

# **Improving quality of decision making in project approvals at the Medical Research Council**

**Thesis submitted in accordance with the requirements of the  
University of Liverpool for the degree of Doctor of Business Administration  
by Susan Simon**

## ABSTRACT

**Title:** Improving quality of decision making in project approvals at the Medical Research Council.

The Medical Research Council has experienced a consistent decrease of capital funding over the recent decade. But capital is essential for the purchase of scientific equipment and the upkeep, updating and expansion of the research facilities. Hence, the development of accurate project estimates and the selection of the proposals most beneficial to the scientific advancement is an increasingly critical aspect of delivering Value for Money to the taxpayer.

Action Research, using interviews and questionnaires has been undertaken to understand the processes and dynamics within the MRC, motivations of bidders and reasoning of approvers. A database has been developed to test the effectiveness of Reference Class Forecasting, heavily promoted by the UK Government, around science facilities.

It was found that a distinct lack of communication between the involved parties led to a failure of understanding of both the bidding process and evaluation criteria as well as project drivers, priorities and assumptions made in the development of the estimates. Furthermore, the charge of strategic misrepresentation should be reviewed considering the way in which government departments distribute funds and/ or award specific projects. Arbitrary budget awards force project teams to engineer the requirements to fit in those envelopes. The environment of projects in the public sector was found to be very complex and have a significant influence on project strategies.

More research needs to be done to understand these complexities better and consider appropriate actions to mitigate detrimental effects. A programme of continuous improvement within the MRC concluded the first two research cycles and has resulted in a specific strategy to target improvements of project performance. Data from the research is being used to bid for an increase of capital funding to ensure the MRC can deliver the cutting edge, world leading science, which the government expects.

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## LIST OF ABBREVIATIONS/ ACRONYMS

<b>Acronym</b>	<b>Full title</b>
AHU	Air Handling Unit
APM	Association of Project Managers
AR	Action Research
BEIS	Business Energy and Industrial Strategy
BAU	Business As Usual
CAAS	Cost Assurances and Analytics Services
CEO	Chief Executive Officer
CDM	Construction & Design Management
CL3	Containment Level 3
Cryo-EM	cryo-electron microscopy
DBA	Doctorate in Business and Administration
DNA	Deoxyribonucleic acid
FBC	Full Business Case
FY	Financial Year
HEFCE	Higher Education Funding Council for England
HM Treasury	Her Majesty's Treasury
HO	Head Office
H&S	Health & Safety
ICER	Incremental Cost-Effectiveness Ratio
ICHT	Imperial College Healthcare Trust
IPA	Infrastructure Projects Authority
IT	Information Technology
LMB	Laboratory for Molecular Biology
LMS	London Institute of Medical Sciences
MRC	Medical Research Council
NAO	National Audit Office
NC3R	National Centre for the Replacement Refinement & Reduction of Animals in Research
NHS	National Health Service

NICE	National Institute for Health and Care Excellence
NPV	Net Present Value
OBC	Outline Business Case
PET	Positron emission tomography
PhD	Doctor of Philosophy
PHE	Public Health England
PM	Project Management
QQR	Quinquennial Review
QUALY	Quality Adjusted Year
R&D	Research & Development
RC	Reference Class Forecasting
RCF	Reference Class Forecasting
RPG	Research Programme Group
SNA	Strategic Need Analysis
SRO	Senior Responsible Owner
UK	United Kingdom
UKRI	UK Research and Innovation
URD	User Requirement Document
USA	United States of America
VE	Value Engineering
VfM	Value for Money

## GLOSSARY OF TERMS

<b>Term</b>	<b>Explanation</b>
workhorse	Equipment, which is highly utilised and provides the or a basis for the research functions. These tend not to be super high tech, but ensure basic functions, such as centrifuges, microscopes, sampling machines, etc.
leap-frogging	Overcoming hurdles in research methodology through technology or opening new areas of research due to availability of innovative technology; opportunity to overtake rival research organizations by investing in the newest technology.
annuality of funds	requirement by HM Treasury that prohibits to carry unspent funds over the financial year threshold or to accumulate unspent funding over several financial years.
electromagnetic shielding	methods of protecting highly sensitive imaging equipment, such as Electron microscopes, Cryo-Electron Microscopes, etc. from electromagnetic interference/influences.
Resource funds	current expenditure, such as pay or procurement and including depreciation, which is the current cost associated with the ownership of assets (HM Treasury, 2015a)
Capital funds	funding for new investment and net policy lending (HM Treasury, 2015a)
failed project	projects, which do not deliver the expected benefits, are terminated and/or expended more than 100% over the approved budget.
Capital Roadmap	planning of the MRC capital investments on a larger scale for the next 5 years (within government spending review terms)

Containment Level 3	Categorisation used for defining biosafety in the context of working with biological agents. Containment level 3 is a higher level of biosafety applied for working with pathogens, such as viruses, bacteria, which are infectious and cause disease (Medical Research Council, 2014).
core funding	Funding of research agreed as part of the QQR. This allows for the costs associated with the research of the research programs recommended by the QQR until the next QQR (5 years). Non-core funding would be any funding that is awarded externally or via specific calls from MRC.

## **DEDICATION**

**DAD – I wish you could have waited...**

## **ACKNOWLEDGEMENT**

This research has been the result of the contribution of many people. I would like to thank all of those, but in particular:

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Most importantly, my mentor, Victoria Hanna, who has been very patient with me and supplied me with the courage and confidence to complete this work.

## **AUTHOR'S DECLARATION**

The principal researcher, Susan Simon, hereby declares 'Improving quality of decision making in project approvals at the Medical Research Council' to represent original research that has not been submitted previously for publication. The researcher served as the sole author for the study, which was completed under the thesis supervision of Dr. Victoria Hanna as a requirement for the degree of Doctor of Business Administration from the University of Liverpool. When drawing upon the work of others within the existing literature, the principal researcher has provided appropriate referencing and acknowledgment to the sources. There was no direct funding source for the 'Improving quality of decision making in project approvals at the Medical Research Council' Study. However, the principal researcher is employed by the Medical Research Council, which provides full tuition reimbursement to employees who are pursuing higher education. While the Medical Research Council did not fund the study in a direct manner, the organization awarded tuition reimbursement of tuition costs.



## CHAPTER 1 – INTRODUCTION

## **1.1. Capital funding needs for facilities in the UK life science**

Medical research is carried out in specialist laboratories which contain a range of distinct functions tailored to the respective discipline or field of research. To support high quality research, these laboratories need to be designed, constructed and maintained to the highest standards.

