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Strengthening Research Portfolio Evaluation at the Medical Research Council

Developing a survey for the
collection of information about
research outputs

Sharif Ismail, Jan Tiessen, Steven Wooding

Sponsored by the Medical Research Council

The research described in this report was prepared for the Medical Research Council.

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Preface

The Medical Research Council (MRC) wished to better understand the progress, productivity and quality of the research it supports, and assess the wider impact of MRC research output on society and the economy. In 2007, the MRC took the decision to improve the evidence base available for strategy development and planning and to invest in an enhanced evaluation capability. Specifically the MRC wanted to: (1) compare the relative strengths of different types of funding and areas of research; (2) systematically identify the good news stories and successes it can learn from; and (3) identify the barriers it needs to address. As an initial step in this process the MRC asked RAND Europe to support them, firstly, in examining the wide range of output and outcome information that the MRC already collected to understand what answers it could provide. Then, secondly, to use that analysis to suggest ways in which data collection could be improved.

This report outlines the approach taken to the second part of this exercise and focuses in particular on the development of a new survey instrument to support the MRC's data collection approach. Our intention is that the report will provide a reference for funders seeking to develop survey-based information gathering tools for research evaluation, by describing the process we went through in partnership with the MRC. However, readers should bear in mind that some later stages of development and implementation of an online version of the survey tool were conducted exclusively by the MRC and are not reported here. This report will be of interest to researchers, research funders, donors and fundraisers, individuals active in research policy and the broader public.

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Dr Steven Wooding
RAND Europe
Westbrook Centre
Milton Road
Cambridge CB4 1YG
United Kingdom
Tel. +44 (1223) 353 329
Email: wooding@rand.org

Sharif Ismail
RAND Europe
Westbrook Centre
Milton Road
Cambridge CB4 1YG
United Kingdom
Tel. +44 (1223) 353 329
Email: sismail@rand.org

¹ For more information on RAND Europe, please see our web site: www.randeurope.org

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Abbreviations

AMS	Academy of Medical Sciences
ARC	Arthritis Research Council
<i>BRfBH</i>	<i>Best Research for Best Health</i> (Department of Health R&D strategy document)
COSEPUP	Committee on Science, Engineering and Public Policy (US)
CSR	Comprehensive Spending Review
DIUS	Department of Innovation, Universities and Skills
HE-BCI	Higher Education-Business and Community Interaction (UK-based survey)
MRC	Medical Research Council
MRC-T	MRC-Technology
NAO	National Audit Office
NCI	National Cancer Institute (US)
NIHR	National Institute for Health Research
ODGT	Outputs Data Gathering Tool
OSCHR	Office for the Strategic Coordination of Health Research
OST	Office for Science and Technology
RAISS	RAND/ARC Impact Scoring System
TRL	Technology Readiness Level (US)
UKCRC	UK Clinical Research Collaboration

Summary

The Project Brief

The MRC had three key aims for this project. It wished to:

1. Collect information on the range of outputs and outcomes from its funded research, in a way that was amenable to detailed analysis. It also wanted to collect information on impacts from knowledge production, through research capacity building to wider outputs including dissemination, policy impact and product and intervention development;
2. Build a better understanding of the range of research that it funds, across the spectrum from basic to clinical research;
3. Collect a combination of quantitative and qualitative information – on both the types of impacts produced by MRC funded research, and the perceptions of researchers themselves of the support they receive from the MRC.

What we did

To help the MRC meet these objectives, RAND Europe was engaged to provide support in constructing an evaluation framework, building on an extensive body of research work in this field over the past few years. In particular, the project built on work jointly conducted by RAND Europe and the Health Economics Research Group (HERG) at Brunel University in recent years to develop a “Payback Framework” based on the following categories:

Knowledge production
Research targeting and capacity building
Informing policy and product development
Health and health sector benefits
Wider economic benefits

In order to better reflect the particular needs of the MRC, and reflecting the focus on collecting information from the researchers carrying out the research, the project team decided to focus the development of the new tool on:

- Research targeting and capacity building;
- A new category, for dissemination activities; and

- Informing policy and product development. Data on other categories in the framework, while important, were thought to be more efficiently gathered by other means.

We then evaluated a series of potential approaches to data collection. These included:

- Cataloguing tools, such as *tick-list* and *menu-based* approaches; *exemplar scales*; and *calibrators*
- Mapping tools, including *research pathways*²

In discussion with the MRC, it was decided that a tick-list based approach with additional questions to capture detailed information about research impacts, was best suited to this exercise. These discussions took into account well known challenges in research evaluation. These included the issue of the accuracy of researcher recall in systems reliant on self-reporting of outputs and impacts; and the problem of attribution, which for researchers holding multiple forms of funding support at the same time, can be significant. There was also debate about the appropriate level of detail to request from researchers and how to balance the MRC's need for detailed information against the likely burden on researchers.

Building on a tool produced through prior work with the Arthritis Research Council (ARC) in the UK, we then adapted and developed a survey questionnaire to respond to the MRC's evaluation requirements. This tool was tested through an advisory group workshop, stakeholder workshops with academic researchers (both intra- and extra-mural) and finally through cognitive interviews with a series of researchers.

The MRC used this tested instrument, with additional questions, as a basis for its new online questionnaire (the MRC Outputs Data Gathering Tool – ODTG). The ODTG was to be directed at all MRC-supported researchers and research establishments, both intramural (MRC Institutes, Centres and Units) and extramural (research funded through grants, studentships and fellowships outside intramural establishments). The questionnaire sought information on both short-term outputs from individual research grants, and longer-term outcomes reported by interviewed researchers. RAND assisted in testing this survey tool with MRC-supported researchers before the ODTG was launched in September 2008. Details of the results of this exercise are available separately from the MRC.³ The ODTG experienced problems in its first year of operation and this led the MRC to review and improve the IT implementation as well as to simplify the data collection tool, the new tool has been named MRC e-Val and it due to be used for the first time in the autumn of 2009.

Key lessons learned

Among the most important lessons from this project were the following:

² For further details on these approaches, please see Wooding, S. and S. Hoorens (2009), *Possible approaches for evaluating Arthritis Research Campaign grants*, Cambridge, UK: RAND Europe.

³ The ODTG web page may be found here: <http://www.mrc.ac.uk/Achievementsimpact/ODGT/index.htm> (as of 23rd July 2009).

1. **Consider the ultimate objective of your framework.** Prior to developing a research evaluation framework it is crucial to define the ultimate purpose a framework should serve and to be very aware of the context it will operate in.
2. **Choose the right evaluation method.** There exists a wide range of different evaluation methods, ranging from bibliometric analysis to micro- or macro economic analysis of the economic return of research. Each has a specific set of advantages and disadvantages, and the selection should be closely linked to the objective research.
3. **Be aware of the conceptual difficulties.** Research evaluation exercises involve significant conceptual difficulties. While solutions to such problems are not necessarily easy to achieve, they should be at least acknowledged in the analysis of the results.
4. **Engage with stakeholder at every stage of the process of development.** Stakeholder engagement can prove essential in developing a framework, as experienced during this project.

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The authors would also like to thank Claire Celia and Professor Martin Meyer for their very helpful comments on earlier draft of this document.

Measuring the returns from research has become an important concern for research funding organisations. These organisations are now under increasing pressure to demonstrate how the output from research expenditure benefits society. Moreover, research funding bodies are increasingly seeking evidence upon which to ground strategic planning, and for monitoring the progress of previous initiatives. This is in addition to demonstrating accountability and good research governance through formal evaluation procedures.

The purpose of this document is to describe the approach and results of a project undertaken by RAND Europe to support the Medical Research Council's (MRC) development of a new research evaluation framework and improved data gathering systems for the research that it funds. It takes a chronological approach, charting our progress in developing, first, an evaluation framework, and then drafting an information gathering tool to support the research evaluation process.

This project was undertaken in response both to reform within the MRC itself, and also to broader changes in the research landscape in the UK – in particular, a very favourable settlement for health and biomedical research in the Treasury's last Comprehensive Spending Review (CSR, 2007). In this chapter, we outline the history and role of the MRC, and explain how and why the organisation has decided to develop a new research evaluation framework. That explanation draws on the wider context of public sector reform in the UK and elsewhere, and focus on the implications this has had in terms of an increasing drive towards evaluation and accountability.

1.1 **The Medical Research Council**

The Medical Research Council (MRC) is the UK's leading publicly funded medical research organisation. It was established as a national fund for medical research in 1911, initially with a remit focusing on the treatment of tuberculosis. Since then, the MRC has emerged as an organisation engaged in all aspects of medical and related sciences, with the aim of improving the health and quality of life of the British public, and contributing to the wealth of the nation.⁴ Though primarily funded by the UK government through an

⁴ See the MRC's website at: www.mrc.ac.uk.

annual grant in aid from the Department of Innovation, Universities and Skills (DIUS)⁵, the MRC makes bids for additional resources from the Treasury every two years through the Office of Science and Technology (OST).

The MRC supports a broad biomedical research portfolio that ranges from basic biological investigations to medical practice. In 2007/8 the organisation spent £343 million on “intramural” research.⁶ MRC total spend on grants for research in universities and teaching hospitals was over £ 178 million, with £58 million spent on training awards for postgraduate students and fellows.⁷ MRC total spending for 2007/8 was £442 million on resource expenditure and around £76 million of capital expenditure. The majority of MRC funding is provided through research grants awarded on a response mode basis. Most proposals are investigator-initiated, although to encourage research in strategic priorities areas the MRC sometimes issue highlight notices or calls for proposals in priority areas. Table 1-1 below details the range of intramural and extramural support currently offered by the MRC.

Funding Structure	Type of award	Means of award	Duration
Intramural programme	MRC Units	Intramural	Minimum of five years
	MRC Research Institutes	Intramural	Permanent
	MRC Centres	Jointly funded by universities and MRC	Long-term
Extramural programme	PhD Studentships	Block allocation	Central allocation by university 3 years
	Junior fellowship grant	Individual award	Peer review of grant applications 1-2 years
	Intermediate fellowship grant	Individual award	Peer review of grant applications 3 years
	Senior fellowship grant	Individual award	Peer review of grant applications 4-5 years

SOURCE: RAND Europe

Table 1-1. Summary of key forms of research funding support offered by the MRC, the type and means of award, and their duration.

1.2 How the MRC governs its research portfolio

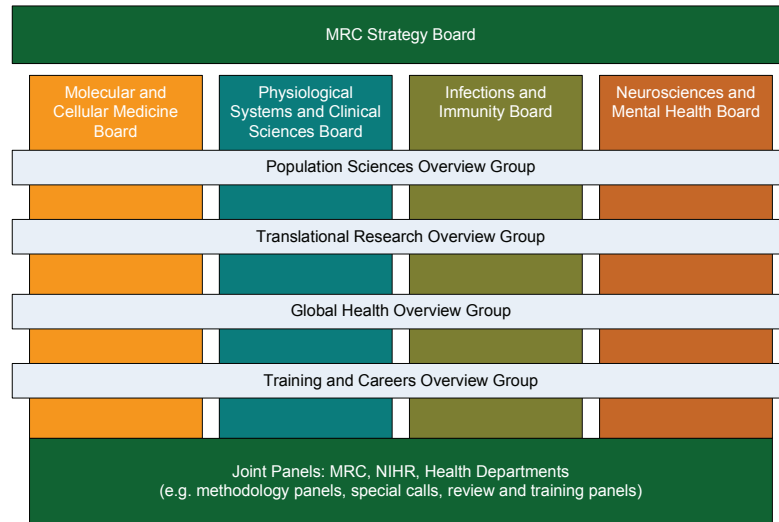
The MRC organises its research portfolio around four main boards, each of which makes funding decisions on grants falling within its allotted subject area. The areas covered are:

⁵ DIUS has recently been dissolved, and its functions split between the Department for Children, Schools and Families (DCSF) and an expanded Department for Business, Innovation and Skills (BIS).

⁶ “Intramural” research describes research that is conducted exclusively in Institutes, Centres, and Units where the MRC funds the infrastructure costs of supporting research. By contrast, “extramural” research describes that research that is supported purely by grants, studentships or fellowships *outside* Institutes, Centres and Units.

⁷ Medical Research Council (2008), *Annual report and accounts, 2007/8* (London: Medical Research Council). Available online at: http://www.mrc.ac.uk/consumption/idcplg?IdcService=GET_FILE&dID=15116&dDocName=MRC004808&allowInterrupt=1 (as of 9th July 2009).

molecular and cellular medicine; physiological systems and clinical sciences; infections and immunity; and neurosciences and mental health.



SOURCE: adapted from MRC Annual Report and Accounts, 2007/8.

Figure 1-1. Outline of the strategic governance structure at the MRC, as it relates to the funding portfolio.

Though each of these boards falls under the strategy board, broader governance of various aspects of the portfolio is divided between a number of groups within the MRC, and there are cross-cutting linkages between the boards to ensure coordination. The division of responsibilities is outlined in figure 1.1 above. Importantly, information collected around outputs from MRC-funded research is forwarded through a number of channels to the Corporate Affairs Group, which then generates publicity for significant new findings or particular achievements by MRC-supported investigators.

1.3 The demand for stronger evaluation mechanisms in public policy – and the MRC’s response

Demand for stronger evaluation mechanisms in public policy is growing internationally

Taking an international perspective, there has been a growing trend in governments in OECD countries towards encouraging the development of strategic goals and performance indicators to guide reform and organisational change. In the US, the Government Performance and Results Act of 1993 required federal agencies – including those that fund research – to set research goals and to use performance measures for management and budgeting. One of the key outcomes of the US Government Performance and Results Act of 1993 was a series of workshops held in 1998 by the Committee on Science, Engineering and Public Policy (COSEPUP) to generate ideas on how best to evaluate research. The workshops identified six methods, including case study research, bibliometric analysis and economic evaluation. In the UK, by contrast, the NAO recently concluded that

government departments ‘have no systematic mechanisms for measuring the overall impact of their research effort’.⁸

There have been important moves in this direction in the UK lately

This picture has changed in important ways over the past few years, however. In 2004, the UK Government published a 10-year Science and Innovation Investment Framework.⁹ A key requirement under the Framework was that the research councils should feed into a performance management system run by the Office of Science and Innovation that was intended to demonstrate the contribution each council makes to achieving government targets. This system included delivery plans, an outputs framework of performance metrics, and a scorecard of targets and milestones.

In a related move, the Academy of Medical Sciences (AMS), the Wellcome Trust and the MRC established the UK Evaluation Forum in 2005, to determine the best approaches to research evaluation. In 2006, it delivered a report entitled: *Medical Research: assessing the benefits to society*.¹⁰ A key conclusion of the report was that measuring the performance and results of research in practice is a challenging and complex exercise. In the first instance, it suggested that many research impacts are not easily quantifiable. Secondly, it is difficult to attribute a policy or clinical impact to a particular research project. The problem of attribution is one to which we will return in greater depth in chapter 2. Despite these difficulties, the report outlined a number of strategies to help funding bodies understand the impact of the research they support, updating and developing the thinking put forward by COSEPUP in the late 1990s to produce a “research evaluators’ toolbox”, incorporating methods directed at various levels of analysis. The contents of the “toolbox” are described in greater depth in table 2.1 in the following chapter.

There has also been some turbulence in the UK biomedical and health research environments

The UK biomedical and health research field was in the throes of considerable change at the time of the project, in two key respects. Firstly, recommendations arising from the Cooksey Report¹¹ and the Department of Health’s Research and Development strategy, *Best Research for Best Health (BRfBH)*¹² – both published over the past two years – have spurred a major re-organisation of the health and biomedical research system. Overall policy coordination in this area is now provided by the Office for Strategic Coordination of Health Research (OSCHR). This body provides policy oversight for both the MRC and the National Institute for Health Research (NIHR) – newly established in the wake of *BRfBH*.

