

“The capture and analysis of research outputs”

Member Organisation Forum on Publicly Funded Research
Working Group on “Comparative Research Portfolios”

Working Document
May 2011

Contents

Executive Summary	3
1. Background	4
1.1. Key considerations for the capture and analysis of research outputs	4
1.2. "People or Projects" What is the unit of analysis?	4
1.3. Sourcing data from researchers, research organisations or repositories?	5
1.4. Frequency/Timing of data collection	5
1.5. Definition of outputs	5
1.6. Attribution	5
1.7. Collect what is useful for evaluation	6
1.8. Sanctions and incentives for capturing the data	6
1.9. Analysis of output data	6
2. Workshop presentations	7
2.1. ARUK implementation of the RAISS tool (Lisa Croucher, Arthritis Research UK)	7
2.2. NIHR output collection programme (David Kryl National Institute for Health Research (NIHR), UK Department of Health)	10
2.3. MRC e-Val programme (Beverley Sherbon MRC)	12
2.4. STFC e-Val (Isobel Climas, Science and Technology Facilities Council, STFC)	14
2.5. Collection of output data in Switzerland (Katrin Milzow, Schweizerischer Nationalfonds (SNF))	15
2.6. Collection of output data by the HRB in Ireland (Brendan Curran, HRB)	16
3. Summary of Discussion from Workshop Session 2	18
3.1. Policy Issues	18
3.2. The types of output/outcome/impact to be collected	18
3.3. Process for collection	19
3.4. Approaches for analysing output	19
Annex 1: Session 2 Presentation Slides	21
Annex 2 – Acknowledgements	22

Executive Summary

As Governments take tough decisions about the priorities for deploying public funds, there is significant interest in approaches to ascertain and analyse the return on investment from research. A crucial element of making the case for investment in research is understanding what this investment has in the past, and is currently, delivering.

Research funding and research performing organisations are interested in capturing information about the progress, productivity and quality of research, and there are important policy and practical issues regarding whether this information can be captured from existing sources or whether systems have to be established to gather it prospectively. Once this information is gathered there are also challenges to analysing and presenting quantitative and qualitative data in order to better understand what leads to, and the extent of, academic, societal, and economic impact.

This report summarises the discussions of an ESF members organisation forum working group aimed at exchanging expertise and experience in this area. This is initial work, and the intention is to continue to develop this in order to understand and contribute to a quickly developing field.

The report highlights several significant points:

- There are a number of policy issues in this area, most importantly the need to minimise the administrative burden on researchers in order to maximise the time spent on front-line research.
- The types of output/outcome/impact to be collected is an area of active discussion. Although there is substantial agreement between organisations over established metrics such as publications and patents, there is a need for more effort to capture outputs that are more difficult to quantify, but give a more holistic picture of research output (such as influences on policy and practice).
- The process for collecting output information. Organisations are planning and implementing different practices for the collection of this information, and some of the advantages and drawbacks of these are discussed.
- Approaches for analysing output. As research organisations develop more consistent and rich datasets on research output better methods to track, visualise and assess the significance of this data are needed.

1. Background

A number of organisations within the ESF Member Organisation (ESF MO) Forum on "Evaluation of Publicly Funded Research"¹ established a working group² to exchange experience and expertise on the analysis of information about their research portfolios and also on the collection and analysis of output data. After preliminary discussion of this area at the ESF MO Forum meeting in Slovakia (November 2010), the working group agreed to meet with a wider set of representatives from research organisations in London (December 2010).

Discussion within the working group highlighted that all participating research funding and performing organisations were interested in the capture and analysis of information about research output. This information was used by research organisations to:

- communicate the benefit of research funding to external stakeholders. For example to help build public and policy maker support for the public funding of research.
- provide an evidence base for strategy development, and support internal processes for learning about the research system.
- support partnership working and collaboration. Establishing benchmarks in order to determine what "good" performance is.

It was emphasised that while it is an aspiration to compare progress with other research funding and research performing organisations, in reality the interventions to support research used by different organisations are likely to be different enough to make benchmarking difficult. Comparisons therefore are more likely to examine the merits/drawbacks of various strategic approaches, provide a detailed evidence basis for discussion about the productivity, quality and stage of development of research, and provide the potential for testing hypotheses about what leads to impact.

The working group identified a number of key considerations for the capture and analysis of research outputs.

1.1. Key considerations for the capture and analysis of research outputs

Working group members identified a number of processes that were important to examine in sharing experiences about the capture and analysis of research outputs.

1.2. "People or Projects" What is the unit of analysis?