The estate in the life science sector is dependent on complex technical provisions in mechanical, electrical and public health solutions to enable a very wide range of research activities. These facilities are expensive to design, construct and operate.

Estates and facilities are not the priority for investment decisions in science. Across the public and university sector the focus for investment in science is directed towards enhancing science through funding research programmes and/ or procuring scientific equipment.

The UK Government has put science and innovation as one of the key elements of future planning. This commitment is focused on large investments in new facilities, such as the Sir Francis Crick Institute (new science building in the centre of London with project costs of over £600m) or the Big Data Institute (Great Britain. HM Treasury, 2013). Whilst this is hugely welcomed in the science community, public organisations concerned with science activities continue to lobby for better funding for the existing research estate.

Many research facilities in the public sector have suffered decades of underinvestment, partially due to the lack of available funding, inability to ringfence estates budgets and the science community prioritising to invest in scientific equipment over estates related aspects.

Maintenance of high-tech buildings requires significant budgets. Additionally, modernisation must be allowed for to keep abreast with scientific and technological developments. Some of the older facilities are flexible enough to be upgraded and given a new life, therewith reducing the need for additional estate and its maintenance.

Subsequently, estates projects in the life science sector organisations are often concerned with refurbishments and upgrade projects to facilitate new recruitment, allow the procurement and installation of innovative technology or undertake basic plant replacement. Such projects generally require capital funding too. The definition

of capital expenditure (or capex), its actual application and management is seen as a key contributing factor to the difficulties of securing the funding.

Capex is defined as 'expenditure on substantial items (usually in the form of projects) that will have a benefit for the organisation beyond the current year' (Great Britain. HM Treasury, 2015a) and is usually associated with purchase of land, construction of buildings or major refurbishments, which result in an upgrade of the facility. Furthermore, the UK Government has established thresholds, above which all procurement of equipment, plant and other assets is defined as capital with particularly complex rules for services and works.

Currently, this threshold is set at £10,000. The implications of this is significant: the value of most plant replacement and works carried out in laboratory buildings are significantly above that threshold. In comparison, universities, such as Imperial College of London use a threshold of £50,000. With allocation of capital being subject to severe annual fluctuation and uncertainty, aspects of maintenance and estate upgrade work relies on success in project bidding processes, rather than being planned throughout the life of a facility.

Over the years, this approach has resulted in rolling plant replacement programmes come undone, maintenance and upgrade works being deferred and, subsequently facilities dilapidating at a faster pace. This is evidenced by the conditions of many of the more technical facilities in public-sector, such as laboratory facilities in hospitals, schools and the higher education sector. For example, the Imperial College Healthcare Trust (ICHT) is trying to operate its facilities with a maintenance backlog of over £1bn (National Health Executive, 2016).

In turn, this results in difficulties regarding staff retention, recruitment of senior staff (such as internationally renowned scientists) and lack of capability to compete for international grants for public sector funded research organisations.

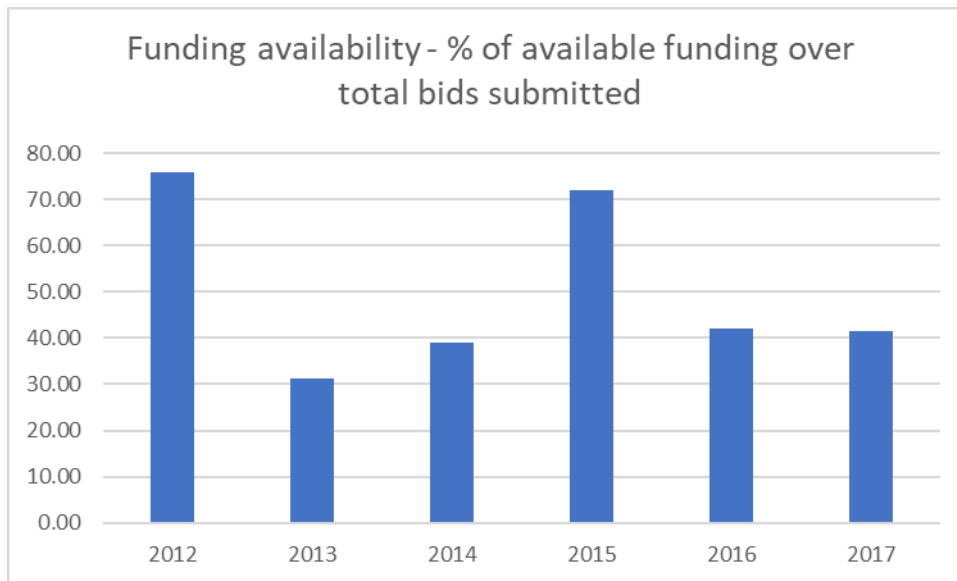
## **1.2. Project funding in the Medical Research Council**

Since the fiscal crisis in 2007, the MRC – like many other public-sector organisations – has seen more restrictions in funding by the government. Amongst the UK Research Councils, the MRC was the largest, based on number of Units and Institutes, staff numbers (4,000) and total funding received from the UK Government (£1.7bn per annum) (Medical Research Council, 2009).

The MRC operates with a stringent hierarchy of delegated authority, where the Chief Executive Officer (CEO) is authorised to approve investments up to £10m, anything over and above this requires applications for funding directly to Government (either BEIS or HM Treasury). An example is the new Laboratory for Molecular Biology (“LMB”) in Cambridge, for which a direct application was made to, and funding approval received from, HM Treasury outside the MRC annual funding allocation.

Capital funding allocations to individual Units and Institutes were assessed and fixed establishing an annual capital allocation in the Quinquennial Reviews (“QQR”). This ensures that capital is spent on items and projects which will support only highest quality research and enhance the science, because it is tested by international experts in the relevant field of discipline. Allocations from QQRs were binding and enabled appropriate planning of projects over five years until the next QQR.

With the implementation of funding cuts by the UK Government the QQR commitments on capital funding could no more be honoured. In 2012 the funding for MRC overall dropped by over £100m and the capital funding provision available to MRC reduced by almost 50%. It became instantly clear that a mechanism had to be found to allocate capital funding in a different way, but fair and transparent manner. Thus, the capital bid process was established as a method for making decisions on the funding allocations to Units and Institutes.