⁸ NAO (2003), *Getting the Evidence: using research in policymaking* (HC 586-1, session 2002-3).

⁹ HM Treasury (2004), *Science and Innovation Investment Framework, 2004-2014* (London: HMSO).

¹⁰ UK Evaluation Forum (2006), *Medical Research: assessing the benefits to society* (London: Academy of Medical Sciences, Medical Research Council and the Wellcome Trust)

¹¹ Cooksey, D. (2006), *A Review of UK Health Research Funding* (London: HMSO).

¹² Department of Health (2005), *Best Research for Best Health: a new national health research strategy* (London: Department of Health).

Secondly, the most recent CSR, published by the Treasury in autumn 2007, included a commitment of £1.7bn for the support of health research in the UK. This is a substantial increase on allocations in previous years, and brings with it a clearer demand from central government for evidence of impact. Such demonstrations of impact are also imperative as key actors in the health and biomedical research fields look to strengthen their case for a similarly favourable allocation from the Treasury and DIUS at the next CSR. The tightening fiscal climate in the UK at present only increases the need for such clear demonstrations of impact.

In light of these and other developments in the UK biomedical research field, evaluation has been enshrined as a core concern for the MRC in a range of key strategic documents (most notably the MRC's Delivery Plan 2008/9-2010/11), and the MRC is currently in the process of re-structuring its evaluation procedures. Restructuring has also occurred partly in response to a joint MRC/Ernst and Young review of MRC structures and governance that reported in March 2007, and which recommended that the 'MRC should invest in designing and implementing a more effective evaluation system', and 'develop evaluation to be a core capability of the organisation'.¹³

1.4 The scope and focus of this report

In this broader context, the MRC wanted to develop a framework that would help it meet some of these new evaluation challenges. We used previous and ongoing work for the Arthritis Research Council (ARC) (in particular, that outlined in the *The Returns from Arthritis Research* report) to develop a new evaluation methodology – to help the MRC meet its evaluation objectives and gather data on its research programme in readily analysable fashion.¹⁴

While recent calls for improved evaluation in the research field have focused increasingly on long-term socio-economic impacts (consider, for example, the Worry Report published by Research Councils UK in 2007¹⁵), the MRC also wished to explore whether leading indicators of success could be found to give them meaningful outputs within a Comprehensive Spending Review (CSR) period – while at the same time building up a picture of impacts over the longer-term.¹⁶ The MRC was particularly concerned with generating information on:

¹³ MRC-Ernst & Young (2007), p. 33; and p. 36. Available online at: http://www.mrc.ac.uk/consumption/idcplg?IdcService=GET_FILE&dID=10702&dDocName=MRC003764&allowInterrupt=1 (as of 9th July 2009).

¹⁴ Wooding, S. et al (2004), *The returns from arthritis research, volume 1: approach, analysis and recommendations* (Cambridge, UK: RAND Europe).

¹⁵ Research Councils UK (2007), *Excellence with Impact: progress in implementing the recommendations of the Worry Report on the economic impact of the research councils* (London: RCUK).

¹⁶ Throughout this report, we use the terms “outputs”, “outcomes” and “impacts” to describe the downstream results of scientific research. “Output” describes immediate term results or products of scientific research, including – for example – scientific research papers, PhD students trained, conferences attended to present research work and so forth. “Outcome” describes the downstream effects of scientific research, including – for

- The outputs from its funded research;
- Impacts of its funded research (recognising the difficulties of collecting this information historically);

Ultimately, it wished to develop an information collection system that could be used to gather historical evidence in the first instance, but could be applied longer term to the collection of data going forward.

RAND Europe's involvement in this project built most directly on concurrent work with ARC to develop a new impact mapping tool, described in a report entitled *Mapping the Impact*.¹⁷ The tool forms the basis of a new survey system at ARC to provide an overview of the research the charity funds – through quick and easy information-gathering. A key purpose of the tool is to provide information on the *diversity* of impacts arising from funded research. The tool provided much of the detailed structure for the final MRC instrument. On this occasion, our role was more advisory than executive, however. We have therefore structured this report both a summary of the steps we took to help the MRC improve its evaluation systems, and at the same time, a technical or “how-to” guide on setting up research evaluation schemes for funding bodies.

1.5 Structure of the report

We begin in chapter 2 with a description of general issues in research evaluation, and a discussion of how a modified evaluation framework was derived to support the MRC in its development of new data gathering systems. In chapter 3, we outline the range of possible tools available to the MRC to support improved data gathering, and describe how an appropriate approach was selected. In chapter 4, we describe how new questions were developed for the questionnaire, and how it was structured. In chapter 5, we outline how the tool was tested and improved, through interactions with the project advisory groups and academic researchers. We conclude with some general observations on key lessons learned from the project.

Although we hope and anticipate that this document will provide useful guidance to other research funders seeking to develop evaluation tools, we do not wish to claim universal applicability for the methodology we present here. It should be borne in mind that MRC handles a distinctive research portfolio and also had particular information collection and evaluation requirements coming into this project, including an need for particularly

example – effects on population health and wellbeing. The term “impact” is a general term to describe the results of research – including both outputs and outcomes.

¹⁷ Wooding, S. et al (2009), *Mapping the Impact: exploring the payback of arthritis research* (Santa Monica, CA: RAND Corporation).

detailed and comprehensive data collection. The tool we developed in partnership with the MRC was responsive to these particular characteristics.

In this chapter, we describe some of the main issues in research evaluation, before outlining how a modified evaluation framework was developed to help inform the MRC's data gathering reform efforts. This is followed, in chapter 3, by a discussion of how the most appropriate method for data collection was determined.

2.1 **Approaches to research evaluation and the MRC's requirements**

The pressure for increased accountability has been met by two broad approaches to research evaluation: "broad and shallow" and "narrow and deep". Broad and shallow approaches aim to quantify the large-scale impact or quality of research. Narrow and deep evaluations focus on understanding how research funding could be improved, and how the process of translation could be accelerated. Broad and shallow evaluations have tended to be based on bibliometrics, although there is growing interest in the potential of large-scale economic evaluations – calculating the total investment in a field of research and total payback in terms of monetarised health benefits. Narrow and deep approaches, on the other hand, have used a series of methods including case studies, bibliometrics and small-scale surveys to understand the impact of a small sample of research projects. The range of possible approaches – and brief description of advantages and disadvantages – is described in table 2-1 below.

What was required here was a new system that was broad and shallow, but still captured the full range of research impacts. There has been previous work in this area, including for the North Thames Health Authority and the UK Health Technology Assessment organisation, but both projects took only a snapshot of whole portfolios of research, and there was no ongoing process of assessment.¹⁸

The approach to re-structuring information collection systems that the MRC took was based on a comprehensive, bottom-up attempt to collect key information about the outputs and outcomes deriving from research that it funds. The objectives of this approach were:

1. To catalogue the range of outputs from MRC-funded research work; and

¹⁸ Hanney, S. et al (2007), "An assessment of the impact of the NHS Health Technology Assessment Programme", *Health Technol Assess* 11. Buxton, M. et al (2000), "Assessing benefits from Department of Health and National Health Service R&D", *Public Money and Management* 20, pp. 29-34.

2. To improve understanding of its portfolio.

Evaluation method	Characteristics	Advantages	Disadvantages
Bibliometric analysis	Can be narrow and deep or broad and shallow	<ul style="list-style-type: none"> Quantitative, measuring volume of output Can be used to indicate quality of output Enables analysis of global trends 	<ul style="list-style-type: none"> Estimates of quality based on citations can be misleading Data must be normalised to compare across research fields
Case study analysis	Narrow and deep	<ul style="list-style-type: none"> Provides in-depth analysis of the process of discovery Can demonstrate pathways from basic science to application 	<ul style="list-style-type: none"> Selection bias: how do we know the chosen cases are representative? Highly resource intensive to do well
Systematic peer review	Narrow and deep	<ul style="list-style-type: none"> Well understood component of research management Widely accepted by both the 'establishment' and researchers themselves 	<ul style="list-style-type: none"> Time consuming for experts involved Concerns over the objectivity and reliability of findings
Surveys and consultations	Can be narrow and deep or broad and shallow	<ul style="list-style-type: none"> Can identify outputs and outcomes associated with particular pieces of funding/research Provides qualitative analysis of outcomes 	<ul style="list-style-type: none"> Dependent on contact details being available for researchers in question Poor response rate can limit findings
Economic rate of return 1: micro-economic analysis	Broad and shallow	<ul style="list-style-type: none"> Can be applied to different sectors Comparative potential e.g. cost-benefit analyses 	<ul style="list-style-type: none"> Difficult to put financial value on many of the influences involved
Economic rate of return 2: macro-economic analysis	Broad and shallow	<ul style="list-style-type: none"> Quantitative Provides 'big-picture' and context on research 	<ul style="list-style-type: none"> Difficult to identify the contribution of an individual sector/funder

Table 2-1: Key methodologies in the research evaluators 'toolbox' (adapted from UK Evaluation Forum, 2006)

To provide a structure for this exercise, we turned to a research evaluation framework used extensively by RAND Europe in previous studies: the Payback Framework which was developed jointly with the Health Economics Research Group (HERG) at Brunel University.¹⁹ Before addressing this adaptation of the Payback Framework, however, it is

¹⁹ See Wooding, S. et al (2004), *The returns from arthritis research, volume 1: Approach, analysis and recommendations* (Cambridge, UK: RAND Europe, TR-176-ARC), among others.

instructive to consider some of the broader complications associated with research evaluation exercises, and of relevance here.

2.2 Complications of research evaluation: accuracy and recall

Most information collection systems rely on accurate recall from the researchers they target. However, such recall may not always be perfect and it is difficult to corroborate claims made by researchers without returning to gather further information on a case-by-case basis. This is often impractical because of time and financial constraints. In practice, many research evaluation systems have to rely to some extent on the word of participating researchers.

This issue was raised on several occasions during our discussions with the MRC as we built the survey instrument. The MRC sought “evidenced” outputs wherever possible, and was clear that it wanted to be able to use information provided in the survey to burrow deeper into individual research projects through qualitative information collection (case studies etc). Indeed, the MRC highlighted in the guidance notes that eventually accompanied the final survey questionnaire that it intended to do this in cases where it was felt to be relevant.

2.3 Complications of research evaluation: the problem of attribution

The problem of attribution is one of the most challenging issues in research evaluation. It presents significant difficulties, particularly when attempting to ensure the validity of information gathered in support of research evaluation.

2.3.1 The time lag between end of grant and research outputs

It is a common characteristic of the research process that some, or sometimes most research outputs and outcomes occur with a certain time lag. As a simple example, publications from a specific research tend not to be published until a year or two after the project is finished. Similarly, patents or pharmaceutical products might occur with an even longer delay. This time lag can create difficulties in identifying outcomes and outputs and in attributing them to specific research funding, as this research project attempts to do. The basic difficulties are illustrated in Figure 2-1.

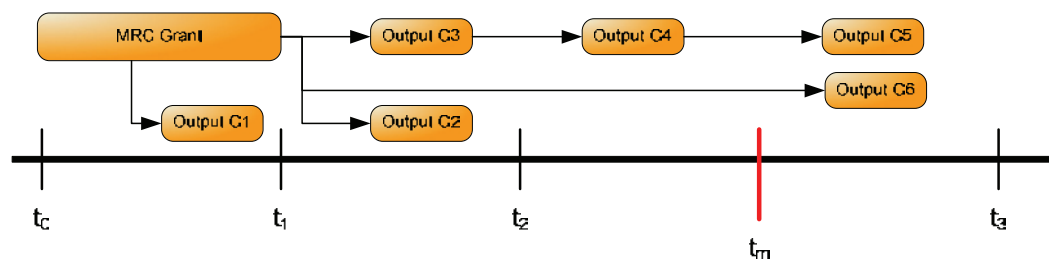


Figure 2-1: Illustration of emergence of research outputs over time following the award of a grant (t_m indicates the point at which data is collected).

A MRC fellowship or programme grant lasting from t_0 to t_1 could produce a number of outputs, which are labelled O1 to O6 in this figure²⁰. While some of them might occur during the phase in which the grant is active (O1) others will only occur after the grant has finished (O2 to O4). In addition some of the outputs might not even have occurred yet, but will only occur in the future (O5 and O6). These might be the result of previous outputs (O3 leads to O4 which leads to O5) or be a completely new output (O6). This spreads of outputs of a research project over time leads to problems in capturing all relevant outputs of a research grant. The two main conceptual as well as practical problems are:

1. If outputs are immediately reported after the grant has finished (t_1) only a limited number of immediate outputs (O1) could be observed as the result of the research project, as other outputs will only occur in the future. Measuring outputs close to the end of grant has however the advantage that information provided can be linked easily to the specific grant and that researchers will usually be still very aware of the results of the grant.
2. At later times (t_2 , t_m , t_3) more outputs could be identified, however with increasing distance from the grant, attribution problems might increase with linking outcomes to specific grants (see also below). In addition, it will be more difficult in practical terms to track the researchers to provide information about outcomes after a grant has finished.

2.3.2 Sequential grants

Rather than being dependent on single grants, medical research projects often rely on financial support from a series of sequential grants, frequently from different grant-giving organisations. This complicates the attribution of research outcomes to a specific grant. Funding for MRC's intramural research, which is based on five year budget appropriations, can be understood as such a system of sequential grants. An underlying assumption of our work here is that, by and large, researchers will be able to attribute research outputs to *specific grants*, rather than to funding periods.

Figure 2-2 illustrates characteristics of sequential grants (G1 to G3) with a multitude of outputs. In this scenario we assume that in most times the grants are linked in terms of research topic and content, but that outputs are clearly attributable to a single grant only. The different grants (G1 to G3) lead to a number of outputs, some of which occur during the grants (O1, O5, O10), while others occur slightly later or will occur some time in the future (O15 to O17). In addition, there will be still outputs from previous grant periods (e.g. O2 to O4) which occur with a time lag.

²⁰ For simplicity, this Technical Report will not differentiate between outputs and outcomes of research; instead the term "output" will be used to denote both.

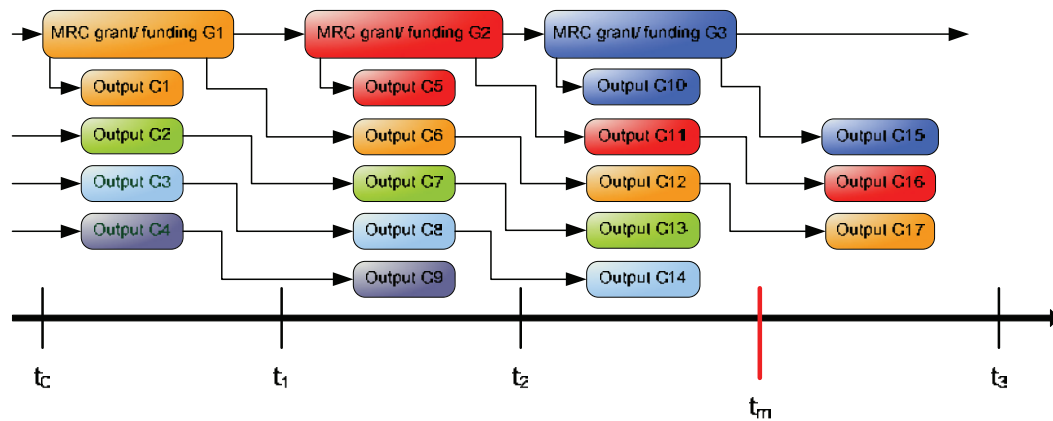


Figure 2-2: Illustration of emergence of outputs over time for sequential grants.