The US STAR METRICS programme³ aims to establish an information infrastructure in which all those involved in research are represented. Information about all inputs and subsequently data on output will be added to this framework. This approach "follows" the people in the research system ("actors"), other inputs such as project/programme funding are treated as interventions causing the actors to be more or less productive. This approach requires

¹ ESF MO Forum on Evaluation of Publicly Funded Research <http://www.esf.org/activities/mo-fora/evaluation-of-publicly-funded-research.html>

² ESF MO forum on evaluation Working Group current membership: Brendan Curran (Ireland, Health Research Board), Katharina Fuß (Germany, DFG) Iveta Hermanovská (Slovakia Academy of Sciences), Katrin Milzow (Switzerland, Schweizerischer Nationalfonds), Jenny Nordquist (Sweden, Swedish Research Council), Ingrid Roxrud (Norway, The Research Council of Norway), Ian Viney (UK, Medical Research Council), Rafael de Andrés Medina (Spain, Instituto de Salud Carlos III)

³ STAR METRICS - Science and Technology for America's Reinvestment: Measuring the Effect of Research on Innovation, Competitiveness and Science, is a multi-agency venture led by the National Institutes of Health, the National Science Foundation (NSF) and the White House Office of Science and Technology Policy (OSTP) <https://www.starmetrics.nih.gov/>

significant investment in a national information framework to join up data held by universities and funding agencies.

Many research funding and research performing agencies have chosen to seek information on output, primarily capturing this directly from researchers or existing repositories, taking the shortest route to capturing information on outputs and impacts. While this data may be linked to information on principle investigators or other management information about staff supported by research funding, data about all the actors in the research process may not be captured. This approach largely follows project/programme funding, seeking to link outputs to these funding inputs. This approach can be taken without the need to establish a new information framework on the whole workforce, but may lack the information needed to fully understand the return on investment.

1.3. Sourcing data from researchers, research organisations or repositories?

Ideally data should be provided/captured from researchers once and once only, and then widely shared. Research funding and research performing organisations are acutely aware of the need to minimise the administrative burden on the research community. If data is captured routinely by research organisations (for instance for the purposes of performance management or communication), or provided to repositories (e.g. in the case of publication datasets such as PubMed⁴), then it is preferable to source this information from these repositories.

1.4. Frequency/Timing of data collection

Information on output is often collected via final grant reports, the advantage being that this is an established part of the grant management process. The disadvantage is that this collects a snapshot of information at the end of the tenure of the grant, prior to some outputs being realised.

Information may be captured on an ongoing basis throughout the lifetime of the grant and beyond. Issues include how long information should be collected after the completion of the award, whether information should be able to be submitted at any time, or annually etc.

1.5. Definition of outputs

Research outputs, as the products generated from research, include the means of evidencing, interpreting, and disseminating the findings of a research study.

A holistic approach should be taken to research outputs, seeking to capture output beyond papers and patents (including research materials created, dissemination activities other than publication etc.). Categorisation of these research outputs is a large topic. Across disciplines there may be many types of output, but it may be possible to determine a manageable core set of output types for science, technology, engineering and medicine (STEM) subjects.

1.6. Attribution

It is acknowledged that due to the lag times between inputs and impact it is difficult to accurately attribute output. With the STAR METRICS approach the capture of all input and all outputs means that attribution, the linkage of outputs to specific inputs/sets of inputs, may not be necessary. In other approaches involving following project and programme investment there may be some general principles regarding attribution:

⁴ www.ncbi.nlm.nih.gov/pubmed/

- do not apportion output (do not try to measure the relative contribution of different inputs)
- broadly aim to attribute all output to all funding inputs active in a reasonable timeframe

1.7. Collect what is useful for evaluation

Check with the research community to ensure that the data collected appears reasonable, and the questions used to gather it are comprehensible. Capture only data that will be used, so that those providing it see the benefit. Ensure good logic models are in place for evaluation programmes, so that collection of each data item can be justified.

1.8. Sanctions and incentives for capturing the data

To encourage the submission/collection of output data, research funding and research performing organisations will need to put in place appropriate incentives and sanctions. Those used by the organisations represented in the working group include:

- Communicating clearly the need for comprehensive, accurate and timely information on the outputs of research funding to the research community and asking for their support.
- Securing support from researcher's employing institutions, such as Universities.
- Putting research funding on hold for non-compliant researchers.
- Removing eligibility for research funding from non-compliant researchers.

Clearly there needs to be processes in place for these sanctions to be lifted. For research funding organisations thought needs to be given to whether sanctions should be applied at the level of the individual researcher, or their host institution.

1.9. Analysis of output data

It is important to, where possible, have measures in place to assess the quality of output (e.g. citation impact for papers, and information about the licensing of patents). Wherever possible these "quality factors" should be derived for output data, research funding and performing organisations should not rely on volume of output. Counting outputs tends to provide perverse incentives (e.g. "salami" slicing research findings into a number of papers, when a single paper would have more real impact). It is also important to have processes for the quality assurance/validation of data provided. Outputs should be evidenced/referenced, where possible allowing data to be checked.

2. Workshop presentations

The second workshop of the ESF MO Forum on Evaluation of Publicly Funded Research took place in Smolenice 29-30 November 2010. During the working sessions the Working group on Classification of Research Portfolios discussed and summarised experiences of capturing and analysing research output, and how this information has been used to develop strategy. For this purpose the Working group has drafted a survey to be circulated to MOs and other Organisations.