**FIGURE 1 - FUNDING AVAILABILITY IN % OF RECEIVED VALUE OF BIDS**

Since the introduction of this process the available amount of funding has been consistently outstripped by the value of the funding requests (see Figure 1). The evaluation process is based on a system used in other areas of the organisation and it was therefore assumed that it is familiar both to bidders and approvers.

### 1.2.1. The MRC Capital Bid Process

MRC issues an invitation to Units and Institutes to submit funding requests with a short justification and indication of expected benefits for the relevant investment. Eligible are requests for capital funds only, defined as equipment with a value over £10k, estates related projects that are concerned with an upgrade or extension of existing facilities or replacement of major plant.

Received bids are distributed to the review panel members, who are the Heads of Themes, the Director Finance and Director Capital & Estates with the task to return their scores in preparation of the allocation meeting. Historically, most of the bids relate to science equipment for which the scores are established by the MRC Research Programme Group (“RPG”). The estates department tends to restrict its assessment on those bids to the expected impact of respective investments on the estate.

Estates related projects are scored by the Estates department with PRG commenting on the benefits of the project for the science of the relevant unit. Scores are based on a set of criteria, which is shown in table 1. A score of ‘4’ tends to guarantee funding, whilst a score of ‘3’ would generally assign the bid into a group of reserves, which

would be funded, should additional funds become available throughout the FY. Criteria itself does not distinguish between science equipment or estates bids but relies on aspects, which are difficult to define or measure, leaving significant room for interpretation.

Some areas are not covered at all, such as legislative or statutory changes, which force investment – mostly experienced in Health & Safety regulations and support functions for research, such as operation of animal holding facilities.

Score	Criteria
4	<ul style="list-style-type: none"> <li>• underpins leading edge, exceptional quality work</li> <li>• part of a top international programme or of exceptional national strategic importance</li> <li>• aids a crucial scientific question or knowledge gap in an area of strategic importance in the UK</li> <li>• very high return on investment</li> <li>• provides shared equipment for the nation or an area of science critical to novel developments</li> </ul>
3	<ul style="list-style-type: none"> <li>• part of an internationally competitive, world class or nationally strategic programme</li> <li>• highly novel, original and innovative, novel methodology and design</li> <li>• potential for high health and/ or socioeconomic impact</li> <li>• potential for very high return on investment</li> <li>• potential for leverage to aid high value for money</li> </ul>
2	<ul style="list-style-type: none"> <li>• potential to underpin high quality research</li> <li>• internationally competitive parts</li> <li>• robust methodology / design</li> <li>• potential for high health and/ or socioeconomic impact</li> <li>• potential for significant return on investment</li> </ul>
1	<ul style="list-style-type: none"> <li>• assists / enables the continuation of existing work</li> <li>• worthwhile and sound</li> <li>• methodologically sound</li> <li>• potential for significant return on investment</li> </ul>

TABLE 1 - CAPITAL FUNDING EVALUATION CRITERIA MRC

The assessment process is concluded in a panel meeting. It is assumed that all bids with a score of '4' are funded. Subject to the available budget adjustments are made to the scores by either omitting some top scoring projects to stay within the funding envelope or awarding some of the more important lower scoring bids (scoring 3). During this moderation process detailed discussions about the merit of each investment take place. The panel concludes with a review of the total awards for each unit, in some occasions triggering a repeat of the score assessment, when some units were considered to be over- or underprovided.

### **1.3. So, what?**

With insufficient funding available for the value of requests received, awards need to be made to the most deserving projects under the assumption that the requested funding is adequate to complete the project. Therefore, the evaluation must be able to trust provided details as objective judgements on cost, time and benefit.

It is perceived by the organisation that projects regularly overrun time schedule and costs without delivering fully the promised benefits. The extent of cost overruns can put the funding decision into question as the relevant project may not have been considered as good value if the accurate cost or schedule had been known at the time of making the initial evaluation. Any such failed or underperforming project take away opportunities for other projects.

Whilst the estate enables scientific work by providing laboratories and support facilities, it is judged to be an indirect contribution to research activities and is hence a 'second choice' in competition with scientific equipment. However, without the assurance of funding availability the estate cannot be appropriately managed, ultimately leading to risks for research continuity, particularly, failure of ensuring proactive maintenance, such as plant replacement programmes. Solutions are required, which allow sufficient funding of the science estate and allow investment in the most promising projects allowing the science to flourish.

### **1.4. The author's position to the problem**

The author's responsibility in the organisation is to provide adequate research facilities to enable research activities. This includes compliance to statutory and regulatory standards as well as allowing innovation in both research methodology and technology to take place and propel research forward. A combination of lower priority of the estate to research activities and volatile funding provision over years has made traditional preventative estates management impossible. Any funding gained for the estate is therefore precious and must be used for the most important projects.

The author is also part of the problem. With the responsibility for the estate, the author has an interest in bids for estates related projects to be successful and is supporting the project teams in the development of proposals. At the same time, the author is part of the approval process, identifying a conflict of interest. Whilst this is limited due to

the evaluation of the benefits for science being the critical decision point, it allows the author to influence the decision or at least provides insight to the approval process, that has an impact on the advice given to project teams.

Throughout the last 9 year the author had to prioritise projects and make funding decisions based on the proposals put forward from the various units and institutes in the MRC. Often, these had to receive additional funds at some point throughout their life cycle for a wide range of reasons. It is the responsibility of the Author to ensure the projects are successfully completed (i.e. identifying sources for additional funding) and therewith justifying the increase in cost.

Inevitably, this raises the question as to whether the relevant projects would have received funding approval if the true cost had been known at the time of evaluation. More importantly it identifies other investments, which cannot be undertaken, because of the additional funds that need to be allocated to projects, which have not provided accurate estimates as part of their project proposals.

As a result, the author has a keen interest in ensuring that the project proposals reflect the potential realistic cost – allowing approvers to evaluate the expected benefits of a project against the required budget. Furthermore, through the work as an IPA gateway reviewer for high risk projects, the author is aware that this is a problem, which is shared throughout the public sector. Development and implementation of tools for both the bidders and approvers would be a significant improvement to the management of projects overall and therefore better appropriation of public funds.

## **1.5. Research purpose**

Poor project performance in the construction sector has long been an issue targeted by the UK government, however with no considerable impact. Implementation of new project management approaches such as Prince2 and Agile have not led to better performance. Without significant improvement of the performance of project delivery, the onus is on the assessment of projects prior to the delivery phase to identify early, if they are likely to succeed or fail. Finding new ways of improving the funding decisions is therefore a critical task for the MRC in the efforts to ensure best possible investment in science, catapult the UK medical science to the forefront of global research and compete against academic organisations.