In such a scenario, measuring the outputs of research becomes more challenging:

1. The first approach, to measure research outputs at the end of a certain time period (e.g. t_1 to t_2), would almost certainly not only count research outputs from this (O5) but also from previous funding periods (O6 to O9). Thus, such an approach would not only lead to an underestimation of grant G2’s outputs like in the first scenario, but would also misleadingly report the outputs of previous research as results of spending during G2.
2. The second approach, to retrospectively assess which outputs have emerged from a specific grant, e.g. assessing at t_m what outputs can be attributed to grant G1, becomes more difficult as well. A scientist would be required to precisely attribute the outcomes to a funding period or a grant, which can prove difficult if the grants are thematically closely linked and the research continued across grants, which is the case for longer term funding streams.

2.3.3 Interlinked grants

A final complication arises out of the observation that research outputs may be the result of several grants rather than a single one.

Figure 2-3 illustrates the two basic possibilities for this. While outputs O1 to O4 and O6 and O8 can be clearly attributed to specific grants, outputs O5 and O7 are the result of two grants – but they arise from these two grants in subtly different ways:

- First case: In the case of O5, the output is the result of two grants (G1 and G2) running in *parallel* and the output (O5), e.g. a publication, occurs after the project (which was funded by these two grants – G1 and G2) has finished.
- Second case: Output O7 on the other hand is the result of the two *consecutive* grants G1 and G3 and occurs after grant G3 has been finalised.

Both cases can generate difficulties in accurately measuring the outputs of the research grants:

1. In the first case, the output (O5) is likely to be double counted. As we use grants as the primary unit of investigation, grant holders G1 and G2 will most likely

report Output O5 as an output resulting from G1 and G2, thus two outputs would be recorded.

2. In the second case, output O7 might also be double counted if the respective researcher from G1 identifies it as an output from G1 rather than G3 only. There is however also the possibility, that O7 will only be counted as an output of G3. In this case the overall number of outputs will be accurate; however the contribution of Grant G1 will be not reflected in the data. In a situation where G1 is basic and G3 more applied research, this will lead to an underestimation of the outputs of research in early stages.

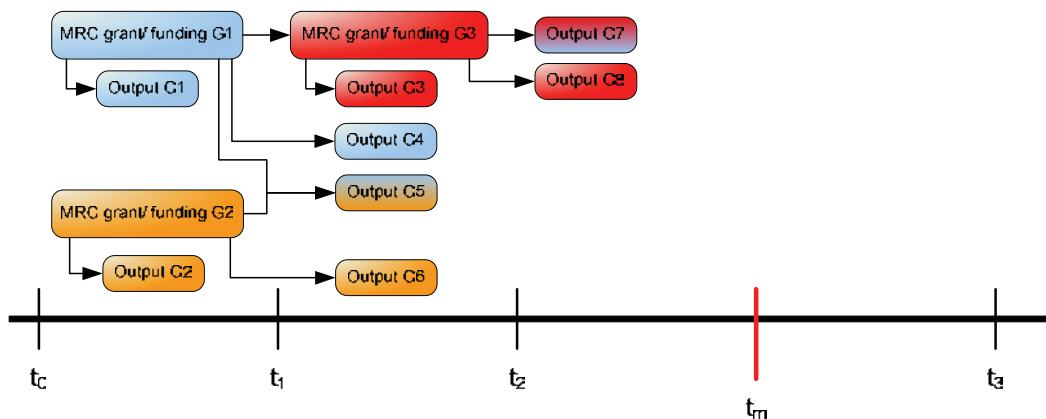


Figure 2-3: Emergence of outputs over time for interlinked research grants.

2.3.4 Managing the attribution problem: analysing the research outputs carefully

The difficulties in attributing and accurately measuring the research outputs have to be carefully managed.

Firstly, questions to the researchers reporting about their research outputs have to be carefully phrased to distinguish between the outputs of a grant and the outputs within a certain time period. Various approaches to this may be possible; however, none of them is entirely satisfactory. We may use subjective thresholds, requiring researchers to list only those outputs that are substantially attributable to the grant in question; but this, of course, relies on a subjective judgement by the researcher and makes it difficult to ensure consistency. Alternatively, we might use broad categories to try to understand impact, asking researchers to clarify whether a particular grant made a minor, significant, major or crucial contribution to a research outcome. This, however, involves important subjective judgements.

Secondly, while we see no strategy to avoid the effects described above without considerable extra complexity, we have to develop tools of analysis which allow us to manage double counting. Such an approach could for example be to aggregate closely related grants into groups and report on the types of outcomes emerging rather than focussing only on the number of outputs. Such an approach is illustrated in the figure below.

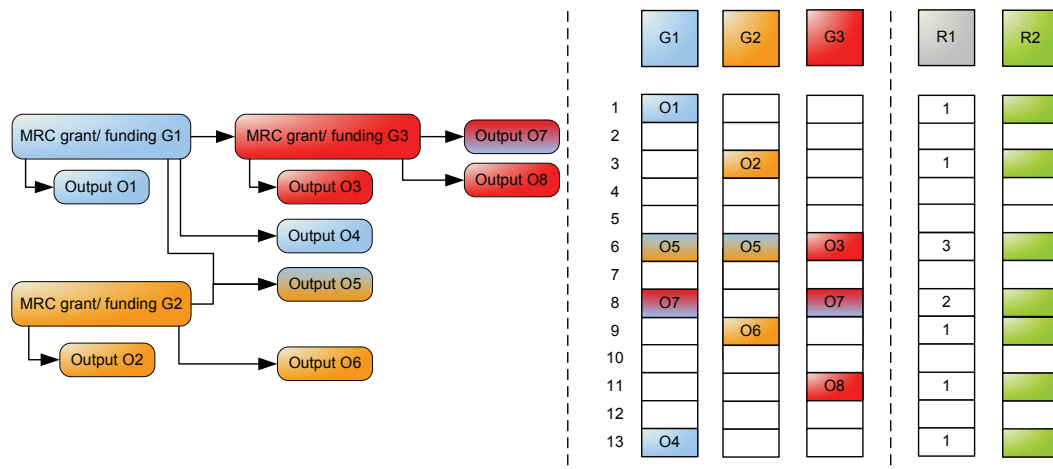


Figure 2-4: Possible scoring mechanisms to help overcome problems of attribution for sequential and interlinked research grants.

In the first reporting mechanism (R1), the number of outputs is simply summed up and compiled per output category (lines 1 to 13). As discussed above, however, this creates inaccuracies; for instance, outputs O7 and O5 are double counted (lines 6 and 8). An alternative approach – which we call R2 here – would simply indicate the existence of an output in a certain category using a logical OR function.²¹ This would sacrifice some of the depth of information collection of R1 (e.g. there are more outputs in category 6 than 1), but would provide basic but accurate information about outputs.

Clearly there is a trade off to be made between the complexity of the information researchers are asked to provide and the ease with which they can complete the survey. The complexity of the MRC tool has varied during its development and deployment with MRC e-Val taking a simpler approach to the ODGT.

2.4 The evaluation framework

The evaluation framework generally comprises two elements. The first is a definition of the evaluation criteria for the outputs and outcomes of research. The criteria here are either quantitative, qualitative or both. The second component is a logic model of the research process.²² Logic models are widely used in evaluation methodology to understand input-process-output relationships and to break research programmes down into their

²¹ By logical “OR” here, we refer to a logical rule in which a positive result is recorded in the R2 column when there is a positive result in any of G1, G2, or G3. This contrasts with the approach outlined in R1 which adds up the total number of positive results in G1, G2, and G3.

²² Hanney, S. et al (2003), “The utilisation of health research in policy-making: concepts, examples and methods of assessment”, *Health Research Policy and Systems 1*.

component parts.²³ To help meet the MRC's needs, we focused on adapting the second component of the framework. We did this by "flattening" the payback model to incorporate important elements, such as dissemination, that might otherwise have been lost.²⁴ This left us with a series of payback categories, in common with a previous RAND Europe studies in this area, covering a range of outputs, outcomes and impacts, from knowledge production to health benefits and wider economic benefits.²⁵ This is illustrated in figure 2.5 below.

A key lesson from previous attempts to apply the evaluation framework has been the imperative to adapt it in various ways to reflect the particular circumstances of the research funder in question.²⁶ Since extensive data-gathering systems were already in place at the MRC, the organisation was primarily interested in using this exercise to generate information on the outputs from its research portfolio for which no data was being gathered, or to help develop improved understanding of aspects of the research process (such as product development). On this basis, it was decided that "research targeting and capacity building", "informing policy" and "product development" should be retained, but that "knowledge production" should be removed from the framework. It was assumed that the MRC would collect this information separately - primarily through bibliometric analysis of publications data. Given the particular requirements of the MRC, we added an additional, distinct category – "dissemination", to capture a discrete set of activities undertaken by its funded researchers.

Finally, since the MRC's primary concern in this exercise lay with collecting information on short- to medium-term outputs and outcomes to complete data collection on broader impacts elsewhere, the categories of "health benefits" and "broader economic benefits" were not included here – although they remained an important part of the MRC's overall evaluation approach. In any case, it was felt that information on wider economic benefits could not be collected effectively using a survey of researchers. Instead, information on outputs such as supply of skilled individuals, influences on businesses and services, inward investment and income from commercial activities would be required – some of which would have to be collected from users and beneficiaries of MRC research, rather than researchers themselves.

In the following sections, we provide definitions of the range of outputs and impacts included within each of the categories retained.

²³ W. K. Kellogg Foundation (2001), *Using logic models to bring together planning, evaluation and action: logic model development guide* (Michigan: W. K. Kellogg Foundation).

²⁴ The payback model is described in some depth in Wooding et al (2004), *The returns from arthritis research, volume 1*.

²⁵ E.g. Wooding, S. et al (2004), *The returns from arthritis research, volume 1*.

²⁶ Buxton, M. and Schneider, W. (1999), *Assessing the "payback" from AHFMR-funded research* (Alberta: Alberta Foundation for Medical Research). Buxton, M. et al (2000), "Assessing the Benefits from Department of Health and National Health Service Research and Development", *Public Money and Management* 20(4), pp. 29-34. Croxson, B. et al (2001), "Routine monitoring of performance: what makes health research and development different?", *Journal of Health Services Research and Policy* 6, pp. 226-232.

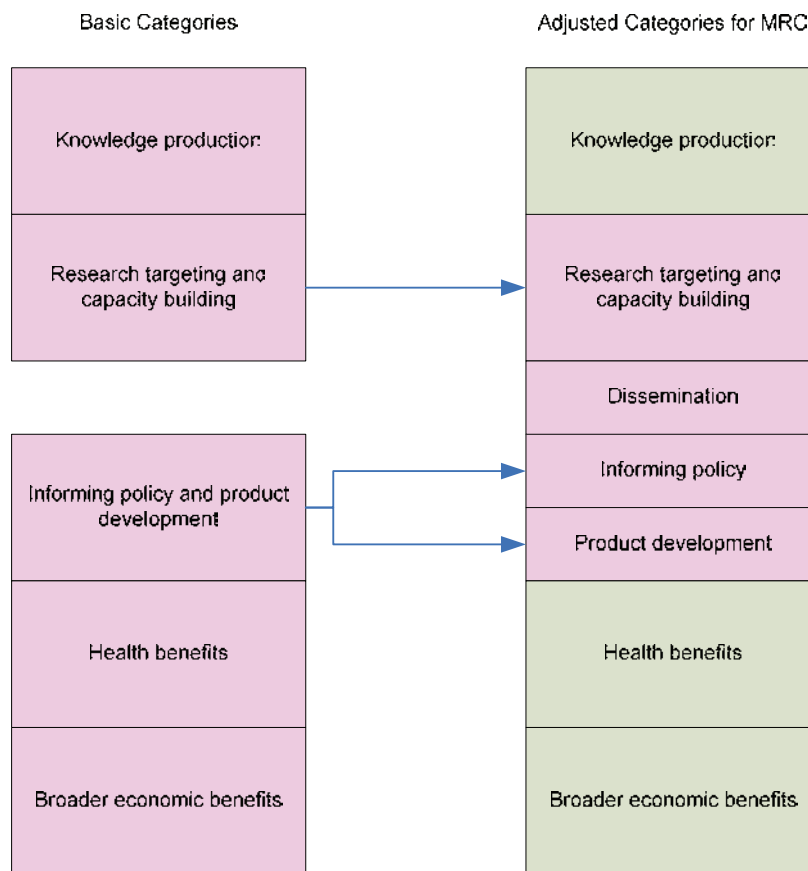


Figure 2-5: Correspondence of payback categories between the ‘standard’ model advanced by Buxton, Hanney and others, and an adjusted model developed by RAND Europe for the MRC (grey cells on the right indicate those categories that were excluded from the tool constructed for the MRC).

2.4.1 Research targeting and capacity building

Re-targeting of future work is often a key benefit from research, especially where that research is more basic and/or methodologically orientated. This may occur in one of two ways:

- It may affect the research being conducted by the PI in question by directing the research group to focus in a new area; or
- It may affect the research programmes of others working in similar or related research fields by directing them to focus on new areas.

Re-targeting may, of course, have important implications for researchers’ ability to secure further funding.

Research training and capacity building, on the other hand, may involve taking on support staff (whether technicians or students), or those specifically funded to undertake research through fellowships, lectureships and so forth. One possible measure of research training – which may appear crude but which has nevertheless been used in previous studies – is the number and level of higher and research degrees resulting (either totally or in part) from

research funding.²⁷ Importantly from the perspective of a national charity such as the MRC, we must also consider the dimension of training contributing to the wider economy, in the form of researchers who move out of formal research once their funding comes to an end.

Finally, we include the development of tools for research which may provide important support for future projects. This could include the development of databases or data collection methods, data analysis techniques, improvements in existing laboratory methods such as assays,²⁸ new models of disease and even research infrastructure improvements.

2.4.2 **Dissemination**

We have included ‘dissemination’ as an additional category in this adaptation of the payback categories, as distinct from ‘informing policy and product development’. Previous payback studies have treated dissemination as a process, but we consider it an important early indicator of potential impact, which is why we have included it as a formal category on this occasion. ‘Dissemination’ is taken to include activities such as seminars for academic and non-academic audiences, media coverage, and the uptake of research and research findings (e.g. into the curriculum for practitioner training), and various forms of public engagement activity.

2.4.3 **Informing policy and policy outputs**

We have included “informing policy” as a separate category in this exercise. This contrasts with previous work involving the payback framework by RAND Europe, which has tended to view these outputs as falling within “dissemination”. It was decided that information should specifically be gathered in this area because (i) it is high on the MRC’s agenda, and (ii) it has tended to be a neglected area of analysis in the past. The MRC was particularly interested in understanding where policy-related impacts had tended to occur in the past.

Research can be used to inform policy making in a wide range of circumstances. We interpret policymaking here in a broad sense, to cover not only government national policies, but also:

Policies made by managers at many levels within a health service;
Policies agreed at the national or local levels by groups of health care practitioners in the form of clinical or local guidelines; and

²⁷ Mushkin, S. (1979), *Biomedical research: costs and benefits* (Cambridge MA: Ballinger). Verhorn, C. et al (1982), “Measuring the contribution of biomedical research to the production of health”, *Research Policy* 11, pp. 3-13.

²⁸ An assay is a procedure in molecular biology for measuring the activity of a drug or biochemical in an organism or organic sample. A quantitative assay involve using experimental observation to measure the *amount* of a substance in a sample. Other assays measure processes such as enzyme activity and protein binding.

Policies developed by those responsible for training, education or inspection in various forms including training packages, curricula and audit and evaluative criteria.²⁹

It has been observed that, in general, basic research is less likely to inform policy in this fashion compared with research undertaken by clinical researchers or allied health professionals (AHPs).

2.4.4 Product development

On a similar level – although very different processes may be involved – research can also be used to inform product development. There is a conceptual similarity between policy and product development in that the policy or product must be adopted into *practice* in some form for health and economic benefits to accrue – it is not enough simply for the product or policy to be developed.