The group held a follow up meeting on the December 2010 in London, attended by 16 representatives from funding organisations. The second session of this meeting was focused on the capture and analysis of output data

2.1. ARUK implementation of the RAISS tool (Lisa Croucher, Arthritis Research UK)

Arthritis Research UK (ARUK, formerly the Arthritis Research Campaign) aims to improve the lives of people with arthritis by funding high quality research into the cause, treatment and cure of arthritic conditions; translating the outcomes of that research to benefit patients; educating health professionals and providing information on arthritis to the general public. In 2008/09 ARUK spent £25m (€28m) on research⁵.

In 2006 RAND Europe⁶ were commissioned by ARUK to examine the payback from ARUK funded research. 16 case studies were analysed focussing on research funded by ARUK in the 1990s. The work built upon the payback framework first set out by Buxton and Hanney in the mid 1990s. The results were published as "The Returns from Arthritis Research (2004)"⁷.

The RAND/ARC Impact Scoring System (RAISS) was developed from this work around 6 of the payback criteria. Development of the tool is described in the report "Mapping the Impact (2009)"⁸. RAISS is an online questionnaire which ARUK has used to replace the written end of grant report, it presents researchers with a list of approximately 160 yes/no questions to record outputs and outcomes, and it has been shown that researchers take between 1 and 2 hours to complete the questionnaire.

Researchers are asked to fill out RAISS five months after the end of a grant, and their return must be completed and submitted within one month. A permanent file of the completed questionnaire, once approved, is made available to the researcher. If the report is not completed, then new applications from that researcher are deferred. RAISS is deployed via ARUK's electronic grant application system (ARUK grant tracker) and data from RAISS is matched to finance and other data held in the ARUK grant management system.

Developments under consideration for 2011 include:

- RAISS as tool for collection of grant-specific bibliometric info. ARUK are examining an interface with UK PubMedCentral⁹ and the opportunities that this will provide to link publications with the funding that led to these outputs.

⁵ ARUK annual report 2008/09

<http://www.arthritisresearchuk.org/pdf/Arc%20Annual%20Review%202008%2009.pdf>

⁶ RAND Europe is an independent not-for-profit research institute whose mission is to help improve policy and decision-making through research and analysis. <http://www.rand.org>

⁷ Wooding, Steven, Stephen Hanney, Martin Buxton and Jonathan Grant. The Returns from Arthritis Research Volume 1: Approach, Analysis and Recommendations. Santa Monica, CA: RAND Corporation, 2004. <http://www.rand.org/pubs/monographs/MG251>

⁸ Wooding, Steven, Edward Nason, Tony Starkey, Stephen Hanney and Jonathan Grant. Mapping the impact: Exploring the payback of arthritis research. Santa Monica, CA: RAND Corporation, 2009. <http://www.rand.org/pubs/monographs/MG862>

⁹ More information about UK PubMed Central can be found at <http://ukpmc.ac.uk>

- Annual RAISS follow up of grants. The prospective and annual tracking of progress may allow the capture of developing impacts.
- Mapping RAISS data to HRCS?

The information collected by the RAISS supports ARUK's research evaluation programme. The initial aim was to try to understand research, and pathways to impact, better. ARUK's current strategic plan highlights the need to bridge the gap between the aspirations of people affected by arthritis and what research has delivered so far.

Information from RAISS has been used to:

- Help communicate the benefits of ARUK funding, providing evidence that is included in publicity information and for the ARUK website, patient publications and the Annual Research Review (2011)
- Audit ARUK activity (c.f. Annual report)
- Support fundraising (e.g. from charitable trusts, via appeals for funds etc.)

Most importantly information from RAISS has triggered thematic reviews of ARUK research. Where significant outcomes are identified via RAISS additional information is requested from researchers, and this is reviewed by experts. Findings may help develop individual research programmes or contribute to wider strategy development.

In summary RAISS has provided a rich source of information for ARUK to more fully understand the output from its research. Evaluation has yet to reach down to the level of individual funding applications, but RAISS is a quick way of identifying projects and programmes which should be highlighted as particularly productive or with output of a specific type. The data is used as a "stepping off point" to more in depth analysis. The wider role that this information has in shaping strategy development is still evolving.

Discussion points:

- 2.1.1. Attendees discussed the benefits of quantitative and qualitative data. Although most of the questions in RAISS are useful for quantitative analysis (for example producing a plot of types of output realised across the portfolio) the survey also collects a lay and a scientific summary of the work that has been undertaken, and a description of the main impacts. In addition researchers are prompted to add additional text in some of the sections.
- 2.1.2. ARUK had taken care to introduce a system with the aim of not adding substantially to the administrative burden on researchers. Monitoring of the time taken by researchers to fill out RAISS has determined that this usually takes 1-2 hours. Attendees noted that the actual burden on researchers was difficult to quantify, but that the time taken to fill out the survey would be an under-estimate of this. Researchers would take time offline to collate the information needed for the survey, although the questions in RAISS were very straightforward to respond to.
- 2.1.3. Attendees noted that timing of such surveys was an issue under discussion in several research organisations. Issues included whether this information should be collected throughout the tenure of funding and beyond, or should data collection start after the award has finished? There was agreement that funded work needed to be followed up for a number of years given that there is a significant lag time between research and output. However there was no firm data to support proposals for the length of time that this follow up should continue. Some suggested that research organisations should inform funders when there was no longer any expectation of further output, and this should be the signal to stop follow up.
- 2.1.4. Should data collection be an annual exercise during a limited data gathering window, or should systems be open for input and editing all year? There was discussion of the

practical consideration of wanting as near complete data from the research community at regular intervals (e.g. annually) for reporting purposes, and the flexibility and timeliness of capturing feedback at any point in the year.