Whilst government spending reviews offer opportunities to lobby for additional funding, it is generally expected that current funding levels are maintained or reduced as a result of implications of the BREXIT negotiations and over financial pressures. Consequently, the improvement of funding decisions presents itself to be the most appropriate way to influence this issue – not only within MRC but government wide.

Action Research (AR) is offering a unique opportunity to research the problem academically and test this knowledge by implementing measures and assess the impact. The process therefore aims to enrich the organisational knowledge of its own processes and procedures and will inform others of potential solutions for similar issues. **RESEARCH QUESTIONS**

As indicated above there are two key aspects, which are intrinsically associated with the funding process – project estimation and the evaluation process and I am adding a third, the evaluation criteria. These three aspects are also within the remit of the MRC authority to change and improve and hence viable for the AR approach.

#### 1.5.1. Project estimation

The accuracy of project estimates varies greatly. Unlike the process of purchasing most science equipment, estates related projects always have unique features, which prevent a standard estimation of both cost and time schedule. Establishing estimates for such projects requires a range of processes, such as definition of the requirements, specialist design development, surveys and /or gathering quotations for works. At MRC, the bids submitted by Units will usually not have had a detailed design developed (cost for this service will be part of the bid) and hence very rough budget assumptions are made resulting in potentially significant variances upon conclusion of the projects.

The consequence of these differences between the value of the award and the actual cost is twofold. An underestimation will result in the bidder having to request additional funding post award. In such cases, much of the awarded funds will already have been spent and rejection of the additional request may render the initial commitments a wasted investment. It is therefore viewed as a situation where the only option is a further award. Such occurrences reduce any generic contingency funds that may be held by the Finance Department and therewith the ability to react to emergencies.

A more important aspect is that in projects where this overspend is exceeding 20% – 30% of the award, the panel members feel that they would not have approved the project, had they known its true costs. It means that other proposals have been rejected for the benefit of this project and it raises the suspicion that some bidders may deliberately understate the cost of the project to increase the chances of success.

This approach is termed ‘strategic misrepresentation’ (Flyvbjerg, 2009) and has been noted by the government as a key target, evidenced by the inclusion of this aspect in the MPLA courses (Sahid Business School, 2012). These courses are mandatory for anybody, who is likely to be appointed a Senior Responsible Owner (SRO) for a major project funded by the public.

Similar issues exist with the calculation of timelines for the projects, in that the annuality of capital budgets in the public sector (Great Britain. HM Treasury, 2015a) causes difficulties in planning and forecasting. Budgets – especially in relation to capital funding – cannot be carried over financial years. Without knowledge of levels of funding allocations for the next 12 months, no guaranty can be given that funds will be available to continue works over the end of the respective FY. Therefore, projects which show a programme exceeding 12 months duration can be disadvantaged in an annual process for funding allocation.

One of the key terms and conditions given in the MRC funding request letters is that the proposed projects are to be completed within the respective current FY. This indicates to bidders that projects with durations of over 12 months will not have a significant chance of being funded and encourages more optimistic estimates of the works. However, projects, which cannot be completed in the given timeframe will inevitably require funding to be ringfenced from the next year’s allocation therewith reducing the funding availability further.

Unspent funds cannot be recovered into the next FY and are lost. In the context of uncertainties of budget allocations beyond the current FY, it becomes a very complex and challenging task to manage capital allocations in compliance with the public-sector finance rules and to the satisfaction of the organisation.

### 1.5.2. Evaluation Criteria

With funding resource being scarce, the award criteria should aim to award only the worthiest projects. In MRC's view this should be anything that provides maximum benefit to the science of its units and institutes. This is clearly reflected in the description of the criteria for the top score of 4 (see Table 1).

The lowest criteria include anything, which assists/enables continuation of existing work. Research equipment is highly utilised and used until it becomes unreliable or cannot be repaired anymore. With a threshold for capital being so low (£10k), most of scientific equipment will fall under this category. Replacement equipment will therefore have to be bid for under the established process but with no chances of approval due to the low score that can be achieved.

Often these replacement requests refer to real "workhorses", which are essential to the research carried out, do not represent any "leap frogging" opportunities to the science, but if not replaced can cause the research to stop. Whilst it is desirable for the science to make considerable progress, it is in equal terms undesirable for research to stop or be interrupted. This is also an issue in relation to the awards for estates related projects, which have in recent years mostly been concerned with the replacement of major equipment to operate the facilities (for example air handling units, chillers, etc.). As these projects are not considered to propel science forward; they have a less priority.