2.5 Testing the validity of the model: assessing alternative output frameworks

To ensure that all potential outputs from MRC research had been covered by the proposed framework, and to ensure that it mapped adequately with existing frameworks, we compared it with a series of similar representations, issued by Research Councils UK (RCUK), DIUS, the Knowledge Transfer and Economic Impact Group at RCUK and the MRC itself. We found that these frameworks were overwhelmingly concerned with inputs and processes, rather than outputs and outcomes *per se*.

On this basis, we made only one change to our framework, to include effects on future research and capacity building (at the MRC's request, since this was an area of particular interest for them). Specifically, we recognised the contribution of trained scientists to the wider economy, and the ability of research establishments to attract researchers from abroad on the basis of their reputation and/or other factors. The mapping diagrams produced during this exercise are reproduced in Annex B.

²⁹ Hanney, S. Soper, B. and Buxton, M. (2003), *Evaluation of NHS R&D methods programme*, HERG Research Report No. 29 (Uxbridge: HERG Brunel).

CHAPTER 3 **Choosing an Appropriate Tool for Research Evaluation**

In this chapter, we describe the range of tools potentially available to the MRC to support its evaluation requirements. Ultimately, we show how we arrived at the conclusion that, given the mix of quantitative and qualitative information required by the MRC, a modified tick-list approach was the most appropriate in this case.

3.1 **Tools for evaluating research: a review of the options**

Taking the issues highlighted above into account, we may consider a range of options for gathering data to support research evaluation requirements. Evaluation tools for research grants fall broadly into two categories, each with different uses:

- Those that catalogue outputs and outcomes (more strictly employed for research evaluation): these approaches involve building up an understanding of what impacts – if any – have arisen from the research project in question,
- Those that map research: these approaches are typically used for overviews of research portfolios and for building an understanding of translation, either by identifying points of handover or possible bottle-necks.

3.1.1 **Cataloguing tools**

Tick list and menu approaches

Tick lists bring together very detailed sets of likely outputs and outcomes from research. They provide a way of capturing information in granulated form. Because they adhere to a standardised format, they also allow for ready comparison between research grants. Though effective for capturing information in the first two payback categories (knowledge production – not included in this study – and research capacity building), it becomes progressively more difficult to identify the fine-grained gradations in research output necessary to populate a tick list for the later categories– particularly for wider health and economic benefits.

Exemplar scales

Scales are particularly useful in narrow areas of research. They provide suggested scoring levels for a number of hypothetical but closely related research projects in a particular field, acting as a model for scorers to use when assessing end-of-grant reports. The major

advantage of this approach is that it provides assessors with a level of personal discretion when identifying and assessing payback from research. The major drawback of an exemplar scale approach is that the research field must be relatively well-defined for a relevant exemplar to be arrived at. For wide-ranging outputs, the risk is that the exemplars used become so general that they lose rigour.

Calibrators

In contrast to exemplar scales, calibrators rely on examples from actual research grants rather than hypothetical ones. In each scoring round, some sample scores from previous rounds are included, to show how assessors have responded to the categories employed in each case. The major advantage of this method is that it provides concrete examples for scorers to compare a grant against. The major disadvantage is that it is very difficult to ensure that scales are sufficiently disaggregated to do justice to the range of grant reports that a scorer may encounter. For example, if the calibrator grant is regarded as scoring highly against all the measures in question, then a subsequent grant that is even stronger may require wholesale revision of the scale.

3.1.2 Mapping tools

Pathways

Whereas cataloguing tools usefully collect information on the range of possible outputs from research, they do not provide a longitudinal perspective. Instead, they give a ‘snapshot’ impression of outputs from research at the particular point at which the grant report was drawn up. For those research funders that wish to build a better understanding of how research moves from one stage to another – and ultimately understand the underlying reasons explaining why it fails to do so in many cases – research pathways offer a basic but effective means for collecting longitudinal information. An important advantage of this tool is that it requires researchers to engage with the issue of research payback and to understand downstream activities. On the other hand, it is very difficult to draw up pathways that adequately capture a full range of research (where a funder supports a great variety of research) without any suggestions of directionality, or greater emphasis on clinical or applied work. This was a difficulty we encountered on a number of occasions during the course of this project.

3.2 Developing an appropriate tool for the MRC

We have seen that, in this exercise, the MRC wished to:

1. Collect information on the range of outputs and outcomes from its funded research, in a way that could potentially be aggregated – from aspects of knowledge production, through research capacity building to wider outputs including dissemination, policy impact and product and intervention development;
2. Build a better understanding of the range of research that it funds, across the spectrum from basic to clinical, and begin to address the issue of translation;

3. Collect a combination of quantitative information, which could potentially be aggregated, and some qualitative information – around researchers’ perceptions of the support they receive from the MRC, for example.

In view of these complex information collection requirements, we concluded that the most appropriate instrument was a composite of a range of linked tools – each of which was designed to collect rather different kinds of information. Building on our experiences in developing a similar tool for ARC, we opted for a modified tick-list approach, with space for some qualitative responses, and a research pathway attached as an addendum to enable researchers to map their work.

3.2.1 Complications of survey development: when to collect information

A key difficulty in research evaluation – and one related to the issue of attribution – is that impacts may accrue only several years or more after the end of the grant in question. It is therefore not always easy to ensure that information collection is timely. How do you decide on the most appropriate time window within which to collect information? For example, while there is emerging evidence from bibliometrics studies which suggests that, for the life sciences at least, a five year timeframe is appropriate for gathering evidence of journal paper impact (in terms of citations to these papers), this becomes a much more challenging question where wider outcomes from research are concerned.³⁰

Equally important is the problem of gathering information on “early stage outputs” that cannot readily be captured. In practice, the most practical way of capturing initial outputs appears to be through publication records and various forms of dissemination (seminars, for example). But it is possible to envisage a situation in which a researcher may be in the process of making a potentially paradigm-shifting discovery at the time at which information on outputs and outcomes is collected. For example, some of the basic researchers we spoke to during the course of the project argued that a large part of their impact consisted of pre-publication knowledge production – in the forms of unpublished contributions to understanding in their research field, which might not in practice be counted as initial outputs.

In principle, it is possible to collect information about paybacks (or likely paybacks) at the outset of a grant, at its end, at some specified time period *after* the end of the grant, on application for a follow-up grant, or by some means of random sampling if organisational resources are not sufficient to gather information across the research portfolio. It is important to bear in mind that there may not be an ‘ideal’ time to capture outputs as there is an inevitable time lag after the end of a research grant before certain kinds of output are realised, and attempts to capture potential outputs at the outset of a grant may prove to be inaccurate.

From the perspective of the MRC, the primary consideration was to collect historical information on research that it had previously funded. For the future, however, the MRC

³⁰ Van Leeuwen, T. et al (1999), “Critical comments on Institute for Scientific Information impact factors: a sample of inorganic molecular chemistry journals”, *Journal of Information Science* 25(6), pp. 489-98.

wished to re-structure its end-of-grant information collection schemes. We were therefore tasked with helping the MRC to develop a flexible information-gathering tool that could be used to collect information historically, and as the basis for a new form of reporting – both during, and at the end of grants. The MRC elected to focus on evidenced outputs and update data collection on annual basis. In this way, it was hoped that those preliminary outputs that became tangible impacts could be reported on within a relatively short time-frame.

3.2.2 **Complications of survey development: minimising the burden**

Principal investigators are uniquely well-placed to provide information on the impacts of their grants, principally because they will often have seen many of the impacts themselves. However, principal investigators' time is often also short, we therefore advised the MRC to adopt an approach which minimises the burden placed on researchers. In order for this to be achieved, the system should be as simple and quick for researchers to use as possible and we should avoid collecting information that we did not plan to analyse, or for which there was no specific need.

CHAPTER 4 **Developing a Survey Tool to Support the MRC's Research portfolio evaluation**

In chapter 3, we concluded that a modified ticklist was the most appropriate information collection tool for the MRC. In this chapter, we describe the initial construction for the new instrument to support the MRC in evaluating existing and historically-supported research projects. We explain how new questions were developed for inclusion in the questionnaire, and describe attempts to devise a pathway to map the research supported by the MRC that ultimately proved unsuccessful. Finally, we outline some important changes that were made to the content of the instrument based on feedback we received during a series of stakeholder workshops and cognitive interviews conducted to test it.

4.1 **Testing the putative outputs framework for the MRC**

Adapting the survey tool developed for ARC for use by the MRC meant moving beyond the payback categories outlined in chapter 2 (which provided “headlines” to help structure the tool), to the vast range of granular outputs and outcomes listed in the framework.³¹ To test the suitability and validity of this list for the MRC's purposes, we undertook a series of interviews with individuals working in research management at the MRC in the early stages of this project. Broadly speaking, the interviewees agreed with our provisional analysis. The principle changes were the addition of two further categories in the “product development” section of the framework, including:

1. Psychosocial interventions – including research relating to psychotherapeutic techniques, Cognitive Behavioural Therapy (CBT) and other forms of related intervention; and
2. Health services research –including forms of research relating to the organisation and management of health services in the UK and internationally

³¹ Details of the full version of a very similar survey – produced for the Arthritis Research Council – are contained in a recent RAND Europe report entitled *Mapping the Impact* (Wooding et al, 2009).

4.2 Developing the survey tool

Following further discussions with the MRC, we narrowed down the scope of information collection to three key areas:

- Outputs from individual grants – on the assumption that researchers would repeat the relevant section of the questionnaire for each grant (with some indication of outcomes if there were any at this early stage);
- Outcomes from the individual researcher's whole portfolio of MRC-funded research;
- Additional information to help the MRC classify/codify the research that it supports.

We focused on gathering downstream outputs, building on the draft ARC questionnaire. In view of the MRC's desire to integrate this tool with other aspects of its organisational reporting, however, particularly the need to collect quite specific information for the MRC Scorecard,³² extra questions covering information in the area of knowledge production were included. Additional requests for data on specific inputs and outputs – such as figures for the number of laboratories engaged in experimental medicine research, and the number of students supervised by each member of the laboratory, for example – meant that some substantial changes were made to the model developed for ARC. Details were sought principally in the following areas:

- The number of publications per principle applicant
- The number of clinical staff employed on MRC grants
- The number of HEI spin-out companies arising from MRC-funded research
- Active research staff supported on MRC research grants
- First destinations for all staff leaving the grant/fellowship/programme

A range of information on researcher engagement with industry, including PhD and post-doc positions combining industrial research with academic training; and the number of publications with industry co-authors, was also requested by the MRC.

4.2.1 Developing new questions

In this section, we provide some illustrative examples to show how new questions were developed for the questionnaire. We focus on those areas that proved most challenging, or where there were relevant lessons that might be transferred to other exercises. The discussion that follows does not cover all the new questions that we added to the instrument.

³² The MRC Scorecard is a balanced scorecard-style performance management tool, used to capture organisation-wide performance on an annual basis. The Scorecard forms a key part of the MRC's annual reporting structure to government to demonstrate operational effectiveness and the impact of the research that it funds.

Classifying research type

A key issue was determining how best to help the MRC classify the research that it supports through information gathered using the survey instrument. Gathering information on research type was viewed as an important tool to help route the questionnaire, and ensure that researchers were only presented with questions that were appropriate to their work. The MRC was keen for the classification used in the instrument to match up closely with that used by the UKCRC. As shown in annex C1, however, match-up between these two approaches was not always clear, and we agreed with the MRC that we would not stick rigidly to the UKCRC's classification. In fact, the requirement to classify research type was one that the MRC dropped in the later phases of the project, as it did not regard this as suitable for questionnaire routing.

Supporting data collection on knowledge production:

Though not initially part of the project remit, the MRC opted to try to collect information on knowledge production arising from its funded research. This was a response to two factors. Firstly, the MRC was not confident of the effectiveness of its existing systems for collecting information on publications arising from the extramural programme. Secondly, the MRC Scorecard 2007/8 included a specific requirement that information on publications be collected.

Two questions on publications – both peer-reviewed and non-peer-reviewed – were therefore included in the questionnaire to collect information on publications from the extramural programme. It was decided that the tool should collect ISI and PubMed identifiers where possible. The MRC intends to use this information to conduct further, bibliometric analyses of outputs from the extramural programme at a later date.

Gathering information on research staff

The MRC expressed an interest in gathering information about the research staff its funding supports. In particular, information about the size of research teams and the proportion of clinical staff and PhD students was proposed to be helpful in searching for correlations between the size and composition of team and some research outputs. There was also interest in finding out more about the career destinations of MRC-supported research staff. This is a key reporting requirement for the MRC and for other research funders; research council support directly and indirectly contributes to economic impact by increasing the supply of skilled people in the UK.

Two areas of impact present themselves for consideration. Firstly, we may consider *researcher-level impacts*, specifically the movement of individual researchers into, around, or out of the research field. Here, the MRC's main interest was in building a sense of career destinations. Secondly, we may identify *system-level impacts*, specifically the recruitment of researchers from abroad in part as a result of the reputational impact of research previously conducted in the UK.

We experimented with a range of structures/approaches for these questions. Ultimately, the MRC elected simply to capture key data on each individual as a single record. Specifically, the final survey tool sought information on location, job sector, and previous and next job role for each leaver. This enabled the MRC to understand in broad terms where trainees and researchers were moving to. Recent discussions have included

consideration of how data on people moving to the UK might be obtained, as a way of beginning to establish whether there is a brain drain or gain in specific areas. Clearly, this data is needed for any analysis of flux in trained people – but the MRC survey (in its current form) is about the outputs from research not the inputs into research. The previous posts/location of people employed on grants could be determined from application information.

Measures of esteem

Given the long-term emphasis of the second half of the questionnaire, the MRC was keen to capture outputs that might reflect the wider contribution of research conducted by the researchers surveyed. One way of doing this was to gather information on prizes, awards and other 'measures of esteem' accorded to researchers during their careers. In this section, we included outputs such as research prizes, medals, membership or fellowship of learned societies (awarded, rather than applied for), and membership of editorial boards. As ever, the problem of attributing such outputs specifically to MRC-supported research that had occurred within the preceding 5 years was the key challenge.

Feedback on the health of disciplines

This section collected information on any difficulties that research teams had experienced in recruiting staff with particular skills, and any significant changes anticipated by researchers in demands for staff with particular skills. The aim was to provide an evidence base for strategic decisions about capacity-building training schemes. The MRC has a small set of strategic priorities for capacity building – these are not expected to change regularly, and include areas such as the application of mathematical and statistical expertise in medicine

4.2.2 Developing a research pathway

In chapter 3, we discussed that while cataloguing tools usefully collect information on a range of outputs from research, they have limitations when it comes to mapping the journey travelled by research from a longitudinal perspective. As part of its drive to better understand the portfolio of research that it funds, the MRC wanted to build a stronger picture of areas in which its research is concentrated, and how research moves through various stages of development and translation from the laboratory to eventual practical application. To help the MRC build this broader understanding, we conducted a review of pathways used by other funding bodies, including one developed by RAND Europe for ARC, and then developed a modified version pathway adapted for MRC research.

Using pathways to understand research processes

Research pathways have been developed elsewhere by a number of funding and research policy organisations, to perform a range of functions. In general terms, existing pathways fall into three categories:

- Category 1: Represents the outputs from research diagrammatically, by demonstrating how various stages link together;
- Category 2: Describes, in near check-list form, the stages through which research must pass in order for it to be translated into practical applications;

Category 3: Combines diagrammatic output representation (as in category 1) with basic decision points in the research process.

Existing pathways strongly reflect the particular concerns of the research and funding policy bodies that developed them – ranging from cancer research to translation into medical devices and pharmaceuticals. Table 4-1 summarises the key strengths and weaknesses of each pathway model in the context of this exercise.