- 2.1.5. All research organisations were interested in publication output. In the field of health research funding organisations benefited from the comprehensive PubMed¹⁰ database, which provides searchable abstracts and bibliographic information for around 19 million publications. However funding agencies are interested in analysing the properties of (such as citations to) papers which arose wholly or in part as a result of their funding. Acknowledgement of contributions from funding agencies within research papers is inconsistent despite efforts to encourage standard approaches¹¹. In addition, access to full journal articles for more detailed analysis continues to be a problem despite widespread initiatives to encourage open access, such as UKPMC¹². However it is likely that over time organisations will increasingly be able to draw information they require about health research articles from central repositories, rather than need to collect this directly from researchers.
- 2.1.6. Attendees also discussed the objectives for evaluation programmes. It was agreed that these usually focussed on improving the evidence available for a number of key activities. These might cover advocacy (improving the communication of the benefits of medical research), strategy development and decision making, as well as contributing to a better understanding of the research system (particularly processes leading to impact).

¹⁰ PubMed is a service provided by the US National Library of Medicine and is accessed at <http://www.ncbi.nlm.nih.gov/pubmed/>

¹¹ The UK research information network published guidance on the acknowledgment of funders in journal articles in 2008, further details can be found here <http://www.rin.ac.uk/our-work/research-funding-policy-and-guidance/acknowledgement-funders-journal-articles>

¹² UK PubMed Central is an archive of life science journal literature supporting open access to this information and can be accessed at <http://ukpmc.ac.uk/>

2.2. NIHR output collection programme (David Kryl National Institute for Health Research (NIHR), UK Department of Health)

The National Institute for Health Research (NIHR) provides the framework through which the UK Department of Health can create a health research system in which the NHS supports outstanding individuals, working in world class facilities, conducting leading edge research focused on the needs of patients and the public. The NIHR budget for 2010/11 is £992m (€1.1 billion).

NIHR has implemented a system to collect output data based on RAISS, with some extension to provide information of specific relevance to NIHR. RAISS has been used with success by ARUK in the UK, and piloted by the Institute of Musculoskeletal Health and Arthritis (IMHA) in Canada¹³.

NIHR's research management is largely outsourced so there are multiple systems and processes in place for managing award information across the NIHR portfolio. End of grant reports, and in some cases annual reports are required from all NIHR award holders, but the format of these vary from scheme to scheme. It was important to NIHR to maintain these processes, and obtain the best from them. The NIHR RAISS system provides a way of indexing these reports and collecting feedback from researchers, thereby linking all available information on output. Principal investigators are asked to report outputs arising from NIHR funding and then this data is used to locate further details in the formal grant reports – referred to as a "table of contents" concept. Reporting on the type of outputs realised can be undertaken from the RAISS system providing a picture of the diversity of research output across the portfolio.

One new development introduced by NIHR to the RAISS system is the creation of a two-stage "survey centre" for managers/Directors of NIHR funded centres. This allows more detailed information about the networks of researchers with collaborative links to NIHR Biomedical Research Units, Centres, Schools and Clinical Research Facilities to be gathered. These are large multi-disciplinary groups of programmes, which may be substantially funded by other agencies, and represent a substantial proportion of NIHR investment.

The system has been piloted in May 2010, and full implementation will be underway in November/December 2010. The expectation is that the process becomes an annual activity, with follow up annually up to 5 years after awards have terminated.

Discussion points:

- 2.2.1. Attendees noted that, with the multiplicity of funding sources in health research, linking inputs to outputs was a difficult issue. It was suggested that comment on the contribution of various inputs to particular outputs was most appropriately left to researchers. Overall it was noted that trying to determine the relative contributions of particular inputs was likely to be impossible, and so encouraging credit to be given to all funding agencies involved may be acceptable, and possibly the only workable approach.
- 2.2.2. NIHR indicated that output information may be used to evaluate individual grants. Attendees noted that this was an issue of natural concern to researchers, and funding agencies had to set out clearly to the research community how output information may be used.
- 2.2.3. Attendees raised the issue of changing researcher behaviour. The information sought by funding agencies sends a signal to researchers about the processes that funding agencies value. It was also noted that if data about the productivity of researchers is introduced into the peer review of future applications for example, without good

¹³ Wooding, Steven and Tony Starkey. Piloting the RAISS tool in the Canadian Context. Santa Monica, CA: RAND Corporation, 2010. http://www.rand.org/pubs/working_papers/WR749 .

processes for validating this information, there would be a strong incentive for researchers to over-state their output.