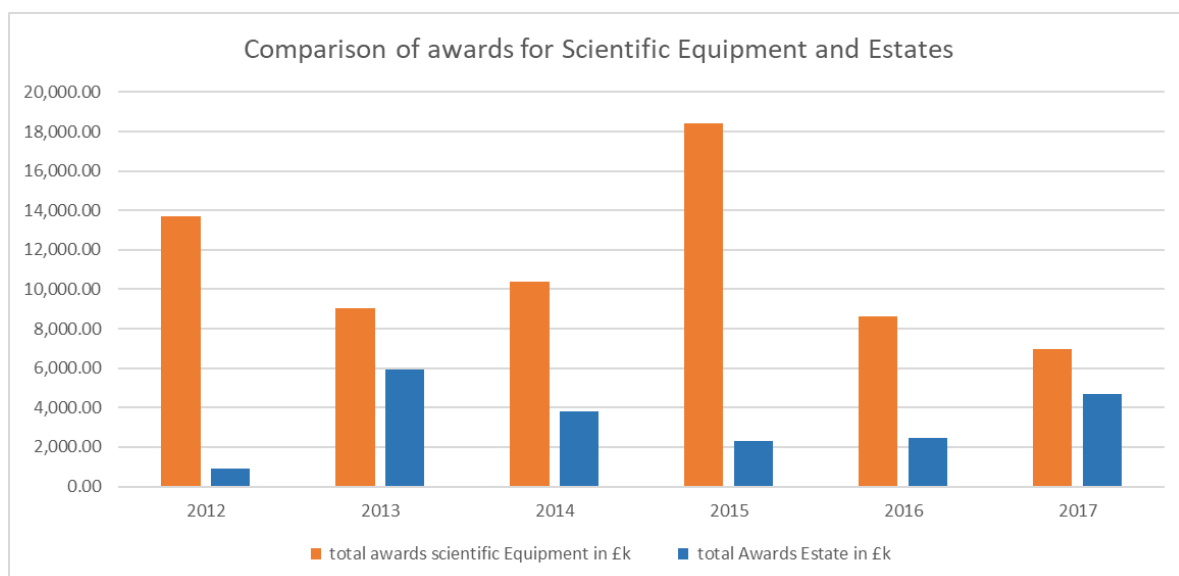


FIGURE 2 - COMPARISON AWARDS FOR SCIENTIFIC EQUIPMENT VS ESTATES

This attitude is clearly reflected in the graph shown in Figure 2. Differences between annual awards for scientific equipment and estates projects is significant – in some years they estates awards represent only a fraction of the overall equipment awards. Furthermore, most of the criteria under the various scores are not clearly defined and appears very fluid in between the scores, resulting in a risk of subjective application by the reviewers.

### 1.5.3. Project selection and prioritisation process

Bidders are required to identify the individual bids with an order of priority. It is important to understand the priorities of the unit directors as otherwise awards would be made without the specific unit needs in mind trying in the attempt to fit the overall financial envelope.

No reasoning for the prioritisation is requested and, therefore, not given. During the evaluation and scoring process, assessors arrive on scores in some cases which may make a lower priority bid fundable and consider a bid with higher urgency not worthy.

This has led to considerable frustration by the bidders and evaluators in equal measure about the process and often led to further negotiations post award. Similarly, rejected projects are repeatedly submitted to the panel, despite very low scores and little or no chances of the evaluators supporting it. Whilst this is not a problem of significance for either finances or delivery of the research, it is a symptom of the process being inefficient and/ or a distinct lack of communication.

The panel relies on the expertise of individuals (scientific discipline and operational expertise, such as estates) to assess the validity of the proposed projects in terms of budget, programme schedule and benefit realisation. As such, the evaluation is dependent on the quality of the individual and their skills in recognising and managing their own bias.

### 1.5.4. Problem statement

The MRC, just as all other public-sector organisations, must ensure that public funding is used for worthy and viable projects. This requires projects being developed with an appropriate degree of certainty for budgets and schedules and suitable evaluation processes using criteria, which reflects the aims of the organisation. In order to achieve this, the organisation must develop a better understanding of the underlying

causes of the dissatisfactory situation before making decisions on appropriate measures.

The research aim arising from the issues described in this chapter is formulated as:

**Developing a fair and transparent processes for the approval of estates projects by establishing more accurate estimation and assessment tools for bidders and approving bodies.**

Throughout the research in literature, the author realised that this aim is covering a vast range of issues and influences and therefore had to establish three key questions that the research had to answer to achieve this overarching target. These will be presented at the end of the literature review to highlight the journey that brought the author to this approach.

## **1.6. Summary**

The capital bid process is trying to make the best of an undesirable situation. Influence by the MRC on future government funding is limited (exacerbated by BREXIT) and hence unlikely to resolve the issues by significantly increasing the funding. There is also a view that this process has introduced a selection of better projects (as opposed to a generic allocation of capital based on the size of the Unit/ Institute) and purchases in view of Value for Money as each are evaluated on their merit for the science.

But there are also issues which affect the MRC's budgets, the relationship between the Units/Institutes and Head Office and, more importantly, the research work. The problems identified have a considerable impact on the operations and research of units and institutes as well as deteriorate the relationship between MRC and the scientists it funds.

Establishing a transparent and fair award process as well as improving the quality and objectivity of the project estimates is expected to not only ensure only deserving projects get awarded, but also restore a mutual trust between bidders and evaluators in the MRC. The research activities and respective results are presented in this thesis by following the path the author has taken. A literature review has been undertaken, in which influencing factors and potential solutions were sought from both academic literature and publications by and for practitioners. It will demonstrate the progression

in thinking of the author relating to the problem and sources for the development of a strategy for the research design.

The author will then describe the methodology for this research by identifying the reason for the choices made including academic justification and what the author considers to be the outcome of this approach. Outcomes of the research are presented in the findings. As this research is undertaken as action research the findings will include the conclusions and subsequent actions that have been taken chronologically and with respect to the research cycles completed.

Following the description of the findings, the author then discusses these in relation to the problem identified and the literature that was considered to be leading academic discourse and informing practitioners. It will consider, whether the findings have resulted in a solution for the research problem.

In conclusion, the author will summarise the outcome of the research in terms of the knowledge gained and consider future research areas to further the insight gained in aspects of this problem. Finally, the author will reflect on the research activity and the impact the process and the findings had on her personal and professional approach and how the organisation has developed as a result of the action research.

## CHAPTER 2 – LITERATURE REVIEW

## 2.1. Introduction

This research aims to develop fair and transparent processes for the mitigation of strategic misrepresentation in estates project bids by establishing assessment tools for bidders and approving bodies.

From the previous explanations (Chapter 1) some key areas emerged.

Project estimation is thought to be influenced by bias, levels of detail available, qualification, experience and/ or skill of estimators and so on. Some of these are subject to underlying, subconscious behaviours, which can only be successfully addressed, if fully understood. There is also mentioning of deliberate actions that project teams may take to enhance the chances of project approval. Determining the extent of such behaviours and their drivers in comparison to genuine misjudgement requires the view through different lenses and experiences.

An initial review of literature yielded at least 10-12 categories of research areas associated with the problem, such as risk management, organisational behaviour, team dynamics, psychology, public accountancy or organisational development. It would not be realistic nor meaningful to investigate all of these categories for the purpose of this research. This literature review is therefore concentrating on the early stages of projects, i.e. the work being done up to and including the approval of project proposals.

Readings of literature on evaluation process and evaluation criteria envisages an equally rich field of opinions, theoretical and practical knowledge. Much of the academic world is operated by the use of evaluation panels (most commonly in the awards of research grants) with different research disciplines competing for a defined amount of funding, not dissimilar to the approach for the capital funding approval by the MRC. The author will seek out knowledge of effectiveness of such processes and positive and negative influences.

Furthermore, there are two additional aspects which is expected to contribute to the understanding of the problem. First, the author wants to understand the influence of governance in the context of the project estimation and approvals. This focuses on the responsibility and accountability for decisions being made during these activities.



Again, the views of the academic researchers and the understanding and experiences from practitioners will be analysed and applied to the problem.