Pathway	Category	Specificity	Advantages	Disadvantages
RAND Europe-ARC	1	Low	<ul style="list-style-type: none"> • Comprehensiveness • Non-linearity • Strength for basic research • Follows translation through to implementation 	<ul style="list-style-type: none"> • Limited information on barriers to research/decision points
Technology Readiness Levels	2	Medium to High	<ul style="list-style-type: none"> • Strength on downstream translation of research • ‘Check-list’ style approach to translation of research 	<ul style="list-style-type: none"> • Assumed linearity • Weakness on basic research • Narrow focus on health technology • Weakness on barriers to research/decision points
National Cancer Institute Pathways	3	Medium to High	<ul style="list-style-type: none"> • Non-linearity • Detail on processes 	<ul style="list-style-type: none"> • Weakness on basic research • High specificity • Narrow view of decision points • Does not follow translation through to implementation

Table 4-1: Summary of pathway comparison findings³³

This raises some important questions about the context in which a pathway is to be used:

1. Will it be used simply to categorise research or to understand *processes*?

³³ Note that, although a diagram is included in the appendix to this report mapping the UK Clinical Research Collaboration’s Research Activity Codes against the RAND Europe-ARC Research Pathway, we did not regard the UKCRC as a pathway as such, because it does not seek to demonstrate progression in the same way as the other pathways examined here. For further details of the pathways described above: (1) the development of the RAND-ARC pathway is described in some depth in Wooding et al (2009), *Mapping the Impact*; (2) further details on the TRL approach can be found here: http://www.aof.mod.uk/aofcontent/tactical/techman/content/trl_whatarethey.htm (as of 4th August 2009); (3) details on the NCI pathways appear no longer to be available on line at the time of writing.

2. If the focus is on processes, what *kinds* of processes are of greatest interest? Specifically:
 - Is the primary interest in understanding barriers to the movement of research from one area/phase to another?
 - If so, is the focus on personal, research-based, legal/regulatory, institutional or funding/policy barriers (or indeed a combination or all of the above)?
3. *How* will the pathway be used to better understand the research portfolio? For example, if the pathway is to be distributed to researchers as part of a written or online questionnaire, it must be presentable in easily accessible fashion.

In the sections that follow, we outline each of the existing pathways identified and compare their attributes. The table below presents a summary of the findings of the pathway comparison exercise as related to the MRC.

Building towards a research pathway: the UKCRC's classification of research activities

In 2006, the UKCRC published a flagship report seeking to understand the health research environment in the UK.³⁴ The report includes a series of 'Research Activity Codes' used by the UKCRC to break down research activity in the UK, and modelled on the Common Scientific Outline system developed by the International Cancer Research Partners to understand the cancer research portfolio. The codes constitute a system of research classification rather than a pathway per se – but the Common Scientific Outline system on which they are modelled has been used as the basis of a pathway by the National Cancer Institute in the US. The MRC has used the UKCRC's classification extensively in relation to its own research portfolio.

The RAND Europe-ARC Research Pathway

RAND Europe has over the past few years developed and tested a pathway to describe ARC's research portfolio. This pathway falls within category 1 above, and represents stages in the research process, grouped according to whether they fall broadly within basic biomedical research, clinical research, qualitative research, public health research and, finally, meta-analyses.

The kinds of analysis that the RAND Europe-ARC pathway supports include:

- Classification of research activities by a particular PI according to the area(s) within which they fall;
- Preliminary examinations of the outputs from research.

The key advantage of the RAND Europe-ARC approach is that it is *comprehensive* across output categories, bringing together research across the spectrum in a single, accessible diagram. As the mapping diagrams in the annexes suggest, it covers in summary all of the categories included in the pathways described below. Furthermore, it does not assume

³⁴ UK Clinical Research Collaboration (2006), *UK Health Research Analysis* (London: UKCRC).

linearity in the research process, including a number of pathway routes at the level of basic biomedical research.

A key disadvantage is that – in its current form – it does not examine how research is handed over from one stage to another. This pathway is primarily descriptive, and has been developed to enable researchers completing a survey questionnaire to describe where their research sits.

The US Army Medical Research and Materiel Command's Technology Readiness Levels (TRLs)

The US Army's TRLs operationalise the progression from scientific hypothesis to product development and marketing, by providing a 'checklist' through which all new medical technologies must pass (a category 2 pathway). They include details of required technological assessments, piloting, clinical trials, and facilities and legal safeguards that must be put in place before a product is marketable, and indeed are viewed as levels of technological 'attainment' by the US Army.

The TRLs describe degrees of 'technology readiness' along an axis running from 'novel concepts and emerging technologies', through to 'applied research' and 'prototype maturation' and 'production and distribution'. They are at once:

- A classification system – providing an understanding of the extent of development of research relative to application, which is understood as the final goal – and,
- A basic research pathway describing the progression of research from basic concept to application

The main advantage of the TRLs is that they provide a good understanding of downstream translation from basic research. They are strongly focused on understanding how research is transformed into marketable and distributable products. If adapted to reflect legal and regulatory requirements in the UK, they could provide a useful model for MRC-Technology (MRC-T) to distribute to partner researchers and research institutions to inform research translation efforts.³⁵

However, there are a number of clear disadvantages to this pathway from the MRC's perspective:

- It assumes linearity of research progression from one stage to the next;
- It offers little understanding at the level of fundamental research;
- It is narrowly focused on health *technologies* – specifically, pharmaceuticals and medical devices. It does not facilitate detailed understanding of developments related to qualitative or public health research, in tune with the MRC's portfolio;
- It offers little understanding of barriers to research translation beyond potential legal and regulatory pitfalls (e.g. failure to adhere to particular processes).

³⁵ MRC-T is an office within the MRC dedicated to supporting its funded researchers in securing intellectual property rights on discoveries they make, and supporting the translation of MRC-funded research into practical applications – among other functions.

The National Cancer Institute's Pathways

The US National Cancer Institute's (NCI) pathways have been developed from the Common Scientific Outline system described above, and are in some respects the most detailed research pathways in the health and biomedical research field. They aim firstly to describe stages in research development, and secondly to describe key *decision points* for funding and/or research policy bodies in determining whether or not to support a particular line of work.

The main advantages of these pathways are that:

- They do not assume linearity in the research process – including both multiple decision points and research lines *within* each pathway, and a range of different pathways to describe developmental stages in different fields;
- They help to provide a basic understanding of *how research moves from one stage to the next* by describing decision points for funding/research policy bodies.

On the other hand, there are disadvantages to the NCI pathways from the MRC's viewpoint:

- As with the TRLs, they offer little understanding of processes at the level of basic research, which presents important difficulties given the balance of the MRC's portfolio
- They have a high degree of specificity within cancer research; it would be cumbersome to replicate this kind of specificity for a research portfolio as broad as the MRC's;
- They include decision stages that are not directly relevant to the MRC – by posing questions such as 'does envisioned clinical need justify expenditure of resources?';
- They do not follow the process of translation through to implementation and surveillance, stopping at early stage clinical trials;
- They do not provide an understanding of barriers to research translation beyond the funding/research policy decision points described above.

Understanding Handover Points

A common feature of the pathways described above is the limited or narrow information they provide on decision points and barriers in the research translation process. While the TRLs focus almost exclusively on regulatory/legal aspects, the decision points in the NCI pathways are closely tied to National Institutes of Health decision-making and are not easily generalisable.

Research handover is a complex phenomenon. Besides regulatory and policy or funding decisions, we need to bear in mind that it may be strongly affected by other factors, including:

1. Exposure through primary outputs – access to journal papers etc;
2. Personal interactions – whether through seminars, conferences, collaborations or simply word-of-mouth;

3. Institutional factors – e.g. limited resources, changes in governance structures, etc.

There may also be substantial differences in the factors at play at various stages of the research process. Detailed understanding – and indeed modelling – of these interfaces is likely to require substantial further analysis.

Conclusions from the Pathway Comparison Exercise

We have seen that different pathways focus on quite different aspects of research and research translation. While the NCI pathway offers in some senses the most comprehensive description of research progression, it is also highly specific to cancer research and requires that research is clearly identified as falling within a particular stream. The RAND Europe-ARC pathway, on the other hand, represents a pared-down but comprehensive (across research areas) and accessible model for researchers that has been tested extensively (and successfully) as part of a survey questionnaire. Finally, while some combination of these pathways may help to further sector-specific understanding (for example, the specifics of research translation in immunology), they do not elaborate – either individually or in combination – on the questions of handover and barriers to translation.

On this basis, we included a slightly amended version of the RAND Europe-ARC research pathway in the draft questionnaire submitted to researchers during stakeholder workshops. This pathway was included as a basis for further discussion and ongoing development, although it was ultimately abandoned.

4.3 Structuring the questionnaire

Deciding how best to combine these various forms of information collection (collecting outputs by grant and by portfolio; and using both a ticklist and a pathway-based approach) presented some important challenges. From a structuring perspective, the MRC was clear that the instrument would need:

- To be clearly routed as an online document, to ensure that it could be easily navigated.
- To include some kind of cap on open response questions, to ensure that information gathered was comparable, and that the questionnaire did not take too long to fill in. In the end, a word-limit of 4,500 was imposed for each open response box.

Clear guidance notes would also need to be drawn up to accompany the survey to explain terminology, abbreviations, and provide further detail on the information being requested at each stage. Initially, we structured the questionnaire as a simple tree of related questions, as illustrated in figure 4-1 below.

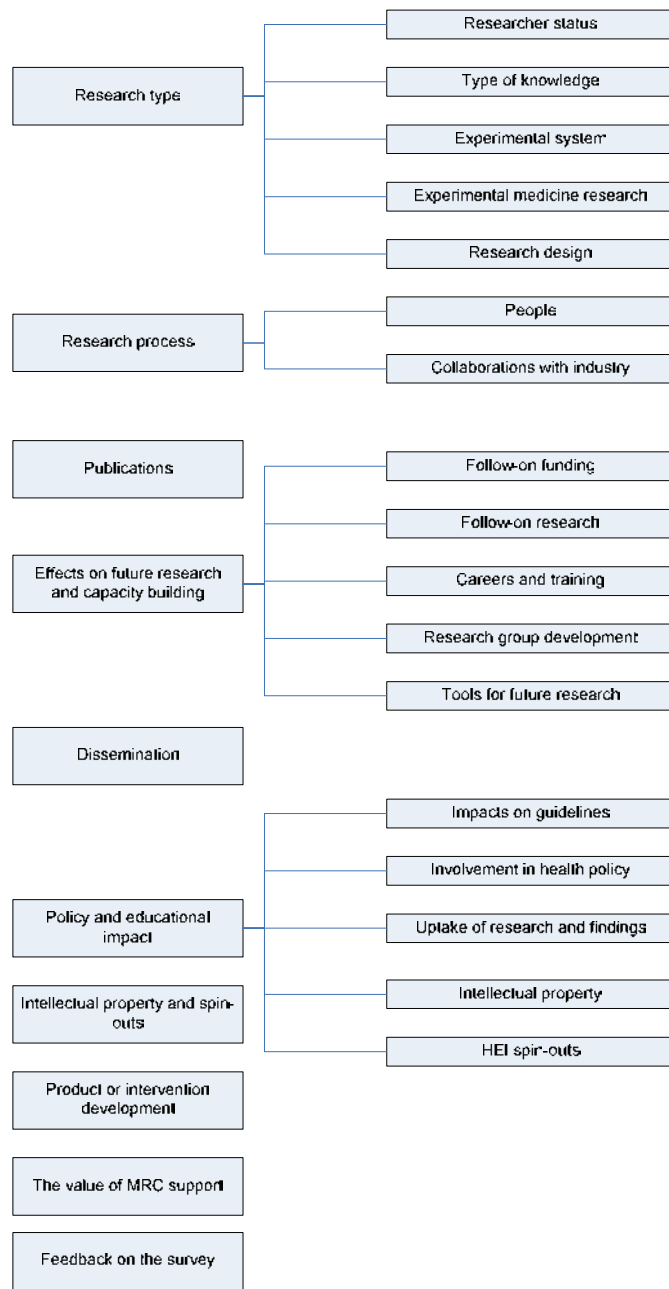


Figure 4-1: The initial structure of the survey instrument developed by the MRC and RAND Europe.

CHAPTER 5 **Testing and Improving the Survey Tool with Stakeholders**

In this chapter, we describe the process of testing and improvement that the survey underwent in consultation with key stakeholders – identified in advance by the MRC. The process is summarised in figure 5-1.

5.1 **Advisory Group workshop**

An important early stage of testing was a review of the draft survey tool with an advisory group to the project, including MRC representatives working in information management, IT, university relations, and knowledge transfer. Although no major issues were identified at this stage, some recommendations were made for further development of the survey. It was suggested that the research classification system should be used to help route the survey and ensure that researchers were asked only those questions that were pertinent to their work. Participants also suggested that guidance in support of the survey should be improved; for example, supporting information from the Higher Education-Business and Community Interaction (HE-BCI) survey could be used to help provide guidance to respondents on the best way to provide information on career destinations and collaborations with industry.

5.2 **Stakeholder workshops**

We then held two stakeholder workshops to test an early draft of the survey instrument and supporting guidance notes in early 2008. These discussions brought together senior researchers across a range of disciplines to offer their perspectives on the instrument, and produced a number of important overarching findings. Researchers were drawn from a leading London-based research institution and Cambridge University, and were selected by the MRC.

5.2.1 **Positives from the exercise:**

Many of the researchers we spoke to during the stakeholder workshops understood the rationale for gathering information in this way, and broadly agreed that the approach adopted was appropriate. One extramural researcher openly expressed his surprise at the somewhat limited nature of information collection requirements in the past, and was positive about the approach taken here.

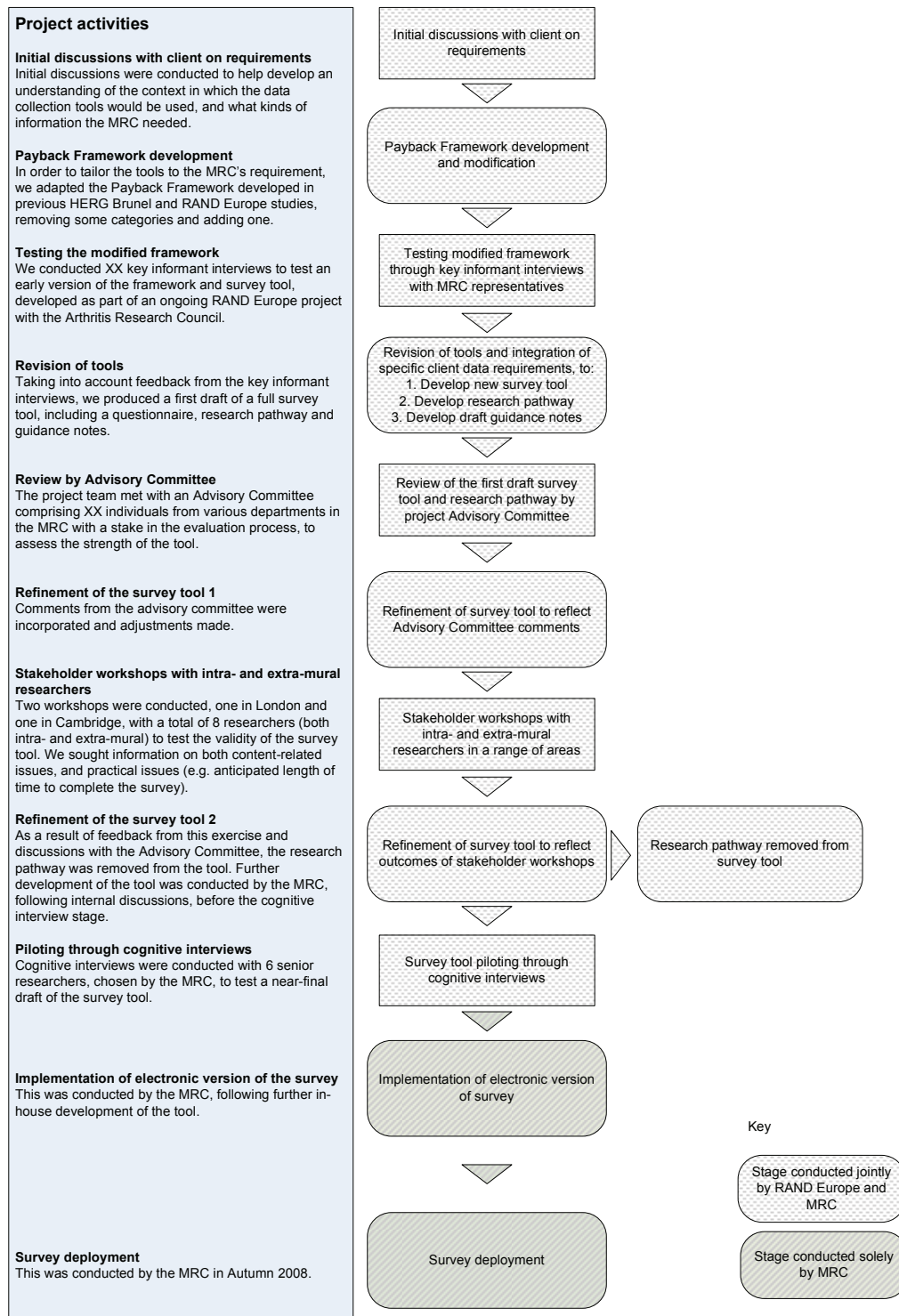


Figure 5-1. Outline of key project stages during the survey tool development and testing phase.