2.2.4. It is possible to validate some output data against other data sources (for example publications and patents). In the NIHR case, this is supported by the fact that most information should be present in detail within formal reports signed off by the investigator.

2.2.5. NIHR intends to compare the outputs captured with original proposals. It was of interest to examine whether successful outcomes corresponded to the plans set out in applications, or the extent to which unexpected or unintended output arose

2.3. MRC e-Val programme (Beverley Sherbon MRC)

The Medical Research Council (MRC) is a publicly-funded organisation dedicated to improving human health. The MRC supports research across the entire spectrum of medical sciences, in universities and hospitals, in its own units, centres and institutes in the UK, and research units in Africa. In 2008/09 the MRC spent £704m (€794m) on research.

MRC e-Val is an online system for collecting outputs, outcomes and impacts from MRC funded researchers. The system was piloted in 2008, and the full system launched in 2009. A significantly improved version was launched in 2010.

The system collects information about output arranged around 12 standard question sections which were developed in conjunction with data providers as well as data users. The system supports the input of highly structured quantitative and qualitative data by using drop down menus, predictive look ups, radio buttons etc. The approach is to replace the depth of information available in final grant reports, by collecting specific details on all evidenced outputs which fall into the 12 categories in e-Val.

The MRC has removed the requirement for final grant reports from its grant holders, and moved to gathering output data via MRC e-Val. Review of the final grant process showed that depending on the scale and duration of award researchers could take 1-2 days to write their final grant report, whereas completion of MRC e-Val took several hours.

Data is collected during an annual exercise and is held at the award level so the data can be aggregated up for analysis and joined with other management information held against each award (e.g. HRCS coding).

Data is available to the researchers (who retain the ability to read and export their reports from the database outside of data gathering periods), and is specifically returned to research organisations so can be used in other processes such as the Higher Education Funding Councils Research Excellence Framework (REF)¹⁴.

Completion of MRC e-Val is mandatory for all MRC funded researchers (grants, fellowships and Unit/Institute programmes) and in 2010 the MRC sought information from over 2800 researchers relating to 3600 awards that had been held since 2006. Detailed feedback on over 92% of MRC's science expenditure was collected.

MRC is working to use e-Val information to replace standard data in its processes for review of MRC Units and Institutes as well as the review of MRC/University Centres.

The evidence base is now being embedded in MRC processes and used extensively for strategy development, communication and evaluation.

Discussion points:

2.3.1. Attendees discussed linkage to UKPMC. Researchers can identify their publications and add acknowledgement of the funding sources in UKPMC, so ideally output collection systems would exploit this functionality and encourage use of this open access repository for research articles. MRC did take relevant information from UKPMC and load it into the MRC e-Val database before data gathering, so that any principal investigator who had complied with the open access policy and fully acknowledged the MRC with their grant number did not have to enter their publications into MRC e-Val.

2.3.2. Attendees also discussed sharing expertise in analysing output data. An increasing number of organisations are developing an interest in this area, and yet there were few

¹⁴ The Research Excellence Framework (REF) is the new system for assessing the quality of research in UK higher education institutions (HEIs). Managed by the UK higher education funding councils it will be completed in 2014. <http://www.hefce.ac.uk/research/ref/>

established tools for checking and graphing the data. The MRC stored its output data in a SQL database, and carried out the majority of analysis in Microsoft Excel.

2.4. STFC e-Val (Isobel Climas, Science and Technology Facilities Council, STFC)

The Science and Technology Facilities Council (STFC) makes it possible for a broad range of scientists to do the highest quality research, tackling some of the most fundamental scientific questions. STFC funds researchers in universities directly through grants particularly in astronomy, particle physics, space science and nuclear physics, and provides access for scientists to world-class facilities in the UK and internationally (such as ISIS, the Central Laser Facility, high-end computing resources, synchrotron radiation sources, telescope facilities and CERN). The Council distributes public money from the Government to support scientific research. Between 2008 and 2009 the STFC invested approximately £787m (€888m).

STFC has recently implemented a version of MRC's e-Val system, launched as "STFC e-Val". The system has the same functionality as MRC's but with small amendments to the question set to reflect the different disciplines supported.

The system developers are currently looking at a way to link STFC e-Val to Thompson Reuter's Web of Science¹⁵ for publication input, rather than the PubMed look up that MRC uses. This database contains bibliographic information more relevant to STFC e-Val's user community.

STFC has completed a pilot of the system, and is now moving toward collecting data from all its grant holders early in 2011.

Discussion points:

2.4.1. STFC has a particular interest in capturing the use of shared facilities, and feedback on the added value of accessing these. It was agreed that this was an area that still needed further work. Principal investigators can indicate which facilities they used, where this use contributed to realising specific outputs. However it was noted that STFC would only receive this output where the users of facilities were STFC-funded. Nevertheless this information would be helpful in validating and expanding upon information provided by facilities about their use, particularly as it provided the user perspective.