Secondly, a clear understanding of the term 'value' and subsequently 'Value for Money' (VfM) is required because it drives funding decisions. The term is subject to interpretation and hence holds very different viewpoints of bidders and approvers or indeed any associated stakeholders. In the context of science, particularly in the area of medical research, the definition of value may be on opposing ends. This literature review will seek out definitions based on different perspectives and consider them in the context of this research question.

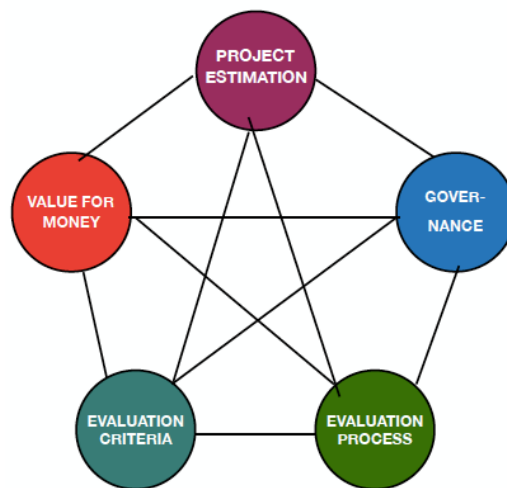


Figure 3 – Key elements of literature review

The author is using both academic literature and publications from practitioners, professional organisations as well as guidance and regulation from government bodies. They are not separated but used to highlight the differences or similarities in the subjects investigated. It is important because practitioners in the public sector are directed by the UK Government to comply with these throughout the whole life cycle of projects.

## 2.2. Governance

Projects require good governance, making users accountable for the accuracy of their requirements, estimates, etc. and establish mechanisms to control and minimise changes. Despite the PM guidance by professional bodies (The Chartered Institute of Building, 2002; Bentley, 2010) highlighting the need for good governance; explaining what this term entails and how it interlinks with accountability, it is not clearly understood. Typical examples are the confusion of the definitions of responsibility and accountability in governance and issues surrounding the nature of project structures.

Project organisations are temporary (Office of Government Commerce, 2009) and just like in any other organisational environment, suitability and effectiveness of governance structures and processes are critical for the chances of success. Using established methodologies can help in this, as supporters of project management standardisation claim (Kostelac, Matriljan and Dobovick, 2011).

UK Government is driving the implementation of standardised methodologies, such as PRINCE2 and Agile to embed similar methodologies and skill levels across government departments. However, organisations and departments adapt these methodologies to their needs, expertise and skill. It is argued, that this may be a key contributor for the lack of improvement in the project performance across government (Joslin and Müller, 2016). Ng (2018) argues that a mix of methodologies is necessary to design an approach that is suitable for the organisational and wider context of projects.

Various methodologies provide governance models which define the organisational structure and do not tailor for the differences in environment, such as organisational culture. Brunet and Aubry (2019) highlights that governance exists in different levels (institutional, organisation and project level) and must be considered in the context of accountability and responsibility for project performance.

Better evaluation of the cultural aspects (both external and internal) when starting up projects and implementing a management approach (Högberg and Adamsson, 1983) is being called for, very similar to the process prior to attempting organisational change. Project governance is a key element of this aspect.

Moreover, difficulties in managing projects, specifically complex projects are not only caused by the technical challenges, but barriers for understanding of the project which supervisors encounter caused by jargon, desire to succeed, too much reliance on experts, lack of time to learn about the project details (Loch, Mähring and Sommer, 2017).

### 2.2.1. Starting a project

A key element in this early development is the implementation of appropriate governance. This aids decision making, which in a fast-changing project environment is often under constraint from both the schedule and the budget.

The aforementioned focus by the UK government on the implementation of formal project management methodologies (PRINCE2, Agile, etc.) has led to considerable inflexibility of project managers and project teams, hindering project success. It was found that although there is a positive relationship between the use of project management methodologies and performance of projects. But unless it goes along with the clear understanding of the environmental influences and adapting according (Joslin and Müller, 2016) to the specific circumstances, success is not guaranteed. Careful consideration must be undertaken to set a project up with reference to these circumstances (Bentley, 2010; Cooke and Williams, 1998; The Chartered Institute of Building, 2002). This is by no means a new concept: Avots (1969) highlights in his article in 1969 the need for taking time to prepare a project by establishing project definitions and structures as well as realistic estimations of the work.

There is a trend in public sector areas to use projects as a convenient approach to organise a wide range of tasks, historically not associated with project management, such as policy making and implementation. It is felt that this may have had unexpected consequences, which are detrimental for the relevant organisations, such as loss of innovation and flexibility (Godenhjelm, Lundin and Sjöblam, 2015). Project management standards have originally been developed by the private sector to deal with specific areas, specifically IT and construction. The application of these standards without altering to suit public sector characteristics could have contributed to the poor performance of public sector projects.

## *1. Defining the “PROJECT START”*

The understanding of the term “project start” is different from the viewpoint of the various stakeholders and participants. A supplier may see this point as the date when an order is received, whilst a client would consider the day of first approvals as the start, if not earlier (Savolainen, Ahonen and Richardson, 2015).

Even within individual teams exist often different opinions as to when their projects started. There are many activities to be completed before a project is formally established, including implementation of a governance structure, identification of potential team members, and many, many more. At times, there may be various attempts to gain a mandate for the plans or this phase takes a long time to complete, leading to the loss of knowledge as team members move on to other tasks or organisations. It is paradoxical that on one hand projects are defined by having a specific start and endpoint and on the other hand find it difficult to agree on what the starting point may be (Eduardo and De Freitas, 2014).

The issue of understanding the exact starting point of a project is important to use comparable and exact data in order to develop statistical evidence for project performance. Planning and shaping activities take place long before any contracts are signed. With increased complexity of the projects the difficulty to define a specific project start point increases (Eduardo and de Freitas, 2014). The birth of a project involves gaining an understanding of business needs and achieving consensus between relevant key parties over options which provide the best solution (Smith, Wyatt and Love, 2008). A conversion from strategic thinking to a definition of requirements for a construction project also often needs input by professionals. These should advice on or follow processes that are suitable for the environment in which the project takes place. Techniques such as “Strategic Need Analysis” (SNA) can be deployed to ensure the formative stage of the project is managed appropriately and addresses all aspects required to fulfil the strategy.