5.2.2 Drawbacks and issues

However, the researchers also highlighted several areas of concern. An important overarching question for the researchers was **why the MRC should wish to conduct this sort of exercise** at all. One asked why the MRC had chosen to evaluate its own research

rather than employing an external body to do so. In particular, though, participants were keen to ensure that the information gathered in this survey would not be used to evaluate individual researchers, especially since it was being collected on a grant-by-grant basis. To help ensure that the rationale for conducting the survey was made sufficiently clear, the participants recommended that the questionnaire should be prefaced with an explanatory note outlining the background to the exercise, and what its aims were.

At a practical level, the participants were keen to ensure that the questionnaire did not impose an **unrealistic administrative burden** on researchers. They felt that this would greatly reduce the return rate, and undermine the exercise as a whole. Specifically, they recommended that the questionnaire should avoid, where possible, collecting information that researchers would assume the MRC already held; and that the number of open response boxes should be kept to a minimum. This was offset by the desire of a number of participants, especially those working on basic research, to ensure that there was adequate provision for them to explain the nature and impact of their research where it had yet to result in tangible outputs, such as publications. Above all, the researchers expressed some concern at having to fill out the first section of the questionnaire several times over, one for each of their current grants. While acknowledging that the MRC needed to gather information on a grant-by-grant basis to ensure correct attribution of outputs and outcomes, they felt that this would impose a significant administrative burden on researchers.

This objection threw the central issue of **attribution** into relief. In chapter 3, we discussed at some length the problem of attributing outputs and outcomes to individual grants, especially where there was overlap with concurrent blocks of funding. The workshop participants suggested that the questionnaire needed to be clear at all times whether requested information was to relate to individual grants or to an entire research portfolio. Furthermore, they felt there were particular difficulties around data collection from extramural grants, since there was a clear risk of double-counting. This is so because extramural research is more likely to have been supported using additional sources than intramural research, and for this reason there is a danger that outputs and outcomes will be counted more than once according to the funding source.

Looking more closely at the content of the questionnaire, it quickly became clear that the researchers were concerned about the potential for **bias and directionality** in the survey. In particular, many felt there were suggestions of a bias against basic research, in that the questions tended to focus, in their view, on translational and clinical research. Sections including the one asking for information on ‘impacts on clinical guidelines’ were specifically highlighted by several of the participants. One of the researchers even argued that the structure of the questionnaire suggested that translational research was to be viewed as the favoured form. Several participants pointed out that such a bias, if present, would ultimately prove counterproductive, since researchers were more likely to try to “game” the system to counter-balance it.

In this context, the **research pathway was perceived as problematic**. Participants felt that directionality in the pathway structure was too strong, and that the orientation of the diagram suggested too strong a focus on clinical and applied/translational research. A number of researchers involved in the workshop seemed unable to locate their field on the

pathway we had developed. One participant, for example, who worked in the field of cognitive psychology, felt that his work could quite easily fit into both the ‘biological system understanding’ and the ‘developing theory and understanding’ categories. Others felt that specific areas of work – such as experimental medicine, the development of vaccines and stem cell research – were not adequately reflected. Overall, there was a sense that most of the research the MRC supports was concentrated in a small number of boxes in one section of the pathway, and that the emphasis of the diagram would need to be adjusted to better reflect the balance of the portfolio.

5.3 **Restructuring the questionnaire based on findings from the stakeholder workshops**

Having experimented with a linear structure for the questionnaire in the first half of the project, we opted to revise it so that a clear distinction was made between information-gathering relating to specific research grants, and that relating to work across a whole portfolio. This decision was made on the basis of feedback provided by participants in the two stakeholder workshops; the new structure is illustrated in figure 5-2.

5.4 **Cognitive interviews and further testing**

The cognitive interviews provided a final opportunity to test the survey instrument with a group of researchers before issuing it. The main purpose of these interviews was to iron out problems of wording, determine whether particular sections of the questionnaire needed clarification and/or guidance notes. Since the interviews were conducted with a paper version of the survey tool, there was no attempt to test the online interface at this stage. There was also no attempt to radically re-formulate the contents of the questionnaire based on the findings from these interviews as this could introduce further misunderstandings.

The MRC provided RAND Europe with a list of interviewees for this part of the project, including 8 senior researchers from institutions based across the country, and working in a range of fields from cardiovascular research and reproductive science to genetics and epidemiology. Our approach to the cognitive interviews was to run through a full draft of the questionnaire over the telephone with each interviewee as if they were trying to fill it in. We made no attempt to ‘guide’ them through the questionnaire, since the specific intent of this exercise was to test whether or not the structure and wording of the questionnaire made sense, and how well the instrument worked as a stand-alone tool. It is important to note that the version of the questionnaire we worked through with the interviewees was in MS Word document form, rather than as an online version with the appropriate routing.

Our findings during this exercise were broadly positive. The researchers we spoke to **understood the rationale** for conducting a data-gathering exercise of this kind, and for collecting information in the specific areas in which it was asked for. They were, in the main, quite positive about the kind of information that the instrument was being used to gather. Some were openly supportive, with one arguing that data collection from funded researchers to date had, if anything, been surprisingly limited in the past.

However, several clear problems were identified, some of which were overarching in nature. First, most of the researchers still felt that completing the questionnaire satisfactorily would be **time-consuming** because they would have to return to their archives to check particular details. Some of the interviewees felt that this would be exacerbated by the need to fill in separate versions of the first section of the questionnaire for each grant that they currently hold. Overall, most of the researchers we spoke to felt that it would take them at least an hour to complete the survey, with two of them suggesting it would take up to an hour and 40 minutes.

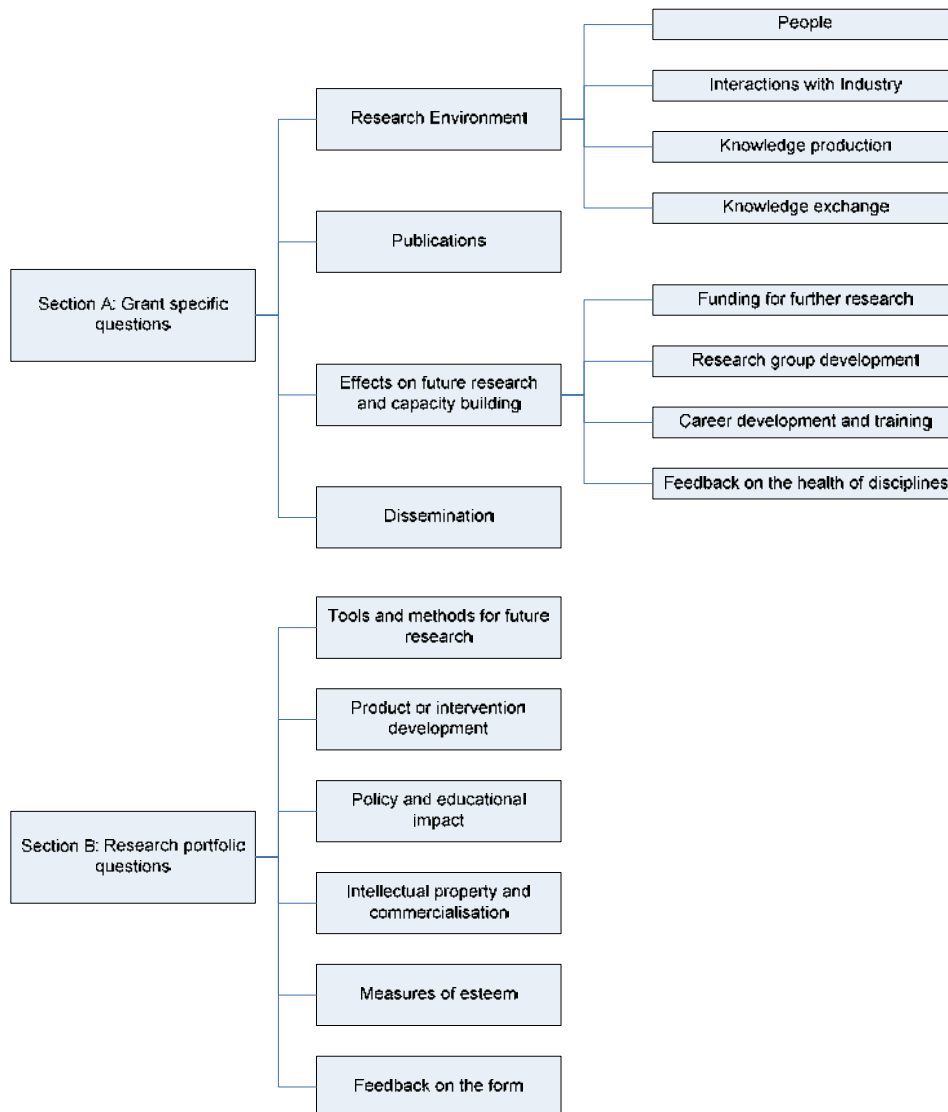


Figure 5-2: The revised structure of the questionnaire, based on feedback from participants in the stakeholder workshops, and the MRC-RAND Europe workshop.

Several counter-arguments were presented to these objections. First, the MRC suggested that, although information collection during this initial round was likely to be time-

intensive because the MRC was building up information systems in this new format from scratch, in future, the researchers could assume that they would simply be updating material already entered into their online questionnaire. Furthermore, the MRC made clear that it would be acceptable for researchers to delegate completion of various sections of the questionnaire to more junior members of staff who were better able to access the relevant information. Finally, the MRC suggested that only a small number of researchers were actually likely to have to fill in the questionnaire more than once. Preliminary research had suggested that this would probably apply to only about 25% of the researchers currently receiving MRC support, and none of their researchers held more than 4 grants concurrently. For those holding more than 2 grants, the MRC suggested that there might be possibilities for providing additional incentives to encourage participation – although this suggestion was not developed further during RAND Europe’s discussions with the MRC.

Despite the time-consuming nature of the first version of the ODGT, however, the in-depth data collection that it enabled has greatly assisted the MRC in identifying what kinds of information are most burdensome to gather, and which data are richest in evaluation material. Subsequent versions of the questionnaire have been focused to gather the information that is most helpful, on this basis.

Many researchers felt that there was a **danger of ‘strategic’ responses** from participating researchers. In other words, they foresaw a tendency to inflate the stated contribution of MRC-funded work to their results and future research direction in a bid to win more funding in the future. The researchers argued that the questionnaire would need to be carefully structured to minimise the effects of such strategic answering.

Some questions were raised about the **structure of the questionnaire**. The draft instrument was divided into two sections, the first applying to particular research grants, the second applying to longer term outputs from the research portfolio as a whole. An important issue was that the researchers were unclear on the timeframe over which the second section of the questionnaire should be applied – 5, 10 or 15 years. The MRC subsequently clarified that it saw this section of the questionnaire being used to collect information relating to the previous 5 years and no longer. Further, there was some disagreement as to whether some of the questions were in the right half of the questionnaire. For example, several interviewees felt that questions asking for information about dissemination to patients and the public, which were originally placed in the first section, should be moved. They argued that it would be impossible to attribute these outputs to individual research grants, since this kind of dissemination usually concerned findings across a whole research portfolio.

In other cases, the **format of particular questions** presented problems. Open response boxes were often cited in this context. Researchers felt that a clear rationale would need to be given to explain why information collected in this way was being gathered. It was also felt that cap would be needed on the amount of information gathered, partly to ensure comparability between researchers. The MRC suggested that all open response boxes should be limited to 4,500 words in length to ensure comparability. However, it was keen to retain open response boxes on the basis that a tick-box approach narrowed perspectives

on research too much, and would not give researchers the leeway they needed to fully describe the complexities and value-added of their projects.

In a related vein, **some of the information requested** using the tool was felt to be **either very difficult or impossible to obtain**. It was widely felt, for example, that researchers would not know if their work had been cited on clinical guidelines, and that collecting this kind of information from the researchers themselves would be impossible.

Finally, there was a sense that targeting of the questionnaire to intramural research units would need to be carefully managed. Some individuals were clearly seen to be better qualified than others to answer some of the questions contained in the instrument. For example, data on career destinations was probably best sourced from resident HR professionals rather than Unit heads. The MRC subsequently agreed that the questionnaire would be sent to research programme leaders rather than Unit heads, to help overcome some of these problems; programme leaders would be able to delegate completion of relevant sections of the survey to those most qualified to do so – especially where human resource issues were concerned, for example.

5.5 **Key outcomes of the survey testing exercise**

Besides the observations highlighted above, we derived some overarching lessons from the interviews in terms of how the questionnaire should be presented to researchers. First, it was clear that buy-in would be a problem without sufficient backing from senior members of the MRC, and some sense that researchers would have to complete it to be certain of ongoing financial support. It was suggested that one way of overcoming this potential problem would be for the MRC Chief Executive to send out a letter to all potential recipients before the survey was launched, outlining the rationale for recent changes to research evaluation structures of the MRC, and explaining how the information gathered would be used. Secondly, it was suggested that the MRC might wish to contact researchers individually after the research was completed, to thank them for their participation. This ongoing engagement could be reinforced by providing the researchers with some early results from cross-portfolio analysis of the research that the MRC supports. There was also a commitment to establish an evaluation section on the corporate website, which would carry preliminary results from the data-gathering exercise in a form that was readily accessible to researchers. This would help to increase buy-in from researchers in ensuing rounds.

The aim of this exercise was to help the MRC develop a new and more effective data-gathering tool to support the evaluation of its research portfolio. It is beyond the scope of this report to outline the detailed results obtained in the initial stages of implementation of the survey tool. However, we did identify some important lessons for future information-gathering tool development exercises, summarised below.

6.1 **Designing a research evaluation framework**

1. **Consider the ultimate objective of your framework.** Prior to developing a research evaluation framework it is crucial to define the ultimate purpose this framework should serve and to be very aware of the context it will operate in. We were surprised to find out how applicable to generalised medical research the outputs sections of the survey tool developed for ARC and RAISS, was. Nevertheless, the type and level of information the MRC wished to collect was quite different, meaning that significant revisions had to be made to the tool to ensure it was applicable in this case. Furthermore, other aspects of RAISS – such as the inclusion of a research pathway – turned out not to be suitable for MRC research. These observations suggest that **context-specificity is crucial**. This was especially the case in this project given the breadth of the MRC’s research portfolio.
2. **Choose the right evaluation method.** There exists a wide range of different evaluation methods, ranging from bibliometric analysis to micro- or macro economic analysis of the economic return of research. Each has a specific set of advantages and disadvantages, and selection should be closely linked to the objective of the research. For example, if academic excellence is regarded as an important criteria, then bibliometrics will be a useful method; it will however not offer much information on about wider societal impacts.
3. **Be aware of the conceptual difficulties.** Research evaluation exercises are rich in conceptual difficulties. This report discussed in more detail the issues of attribution and the time lag between the research itself and its final outcomes in particular for grant-financed research. While solutions to such problems are not necessarily easy to achieve, they should at least be acknowledged in the analysis of the results.