¹⁵ http://thomsonreuters.com/content/science/pdf/Web_of_Science_factsheet.pdf

2.5. Collection of output data in Switzerland (Katrin Milzow, Schweizerischer Nationalfonds (SNF))

The Swiss National Science Foundation (SNF)¹⁶ is the largest Swiss agency promoting scientific research. It supports, as mandated by the Swiss Federal government, all disciplines, from philosophy and biology to the nanosciences and medicine. The SNF has a particular emphasis on encouraging young academics, but also competitiveness, insertion into international networks and the capacity for problem-solving. In 2009 SNF grant expenditure totalled CHF 707m (£455m, €513m) approximately evenly split between Humanities and Social Sciences (25%), Mathematics and Natural and Engineering Sciences (37%) and Biology and Medicine (38%).

SNF are interested in collecting output data to enable them to show the results of funding activities, to assess projects, evaluate and steer their funding mechanisms, and be able to undertake more valuable impact studies. SNF have therefore initiated work to extend their electronic information management system to collect, analyse and disseminate data on the output from SNF funded research.

Data collection will be via a web based platform called 'mySNF'. Data will be collected at the end of the grant and then again 2 years later. Publications will be drawn from Web of Science, Scopus and Pubmed using the CONVERIS webservice from Avedas¹⁷.

For data analysis the data collected will be reviewed by referees and SNF staff in the same way that they currently review final reports. All data will also be published on the 'project database' and therefore publicly available. Researchers have a 'researcher profile' which links the researcher and their outputs. Internally, standard reports will support analyses and valorisation of the output data.

Discussion points:

- 2.5.1. Attendees returned to the issue of assuring the quality of data collected. It is expected that putting the data into the public domain will encourage researchers to ensure that information is complete and accurate.
- 2.5.2. There was also further discussion of the use of publication tools and systems for collection of publication data. Organisations would have to rely on accurate funding and grant attribution in research papers and this highlighted the need to continue to work with researchers and publishers to improve this.
- 2.5.3. Attendees congratulated the SNF on an impressively integrated approach to managing both their application and output collection processes, and noted the way that information about previous outputs would increasingly be available to expert reviewers which emphasised a commitment to use data on outputs at an individual researcher level.

¹⁶ <http://www.snf.ch>

¹⁷ <http://www.avedas.com/en/converis.html>

2.6. Collection of output data by the HRB in Ireland (Brendan Curran, HRB)

The Health Research Board (HRB) is the lead agency for supporting health research in Ireland. In 2008 the HRB invested €43m (£36m) in research and in 2010 it launched a new strategic business plan for 2010-14.

HRB will now focus its funding on patient-oriented, population health and health services research, having announced a policy to no longer support fundamental research which is not orientated toward any particular clinical problem. The HRB currently supports about 400 active grants but due to the international economic downturn the HRB faces some changes and challenges to its budget in future.

In 2007 the HRB published with RAND Europe an analysis of HRB funded work "Making an Impact: The Economic and Social Benefits of HRB-funded Research"¹⁸. The report was based on a set of case studies analysed using the Buxton/Hanney payback framework. This led to amendments in the HRB final grant reporting process to focus on outputs relating to knowledge production, research targeting and capacity building, and informing policy, practice and product development.

At present outputs information is collected using end of grant reports in MS Word or PDF format, but HRB are planning to implement a web-based system to do this (based on SPSS from IBM¹⁹). The aim is to collect data at the end of the grant and to request updates up to 2 years later.

The information from the HRB final grant report has primarily been used for external advocacy and annual corporate reports rather than strategy development, however the aim in the new approach is to better track outcomes and identify potential impacts to both strengthen the case for health research and improve the strategic impact of the information collected.

In planning a more systematic approach to collecting output data the need to focus on 'evidenced' outputs was highlighted. In addition a number of other important issues were outlined in the presentation:

- Sanctions and Incentives – how can the research community be encouraged to comply with this approach?
- Quality Assurance – how can we address data validation and attribution issues?
- Unit of analysis and reporting – how can we ensure that the data is strategically useful?
- Benchmarking – how can we obtain reliable data with which to compare?

Discussion points:

Attendees agreed that these were helpful points to consider, and some further points were raised in discussion.

2.6.1. Sanctions and/or incentives for researchers. Clearly research funding agencies could defer current funding or remove eligibility for future funding, however the importance of engaging the research community in a discussion of the drivers for evaluation and the need for output data was strongly made.

2.6.2. Quality assurance. Previous talks had also highlighted the need to validate data, and avoid over complicating "attribution" or "contribution" of inputs to reported outputs.