Lund et al. (2016) have identified that a key aspect for success of projects lays in the clear definition of project start, finish and the activities that are required. Furthermore, the definition of approval milestones is supporting the project development and prevents activities moving too far to be stopped.

Project methodologies, such as PRINCE2, provide a very structured approach to the project start. In the PRINCE2 context, the point of the start-up phase is to assess if a project is viable to be further pursued before committing resources. If so, it provides a project mandate by gaining approval of a business case and/or project brief (Office of Government Commerce, 2009). This marks the first auditable approval point of a project. With a relatively wide acceptance and adoption of the PRINCE2 methodology as the preferred approach, the public sector should therefore in theory have no problems to define the start of their project.

### 2.2.2. Accountability



Governance is an important argument for a tailored approach to project management. Good governance in projects not only includes the hierarchical definition of approvals and delegated authority, but clarity in responsibilities that enables making tough decisions in an appropriate time frame (Office of Government Commerce, 2009).

Often there are no agreed decision points within the project cycle at which the activity could be stopped or re-directed. Motivation of individuals, social pressures and organisational politics can prevent objective decision making and result in 'over-commitment' (Staw and Ross, 1987). Avoidance of suffering sunken costs is used as an argument to continue unviable projects (Northcraft and Wolf, 1984), sometimes to serve reputational issues of individuals and organisations.

Failing to align governance with the relevant project environment is resulting in making the wrong decisions, not making them in time or not making decisions at all (Joslin and Müller, 2016). The push for rigid standardised approaches to project management and their slavish application leaves little room to adjust the governance to the project environment. The need to implement effective governance at the earliest possible point is considered good practice by industry (Sundes, 2014). However, this does not work without accountability.

#### 1. Accountability of the individual

Understanding the accountability of individuals in charge of projects is multifaceted (Lupson and Partington, 2011). Some individuals feel only accountable to their own

project stakeholders and will not make decisions that could be detrimental for the project even though the wider impact would be undesirable. Somebody who feels accountable for the wider public would see a project in a wider context, in which it may not provide any or very little benefits.

The heightened focus on management accountability has a direct link to concerns about personal reputation and career prospects resulting in an increase of escalation commitment (Mahlendorf, 2015). Correlation has been identified between the strength of capital market orientation and the unwillingness to fail projects, effectively displaying dysfunctional decision making. It also implies that this occurs less in the public sector, where there is little or no focus on capital markets. This, however, does not appear to be the case (Hayhow, 2017) as examples, such as the Airport Berlin demonstrate (Landesrechnungshof Brandenburg, 2015).

The government preferred PRINCE2 approach, establishes a single point of authority as project owner (in PRINCE2 language the SRO = Senior Responsible Owner) to assign resources and funds (Zwikael and Smyrk, 2015) in an aim to define clear accountability to project roles. However, existing project governance models are deemed to be outdated and incomplete with steering boards consisting of key stakeholders are being thought to be more effective in their ownership of the project and holding the project manager accountable.

Governance issues are not the only detrimental influences and constraints, which hold performance of public sector projects back. Not only is the public sector hindered by slow decision making, stifling procurement rules, established and inflexible jurisdictions; it also has retained an intrinsic distrust of private sector entities holding back the development of good project teams (Ning and Ling, 2013).

## *II. Accountability and responsibility*

Accountability and responsibility are terms which are widely used in literature and day-to-day language. However, they have different meanings affecting the context of the research.

The difference is very subtle and in the universal use of everyday language almost non-existent. In the Oxford English Dictionary, responsibility is defined as: “accountability”, whilst accountability is described as “answerability, chargeability,

liability and responsibility” (Soanes, 2003). Black’s Law Dictionary (Garner, 1999) refers to responsibility as “Liability” or “a person’s mental fitness to answer in court for his or her actions, see competency”. Accountability is defined as “responsibility, answerable”. The terms are either mutually exchangeable or so closely associated that one cannot exist without the other. This confusion is addressed by McGrath & Whitty (2018) defining responsibility as an obligation to satisfactorily perform a task, whilst accountability is the liability to ensure that a task is performed satisfactorily.

Some researchers see responsibility as a causal attribution, whilst accountability is referred to as the potential for punishment (Brees and Martinko, 2015). One could not be held accountable where no responsibility was attributed, but one could be responsible and not been held accountable. Both terms are often subject to perception, particularly within the public sector. Judgements of accountability are heavily influenced by the dynamics within organisations and/or project teams.

Burga and Rezania (2017) point out that project accountability is not realised in the way it is suggested in relevant guidance. They state that the accountability in projects is often based on individuals taking ownership. Furthermore Burga & Rezania recognise the influences, character, relationships, social environment, etc. form the project governance and accountability more than theoretical management principles.

### *III. Accountability and the civil service*

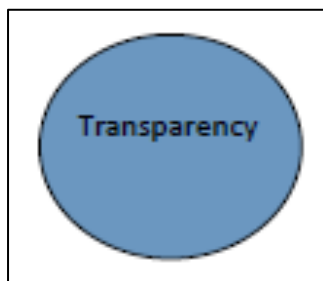
Accountability in the public sector is ultimately associated with transparency and the absence of both would allow individuals or groups to act with impunity (Adam et al., 2012). The public sector provides services that are deemed to be unsuitable for mechanisms used in the private sector. Benefactors are often vulnerable individuals with low income and there is a need to separate services from market interests and fluctuations. Other services have rescue functions and are provided with powers (such as the justice system) and require therefore to remain in the public sector. Whichever purpose it may be, these services are funded through taxation and must be subject to maximum transparency.

Kieslich & Littlejohns (2015) note that transparency, consistency and specific conditions of the decision-making environment, such as publicity, relevance make decisions legitimate. This does not only include the aspect of the decision making but

establish options for the enforcement of conditions associated with the award and processes that allow bidders to challenge the decision makers.

Reports and investigations in failures of public sector organisations, such as the NHS, have raised concerns about the lack of accountability for decision makers in the public sector. However, accountability is judged from different perspectives, which seems to direct to different judges (Ferlie et al., 1996). The sense of being accountable to somebody is also associated with individual loyalties, rather through means of an established governance. Consequently, the term requires explicit definition when implementing governance on a project.

### 2.2.3. Transparency



Democratic governments all over the world are seeking to find workable solutions for ensuring accountability and transparency across their activities. In the USA, the Federal Funding Accountability & Transparency Act (Hatch, 2008) was implemented, but experienced problems with the release of information on federal grants, loans and contracts. The

intention was to provide the public access to data on these awards to focus decision makers on public value and reduce wasteful expenditure.