4. **Engage with stakeholder at every stage of the development process.** Stakeholder engagement can prove essential in developing a framework, as experienced during this project. Besides regular interaction with the project commissioners, this included close engagement with other stakeholders within the research system – notably the researchers who would ultimately be required to supply information using the new tool. This kind of engagement helps ensure that questions are pitched appropriately, but also that the administrative burden imposed by the tool does not become over-bearing.

6.2 **Future development potential**

Although important changes were made to the tool developed with ARC to ensure it was applicable to the MRC's research portfolio, a core set of questions and headings were retained, suggesting that there may be potential for **cross-comparison between research funders** if this tool is taken up more widely across the health and biomedical research system.

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APPENDICES

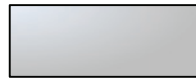
Appendix A: Mapping Output Frameworks

A key stage in the initial phases of the project was to determine whether the RAND Europe-ARC outputs framework (listing possible outputs by payback category) needed to be adapted to suit the MRC's purposes – and if so, how far. Completing this exercise depended on: (1) testing the framework with interviewees at the MRC; and (2) comparing it with potential alternative frameworks in the public domain to see whether gaps existed. The figures in this appendix document the mapping exercise in (2), in accordance with the key below:

KEY



RAND Europe outputs framework and sub-categories



RAND Europe capabilities using a wider understanding of the outputs framework



Categories contained in other outputs frameworks and covered by the RAND Europe framework



Categories contained in other outputs frameworks and NOT covered by the RAND Europe framework, but relevant to this exercise



Categories contained in other outputs framework and NOT covered by the RAND Europe framework, but – in our judgement – not immediately relevant to this exercise



Draft categorisation of wider outputs outside the RAND Europe framework and not immediately relevant to this exercise

RAND Europe Outputs Framework [and potential sources]	RCUK/Dti framework	MRC Outputs Framework	MRC Scorecard 2007-8	KTEIG/RCUK framework
<p>Bibliometrics</p>	<p>Output 1: Healthy UK science and engineering base</p> <p>Major scientific achievements</p> <p>UK contribution to the global knowledge pool through publications etc. metric: publications</p> <p>Dissemination through publication (to wider pool/ audience)</p>		<p>Mission theme 1: Generating and delivering knowledge</p> <p>Strengthening clinical and population health research</p> <p>Promoting translational research and KT</p> <p>Promoting interdisciplinarity</p>	
<p>Dissemination</p> <p>Non academic citations on guidelines → Citations in clinical guidelines</p> <p>Dissemination for non-academic audiences → Citations in other policy documents</p> <p>Dissemination for non-academic audiences → Leaflets and other publications</p> <p>Dissemination for non-academic audiences → Websites</p> <p>Seminars/conferences for academic audiences</p> <p>Uptake of research findings → Feeding into the curriculum</p> <p>Media coverage</p> <p>Public engagement activities → Public lectures and seminars</p> <p>Public engagement activities → Schools work</p> <p>Public engagement activities → Awareness events/ exhibitions</p> <p>Seminars for non-academic audiences</p>	<p>Output 1: Healthy UK science and engineering base</p> <p>Positioning and relationships</p>		<p>Mission theme 3: Partnerships and Engagement</p> <p>Promoting public engagement</p>	
<p>Effects on future research and capacity building</p> <p>Follow-on funding → Interactions with researchers in academia</p> <p>Follow-on research → Interactions with researchers in academia</p> <p>Follow-on research → Interactions with researchers in industry</p> <p>Research training</p> <p>Research careers</p> <p>Tools for research → Data analysis techniques</p> <p>Tools for research → Technique/method improvements</p> <p>Tools for research → Research infrastructure improvements</p>	<p>Output 2: Better exploitation</p> <p>People exchanges between research base and users</p> <p>Collaborative research</p> <p>Building healthy relationships/networks: membership of networks e.g. with major consortia in industry?</p> <p>Interaction with business and public services</p> <p>Output 1: Healthy UK Science and engineering base</p> <p>Supply of trained researchers to the wider economy</p> <p>Generation of tacit knowledge</p> <p>Research facilities and infrastructure</p>	<p>Mission theme 2: Developing people/Mission theme 3: Partnerships and Engagement</p> <p>Encouraging partnership and collaboration</p> <p>Promoting translational research and KT</p> <p>Enhancing engagement with industry</p> <p>Strengthening clinical and population health research</p> <p>Attracting and training first rate people</p> <p>Research facilities and infrastructure</p>	<p>Business and commercial impacts</p> <p>Formation of research clusters</p> <p>KT through collaboration</p> <p>Development of Human Capital</p> <p>Research training</p>	

RAND Europe Outputs Framework [and potential sources]	RCUK/Dti framework	MRC Outputs Framework	MRC Scorecard 2007-8	KTEIG/RCUK framework
<p>Product/Intervention Development</p> <ul style="list-style-type: none"> Intellectual property Medical device development Pharmaceutical development Surgical intervention Physiotherapy-based interventions AHP-based interventions HS delivery improvements Psychosocial treatments <p>Policy</p> <ul style="list-style-type: none"> Policy recommendations arising from public health research Citations Involvement in advisory committees Responding to consultations <p>Case studies and case study research</p>	<p>Output 2: Better exploitation</p> <p>Commercialisation of research</p>			<p>Business and commercial impacts</p> <p>Generation and exploitation of intellectual property</p> <p>Policy Impacts</p> <p>Production of a body of research over a period of time which influences 'received wisdom'</p> <p>Direct responses to specific requests for policy inputs – through commissioned research or advice to individuals</p> <p>Quality of life impacts</p> <p>Healthcare benefits which improve the quality of life for patients and carers</p> <p>Social welfare benefits, such as cohesion, enhanced security</p>
<p>Inputs to research</p> <p>Research-related processes</p> <p>Subject-based concerns</p> <p>Other</p>	<p>Agility, sustainability, user focus aspects of outputs 1 & 2?</p>	<p>Output 1: Healthy UK science and engineering base</p> <p>Expenditure profile for MRC departments</p> <p>Facilities and infrastructure expenditure</p> <p>Mission theme 2: Developing people</p> <p>Promoting workforce diversity</p> <p>Maximising performance and potential of staff</p> <p>Mission theme 4: Developing infrastructure and capability</p> <p>Achieving organisational change, inc enhanced strategy and evaluation</p> <p>Promoting best practice in research</p> <p>Increasing business effectiveness and promoting efficiency</p> <p>International standing of MRC funded strategic facilities</p>		<p>Quality of life impacts</p> <p>Prediction of environmental impacts and how to address them</p> <p>Cultural advances (?)</p>

Appendix B: Comparing Research Pathways

In the annexes that follow, we examine how the pathways map against the UKCRC's Research Activity Codes; and then look at how the pathways map against the RAND Europe-ARC version. This mapping exercise demonstrates that:

- Different pathways focus on quite different aspects of research and research translation;
- The RAND Europe-ARC pathway is probably the most comprehensive pathway across the Research Activity Codes described by the UKCRC.

This mapping exercise does not explicitly address the issue of handover of research.

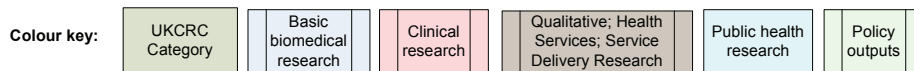
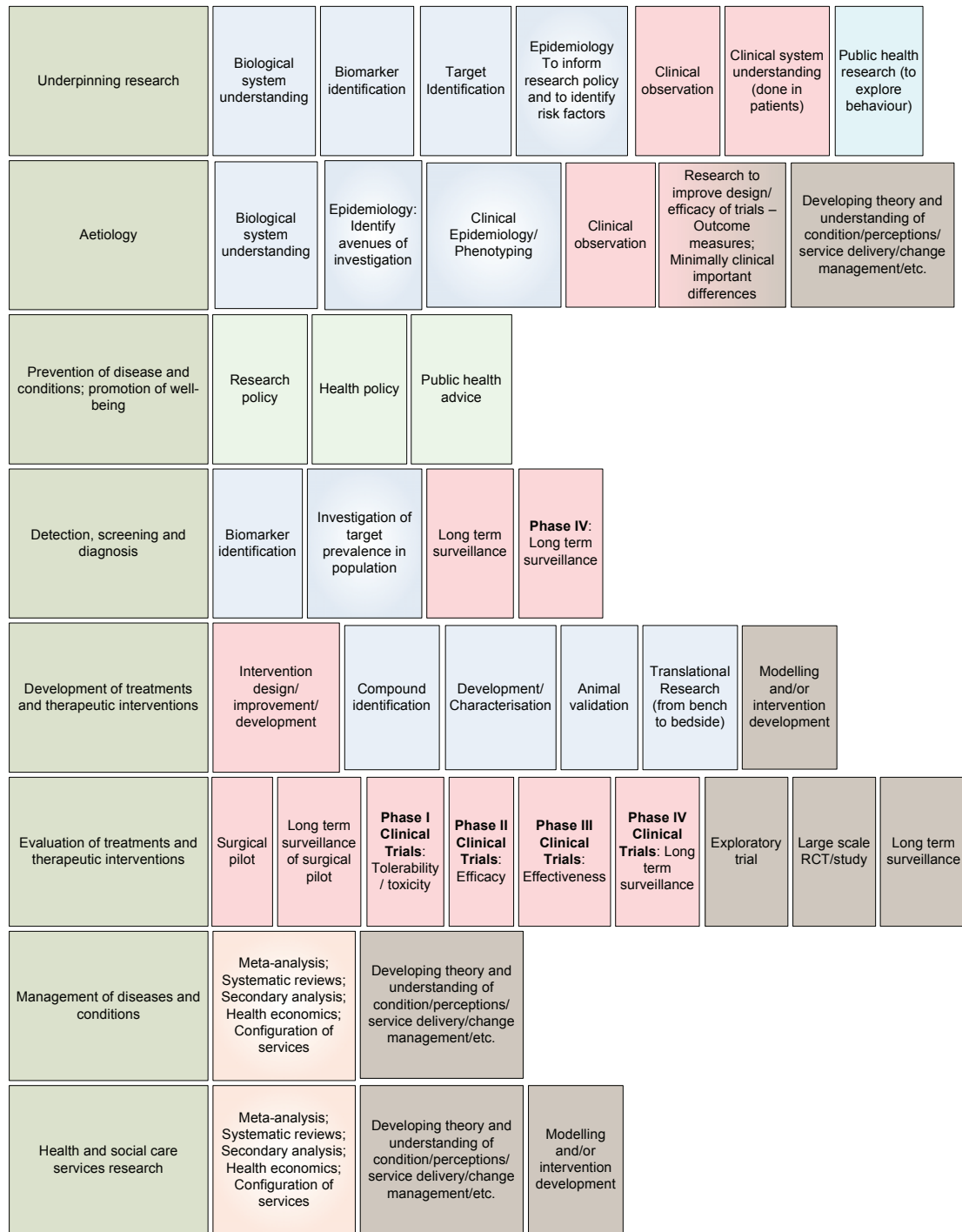


Figure 1: Mapping the RAND Europe-ARC pathway against the UKCRC's codes (colour key applies to this figure only)

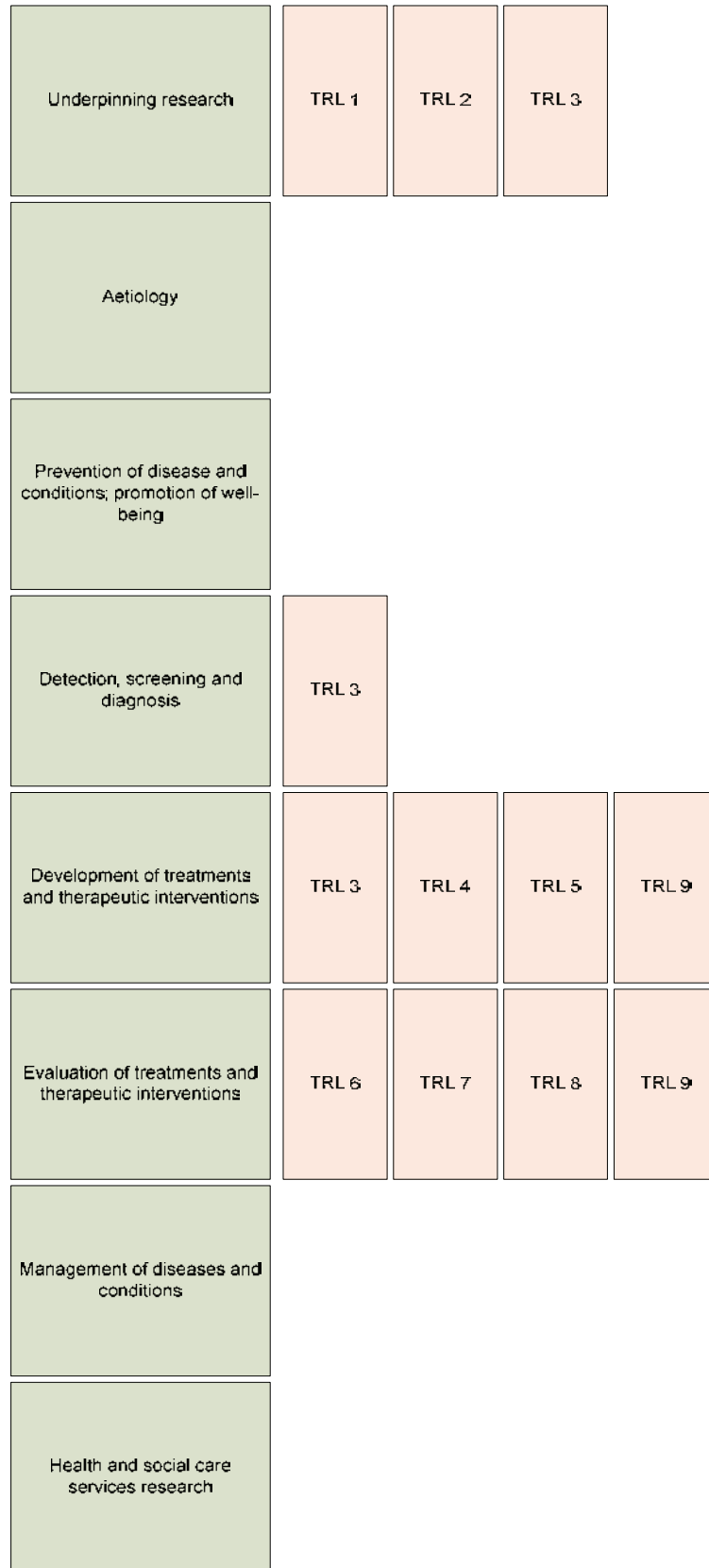


Figure 2: Mapping Technology Readiness Levels (TRLs) against the UKCRC's codes

Underpinning research	Fundamental Research	Discovery with potential clinical application	
Aetiology	Fundamental Research	Identify cohort that would benefit	Discovery with potential clinical application
Prevention of disease and conditions; promotion of well-being			
Detection, screening and diagnosis	Assess target effects		
Development of treatments and therapeutic interventions	Develop modality	Refine modality for efficacy	Refine modality for safety/ manufacturability/ deployability
Evaluation of treatments and therapeutic interventions	Refine modality for efficacy	Refine modality for safety/ manufacturability/ deployability	Early-stage clinical trials
Management of diseases and conditions			
Health and social care services research			

