2 of the awards were in the same KEF cluster it would only count as 1 publication in that cluster to avoid double counting. The goal is to only ever to count the publication once at any level of aggregation.

How is uniqueness determined for people?

A single person may receive funding from many different funding organisations, and each of those organisations might have a different person record for them (name, email address, identifier). In Researchfish each of those organisations would generate an invitation for "their" PI, which would then be accepted by the PI and connected to their Researchfish account. This builds a connection between the person record in each of the funders' systems and the single user in Researchfish. Some people have multiple accounts in Researchfish but generally if they are created then they are consolidated as it is more convenient for the PI to enter information once into one account, than to re-enter it across multiple accounts.

ANNEX D:

Summary of attributions by Common Outcome Type for all UK non-studentship agreements, year of attribution

Outcome type	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Publications	13,726	22,633	184,719	38,526	115,586	184,990	119,990	119,052	124,380	109,881	155,679	136,175	1,325,337
Collaborations & Partnerships	6,950	5,490	22,907	1,501	14,755	19,068	19,861	14,905	17,316	18,837	18,830	20,807	181,227
Further Funding	6,811	4,159	21,076	1,714	14,002	18,416	18,927	17,035	16,420	16,133	18,945	18,491	172,129
Next Destination	3,527	1,787	21,938	603	6,401	10,253	8,890	10,069	9,502	8,739	11,061	11,031	103,801
Engagement Activities	7,779	7,837	50,520	6,787	51,933	65,769	71,535	75,890	73,259	60,269	72,541	76,933	621,052
Influence on Policy, Practice, Patients & the Public	1,985	1,543	3,742	714	4,409	6,194	6,794	6,664	6,674	7,964	8,746	9,496	64,925
Research Tools & Methods	3,661	1,223	2,912	278	2,385	3,751	3,375	3,396	3,630	3,594	3,635	2,952	34,792
Research Datasets, Databases & Models			3,532	210	2,365	2,777	3,725	4,901	3,300	6,075	8,059	5,738	40,682
Intellectual Property & Licensing	638	277	2,077	43	789	972	827	891	888	800	638	715	9,555
Medical Products, Interventions & Clinical Trials	670	641	625	79	648	624	549	506	594	508	639	532	6,615
Artistic & Creative Products			3,892	112	1,547	1,462	1,679	1,534	2,085	2,001	5,127	5,604	25,043
Software & Technical Products			2,058	111	1,417	1,628	1,620	1,496	1,507	1,809	1,852	1,957	15,455
Spin Outs	177	125	489	11	370	292	264	338	369	343	381	294	3,453
Awards & Recognition	14,450	9,710	20,835	1,886	19,612	23,366	24,276	26,129	23,606	17,500	21,093	21,151	223,614
Other Outputs/Outcomes	2,380	1,056	3,329	546	3,555	4,648	4,518	4,580	4,817	4,598	5,632	6,268	45,927
Use of Facilities & Resources	1,083	793	2,546	147	2,152	2,325	2,134	2,152	2,501	1,943	2,283	2,229	22,288

The above table shows the number of attributed entries unique at the level of year of attribution. This means that there is double counting if a single entry is attributed to awards in more than one calendar year. This is a table that shows the behaviour of reporting rather than the year that the outcome took place. The biggest change can be seen in 2014, when a number of large organisations had their first submission period using Researchfish, followed by a gap of just over a year as UK shifted from most submission periods being held in the autumn to February-March, leading to a steep fall in

attributions during 2015, and then a large rise in 2016 coinciding with the submission periods. Whilst there are submission periods held by different organisations every day of the year, the majority of UK reporting and submission activity takes place in the February-March of each year since 2016.

Although some of the outcome types are relatively infrequent, it is important to acknowledge that they are not unimportant not least as their frequency may be a product of relative funding.