¹⁸ http://www.hrb.ie/uploads/tx_hrbpublications/Health_Research-Making_an_Impact.pdf

¹⁹ <http://www.spss.com>

- 2.6.3. Unit of analysis. There was discussion about whether to collect and analyse information at the level of the principal investigator or the grant. It was noted that a central principle to the US NIH/NSF STAR METRICS programme²⁰ was to establish an information management framework based on the individual researcher, and then to associate output data to this. It seems sensible to collect at the lowest level and then aggregate this up using the other sources of management information available. For most funding agencies their information systems were based around the funding of research, and so monitoring focuses on the individual award. Information about researchers, typically the principal or lead researcher, is linked to this award. The usual approach is to link output information to awards, or sets of awards/funding agreements. However this largely ignores the contribution of researchers other than the principal investigator.
- 2.6.4. Benchmarking. All funders were interested in sources of output data. It was difficult in some cases to understand whether a meaningful result had been obtained, unless there were some examples of similar information elsewhere. Attendees highlighted the fact that small differences in definition or methodology would make data difficult to compare. Attendees also noted that there may be a reluctance to share data, given the emphasis on performance, productivity and comparison. A better approach might be to encourage sharing of data with the aim of better understanding pathways to impact, or processes which influence success, rather than direct comparisons. For some areas (such as product development), the rarity of outcomes may mean that statistically useful information, or examples that illustrate sufficient variety of processes, can only be obtained by research funding agencies pooling data.

²⁰ STAR METRICS stands for Science and Technology in America's Reinvestment – Measuring the Effect of Research on Innovation, Competitiveness and Science. This is an ambitious NIH/NSF funded project to track the productivity of all federally funded US researchers. More information about the STAR METRICS programme can be found here: http://sites.nationalacademies.org/PGA/fdp/PGA_057189

3. Summary of Discussion from Workshop Session 2

The discussion points can be broadly summarised under four headings:

- Policy issues
- The types of output/outcome/impact to be collected
- The process for collecting output information
- Approaches for analysing output

3.1. Policy Issues

The workshop endorsed the objectives for collecting output data that had been identified in the ESF working group's previous meeting. It was agreed that strengthening the evidence available about the progress, productivity and quality of research output, was extremely helpful to research organisations in order to communicate the benefits of funding for research, to support strategy development and to facilitate partnership working.

The importance of clearly communicating to the research community the purpose of evaluation programmes, and way in which output data would be used, was highlighted in the workshop (see discussion point 2.2.2.). It was noted that the choice of output data could indicate aspects that funding agencies value, and may be a powerful driver of researcher behaviour. One example that aimed to harness this for positive policy impact was cited by DFG. DFG have introduced a policy referred to as "quality not quantity" in which limits are set for citations in funding applications and final reports, aimed at countering the flood of publications in research²¹. See also discussion point 2.2.3.

The challenge of not significantly adding to the administrative burden on researchers was noted in the workshop. Funding agencies recognised that maintaining the support of the research community was crucial in order to successfully gather good quality information about outputs/outcomes and impacts. Agencies outlined that they had invested time and effort in explaining their approaches to the research community, and had largely conveyed the need for greater structured detail about the output from research (see discussion point 2.6.1.). There were some fundamental differences between approaches used to gather output data, exemplified by RAISS as implemented for example by ARUK, and e-Val as implemented by the MRC. The RAISS system took a light touch approach to collecting information about output, recording the presence of outputs, but not necessarily requiring wider contextual information about these (see discussion point 2.1.2.). The e-Val system was designed to capture enough contextual information for short case studies to be written directly from the data submitted by researchers, and so required more researcher time to complete.

Research organisations had also made positive moves to rationalise their grant management processes, so that where possible information was asked for once and once only. Attendees did however emphasise the potential savings in administrative burden on researchers that might be realised if funding agencies were to collaborate over the gathering of output data, particularly where there were common requirements for information across funding agencies. The potential for linkage of output gathering systems to repositories of existing output data (such as publication databases) was also highlighted (discussion point 2.3.1.).

3.2. The types of output/outcome/impact to be collected

The workshop highlighted the need to carefully consider the information needed to answer key policy questions/performance monitoring requirements. Often these evaluation requirements will be determined by the organisation's strategic plan, and the key objective is to measure progress against this. Several organisations also highlighted that their aim was to understand more about the research system and pathways to impact; were there processes that could be identified which were important for maximising impact?

²¹ http://www.dfg.de/en/service/press/press_releases/2010/pressemitteilung_nr_07/

Discussion point 2.1.1. highlights that in some cases aspects of progress/productivity/quality can be quantified (for example using bibliometrics), and in other areas (such as with research influence on policy) more qualitative information has to be sought. Attendees noted that output is highly skewed, with many output types being relatively rare. The working group was interested in understanding how a wider range of organisations had approached the issue of choosing outputs, defining these, and capturing relevant information. A survey was launched via the ESF Members Organisation Forum to obtain a more detailed picture at the international level. The survey was circulated through MOs and other Organisations, also beyond Europe, and results will be published by the end of 2011.

3.3. Process for collection

The workshop highlighted that research organisations had several key decisions to make regarding the process for collecting output data. Most thought that the ideal situation was to provide a system which could be edited by researchers all year around, although approaches such as e-Val required a defined data gathering period for practical reasons (discussion point 2.1.4.). There was also discussion about follow up. How long should data be collected? (discussion point 2.1.3.). Attendees commended the SNF for taking a complete life-cycle approach which integrated all stages from grant application, gathering output data, assessment of outputs, and publication of results.