Figure 3: Mapping the NCI’s general pathway against the UKCRC’s codes

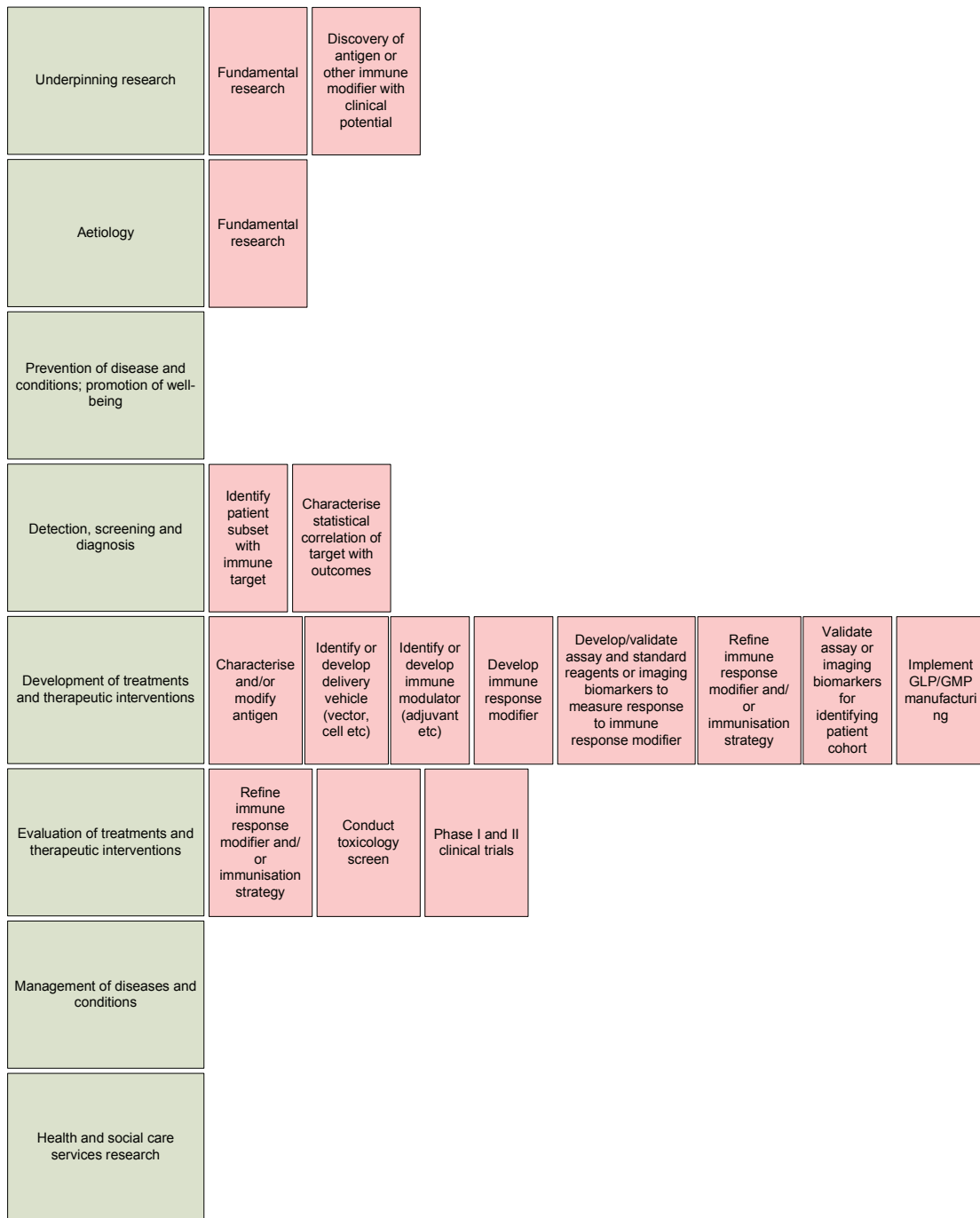


Figure 4: Mapping the NCI's immune response modifier pathway against the UKCRC's codes

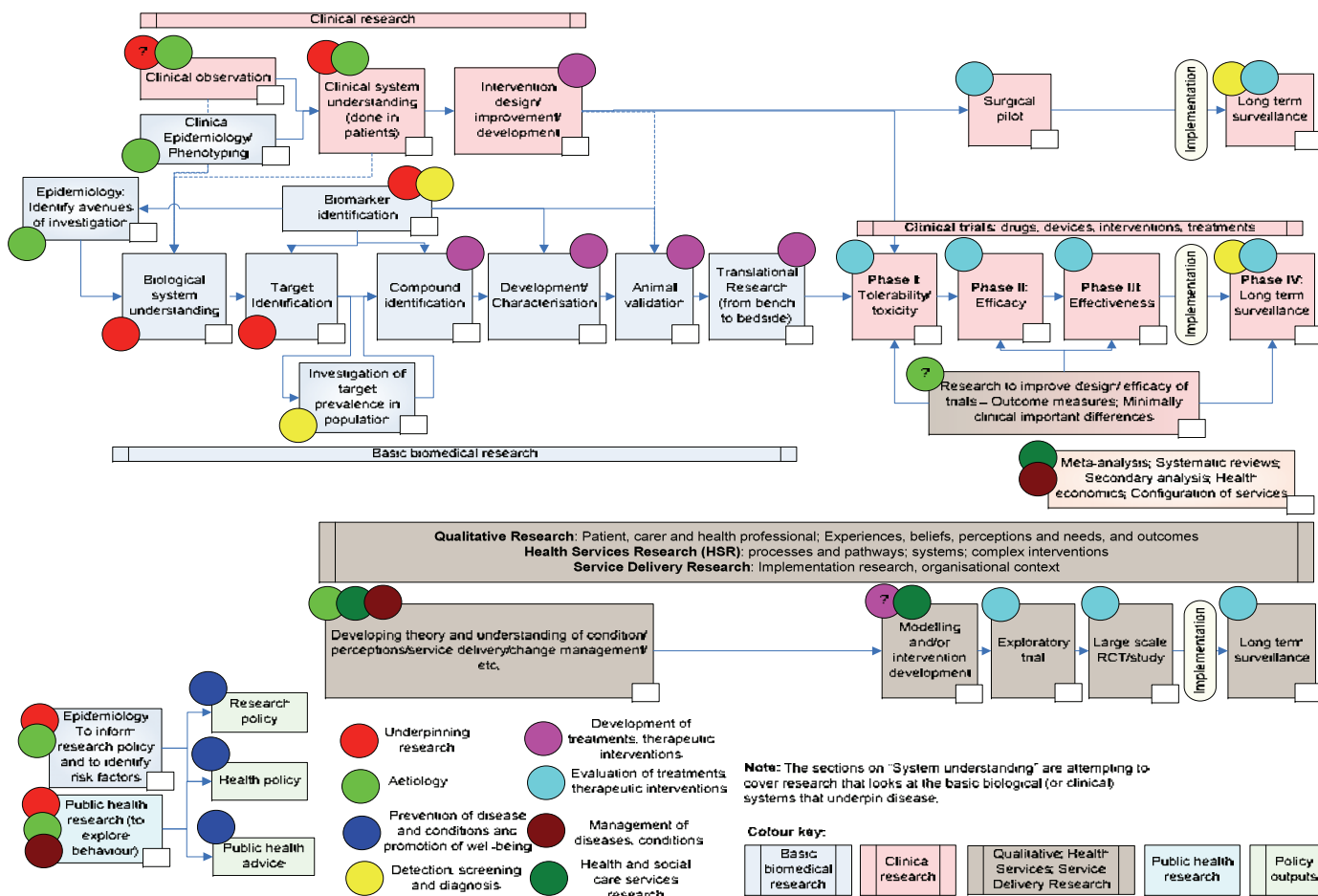


Figure 5: Mapping the UKCRC's 'Research Activity Codes' against the RAND Europe-ARC pathway

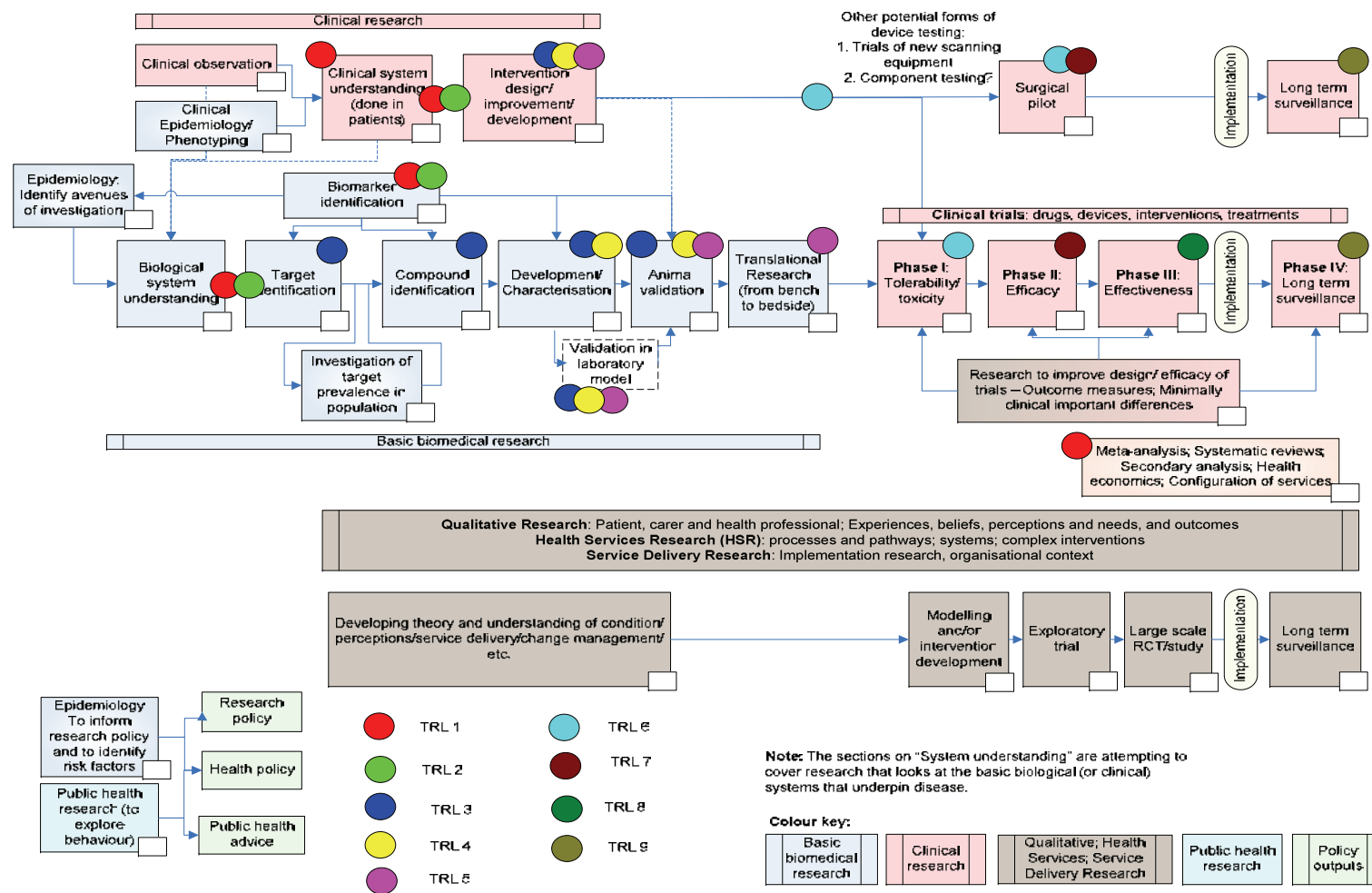


Figure 6: mapping the Technology Readiness Levels against the RAND Europe-ARC pathway

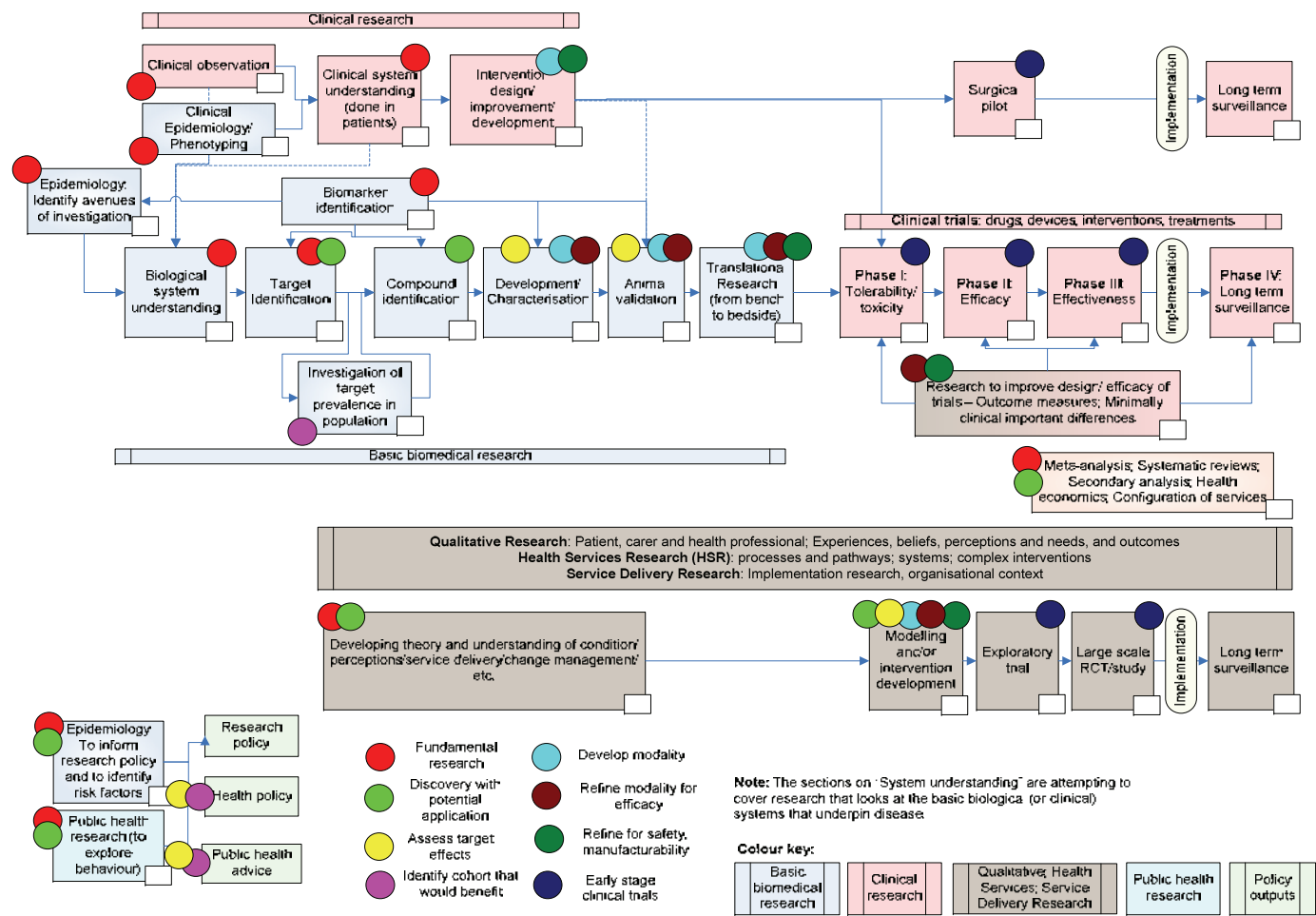


Figure 7: NCI general pathway mapped onto RAND Europe-ARC pathway