ANNEX E:

Alternative representation of outcome wheels

Figure C7: Outcome wheels for government and charity/non-profit funders

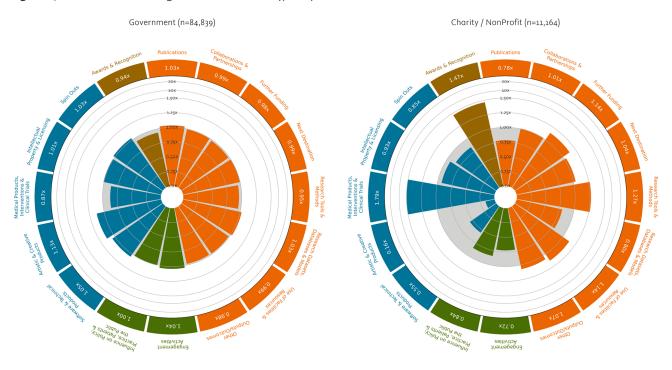
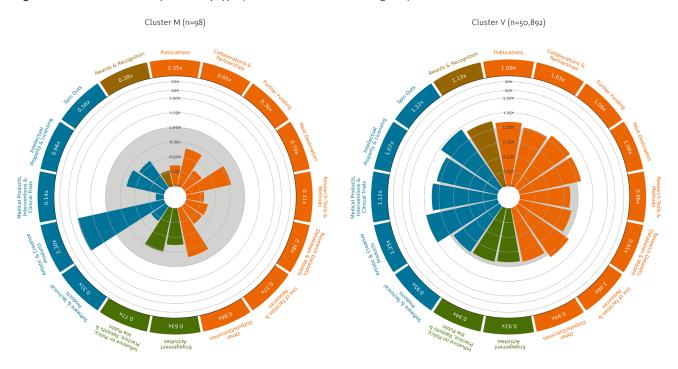


Figure C8: Outcome wheels by university type (based on KEF clusters in England)³⁴



³⁴ See Box 1 for description of cluster groups.

Figure C8: Outcome wheels by university type (based on KEF clusters in England)



Cluster X (n=10,735)

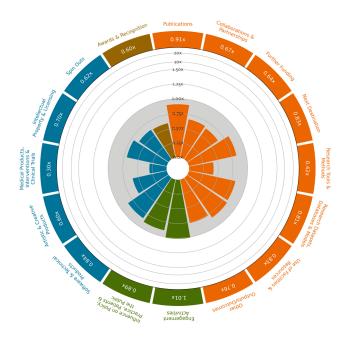


Figure C8: Outcome wheels by university type (based on KEF clusters in England)



ANNEX F:

Elsevier Academic Evaluation Framework

To identify the areas most vital to academic evaluation, Elsevier conducted an extensive international listening tour in 2023. Insights gained were used to draw up this proposed high-level framework for holistic evaluation based on five pillars: Resources, Education, Knowledge Creation Process (Throughput), Knowledge Created (output) and Outcomes & Impacts. The five pillars capture the five key areas that academic leaders and heads of funding bodies from 18 countries told us they want to see addressed.

The community expressed that it needs a range of concepts, practices and indicators that can be selected based on the research being evaluated, whether it is personal or institutional evaluation, geographical location, and other factors. The next step will be to work collaboratively on developing meaningful indicators that support the areas shown in each of the framework's five pillars. Progress in this area is going to require an upgraded toolbox of qualitative and quantitative approaches. Advanced technologies and processes that extract and analyse data at scale will also play an important role.

Academic Evaluation **RESOURCES** Framework **HUMAN CAPITAL FUNDING EQUIPMENT OVERVIEW FACILITIES** CAPABILITIES

ALWAYS USE A COMBINATION OF QUANTITATIVE AND QUALITATIVE INDICATORS ALONG WITH PEER JUDGEMENT. POSITIVE OUTCOMES AND IMPACT CAN LEAD TO INCREASED RESOURCES, SUPPORTING FURTHER RESEARCH AND EDUCATION ACTIVITIES.



RESEARCH **PROCESS CREATED**

I&D

VERIFICATION & REPRODUCIBILITY

OPEN SCIENCE

SUSTAINABILITY

RESEARCH PRACTICES

MULTI-INTERDISCIPLINARITY

RESEARCH

EDUCATION

KNOWLEDGE EXCHANGE

EDUCATION

TEACHING QUALITY

STUDENT DEMOGRAPHICS

LEARNING ENVIRONMENT

PROCESS

RESEARCH

QUANTITY

EXCELLENCE

COLLABORATION

INNOVATION

CAPABILITIES

COMMERCIALIZATION

OUTCOMES AND IMPACT

CULTURAL

ECONOMIC

ENVIRONMENTAL

HEALTH

POLITICAL

SOCIETAL

TECHNOLOGICAL

I&D OF STUDENT BODY RESEARCH OUTPUT

STUDENT SELECTION **EQUITY**

LEARNING GAINS

CAREER READINESS

EDUCATION

STUDENT GRADUATION

OUTPUT

SUSTAINABILITY

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