3.4. Approaches for analysing output

The fundamental unit of analysis was raised several times in discussion. Whether to collect and analyse information at the level of the principal investigator or at the level of an award (project/programme grant etc.). It was agreed sensible to collect at the lowest level and then aggregate this up using the other sources of management information available. For most funding agencies their information systems were based around the funding of research, and so monitoring focuses on the individual award. Information about researchers, typically the principal or lead researcher, is linked to this award. The usual approach is to link output information to awards, or sets of awards/funding agreements. However this largely ignores the contribution of the majority of researchers other than the principal investigator, and the approach therefore fails to provide the insight that many funding agencies seek about the supply of skilled people to the global workforce.

Attendees also noted that, with the multiplicity of funding sources in health research, linking inputs to outputs was a difficult issue. It was suggested that comment on the contribution of various inputs to particular outputs was most appropriately left to researchers. Overall it was noted that trying to determine the relative contributions of particular inputs was likely to be impossible, and so encouraging credit to be given to all funding agencies involved may be acceptable, and possibly the only workable approach. The problem is greater for outputs/outcomes and impacts (the development of new products, influence on policy etc.) which occur an extended period of time post funding, than it is for outputs that occur with a short lag time (such as publications, follow on funding etc.). In summary the advice was to keep the linkage between inputs and outputs at as high a level of aggregation as possible.

Reference was made to the US STAR METRICS programme, which has the advantage of aiming to capture information on all scientists involved in the research system and all their sources of support. Information about output would be linked to researchers, rather than projects. It was noted however that this may raise the same issues, in that outputs are the result of contributions from multiple individuals, just as they are the result of multiple funding inputs. It would be of interest to keep in contact with NSF/NIH regarding the development of the STAR METRICS programme.

Attendees were concerned about validating the data collected. There were several processes for validation discussed. At the level of data entry mechanisms could be built into online forms to check information (e.g. simple checks that numeric/text fields conform to rules about characters that should be entered etc.). The use of data repositories with quality assured data

(such as PubMed or patent databases) to link to, was clearly helpful. During analysis the identification and checking of outlying data points, and corroboration of information was important. It was agreed that research organisations would find it extremely helpful to share expertise in analysing output data, and of course this was one of the main aims of the ESF Members Organisation Forum.

All research organisations were interested in ways to benchmark their output data (discussion point 2.6.4.), as well as the possibility of pooling data in order to obtain a more statistically robust view of innovation. There are likely to be significant challenges in drawing parallels between data which is collected under different circumstances, however the effort of doing was agreed to be likely to lead to interesting questions about the processes that led to differences in output, and potentially new insight into impact.

Annex 1: Session 2 Presentation Slides

- A.1. ARUK implementation of the RAISS tool (Lisa Croucher, Arthritis Research UK)
- A.2. NIHR output collection programme (David Kryl National Institute for Health Research (NIHR), UK Department of Health)
- A.3. MRC e-Val programme (Beverley Sherbon MRC)
- A.4. STFC e-Val (Isobel Climas, Science and Technology Facilities Council, STFC)
- A.5. Collection of output data in Switzerland (Katrin Milzow, Schweizerischer Nationalfonds (SNF))
- A.6. Collection of output data by the HRB in Ireland (Brendan Curran, HRB)

All presentation are available on ESF website following the link:

<http://www.esf.org/activities/mo-fora/evaluation-of-publicly-funded-research.html>

Annex 2 – Acknowledgements

ESF MO Forum on Evaluation of Publicly Funded Research Working Group on “Classification of Research Portfolios”

Chair:

Ian Viney (UK, Medical Research Council)

Members

Brendan Curran (Ireland, Health Research Board)

Katharina Fuß (Germany, DFG)

Iveta Hermanovská (Slovakia Academy of Sciences)

Katrin Milzow (Switzerland, Schweizerischer Nationalfonds)

Jenny Nordquist (Sweden, Swedish Research Council)

Ingrid Roxrud (Norway, The Research Council of Norway)

Rafael de Andrés Medina (Spain, Instituto de Salud Carlos III)

Additional contributors

Liz Allen (UK, Wellcome Trust)

Shannon Amoils (UK, British Heart Foundation)

Isobel Climas (UK, Science and Technology Facilities Council)

Lisa Croucher (UK, Arthritis Research UK)

Lynne Davies (UK, Cancer Research UK)

David Kryl (UK, National Institute of Health Research)

Liz Philpots (UK, Association of Medical Research Charities)

Beverley Sherbon (UK, Medical research Council)

Anna Smith (UK, Consultant HRCS coder)

Andrew Speakman (UK Consultant HRCS coder)

ESF Forum Coordination

Laura Marin

Sarah S. Chen

Member Organisation Fora

An ESF Member Organisation Forum is an output oriented, issue-related venue for the Member Organisations, involving other organisations as appropriate, to exchange information and experiences and develop joint actions in science policy. Typical subjects areas discussed in the Fora are related to:

- Joint strategy development and strategic cooperation with regard to research issues of a European nature.
- Development of best practices and exchange of practices on science management, to benefit all European organisations and especially newly established research organisations.
- Harmonisation of coordination by MOs of national programmes and policies in a European context.