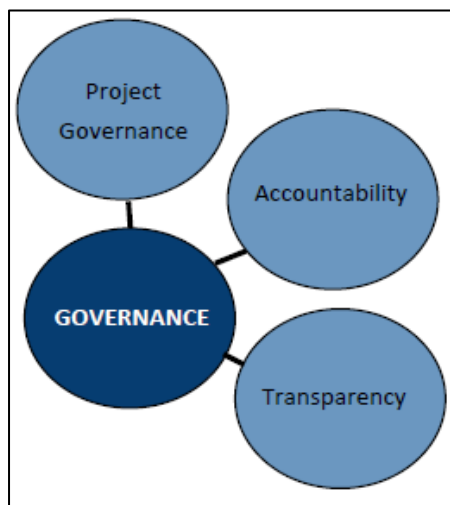
In his review of the impact of this Act, Hatch (2008) revealed that exposure of the range of bids for public funding resulted in pushing decision makers towards lowest bidders with a detrimental effect on quality. It also highlighted that the public perception of value was subjective and therefore the view of wastefulness on federal spending by the public did not improve. It concluded that the drive towards transparency can have unintended consequences.

However, the public sector should work on the premise of maximum transparency, which includes accountability for project approvals, funding, resource and procurement decisions. This can create ethical dilemmas for managers in the public-sector environment: regulations and policies are explicit and detailed, for example, public procurement regulations (The Public Contracts Regulations 2015, SI 2014/2705), and leave no discretion for adjustments to the process when additional information comes to light, which alters significantly the quality of the outcome.



Fear of falling foul of the processes encourages risk aversity, particularly in fear of future audits and reviews. Ultimately, this has a detrimental effect on the performance. There is even an argument that there may be circumstances, in which less accountability would prevent escalation commitment as managers feel less threatened by a project failing (Mahlendorf, 2015).

#### 2.2.4. Why does that matter for the subject investigated in this research?



Projects of any kind require careful and competent decision making. In the public sector, these decisions relate to the expenditure of taxpayer's monies to achieve a benefit to the wider society. Therefore, individuals making decisions should feel responsible for their actions as well as they should be held accountable for them.

The key to this is seen in establishing elevated levels of transparency - the more transparent the process, the more exposed the decision makers are. However, as some of the literature indicates, the balance between the provision of transparency for decisions and the creation of a fear of blame environment can lead to decision paralysis and ultimately to achieve the opposite of what is sought.

### **2.3. Project estimation**

#### 2.3.1. Context

Projects, Project Management (PM) and project performance has increasingly raised the interest of academic researchers over the last few decades. This is particularly the case in relation to the public sector, where high profile project failures, such as the cost overruns at the Defence Information Infrastructure Project of £4.8bn and the NHS National Programme for IT of £3.6bn (Hayhow, 2017) have been reported. This is not limited to the UK public sector only, as the ongoing problems with the Airport Berlin Brandenburg demonstrate. (Landesrechnungshof Brandenburg, 2015).

The MRC has undertaken some major estates projects in recent years (Laboratory of Molecular Biology in Cambridge with £212m investment and the Francis Crick Institute in London with over £600m) as well as numerous medium and small projects. As described in the introduction (Chapter 1), these projects pose some unique challenges. Technology in cutting edge science is often untested and therefore no previous experience of requirements on building engineering available. Scientists, engineers, architects and project professionals embark on a journey of discovery in many of these projects.

Consequently, management of construction projects in the MRC deal with technical complexities which often require a multitude of experts in various engineering fields, such as electromagnetic shielding, vibration and acoustic management, as well as containment of chemical and biological hazards. These must be delivered within given budgets and timeframes, which may not necessarily fit with the natural schedule of the works to be completed. Public sector accounting rules, such as the annuality of funds are a significant element of this. (Hyndman et al., 2005).

### *2.3.2. The estimation in the early project stage*

The first stage of projects tends to be critical for the performance in later phases. A mandate is being gained to proceed with the project by identifying the benefits it would offer versus the required funding (Office of Government Commerce, 2009).

Estimates are at the heart of the project from the beginning all the way through to completion. Even at the very earliest stage of when an idea of an undertaking emerges, people will have very general views of costs or timeframes in their mind, irrespective of how realistic they are. These estimates will be refined and revised throughout the development of the project as more information is gathered, and details of the plans emerge. At each step, the calculations will have a certain confidence level attached to them, which continues to increase – upon the appointment of a contractor, one would expect these to be at approximately 90% (HM Treasury, 2015a). However, it is unlikely to ever have complete accuracy in the estimates – specifically in construction project, not least due to the wide range of circumstances and events that impact plans.

Even when taking the relevant confidence levels into consideration, the estimates often still show great disparity between forecasts at point of approval and the results

at actual completion. Information provided as part of the initiation process determines the approval of the projects and should enable the evaluators to make an informed decision whether the benefits outweigh the costs or vice versa. Grossly inaccurate estimates lead to investment decisions that are unlikely to achieve the desired outcome.

Literature offers a wide variety of potential causes of these inaccuracies, but two areas emerged that dominate the discussion: strategic misrepresentation and optimism bias. Project management activity applies to all phases of a project and is influenced by a wide range of aspects. PM guidance (Office of Government Commerce, 2009; The Chartered Institute of Building, 2002) often focusses on the delivery phase, where procurement decisions, change, risk and issue management are seen to have the most direct impact on the outcome of a project.

But there are many actions taking place before this phase which are influential for a controlled and successful project delivery. The complexities of project environments make a comprehensive approach to address all aspects near impossible, certainly impracticable. Practitioners generally agree that first steps of a project are critical for their later performance (Jost, Petros and Bullock, 2006), mainly because it implements all measures required to deal with risks and issues throughout the life cycle. This is evident from the description of the purpose of the project initiation as defined by relevant bodies of professionals, such as the Association of Project Managers (Naybour, 2014), which refers to the justification of the project, what and how it will be achieved. It also sets out the responsibilities for the individuals involved.

To develop a project from a vision to something deliverable, a comparison between the existing situation and the desired one is made (gap analysis) establishing the requirements. These requirements represent the key objectives that need to deliver the desired benefits. Hjelmbrække, Hansen and Lohne (2015) state that the failure of delivering these benefits is deemed to be the consequence of a lack of engagement with users throughout a project. This is argued to be the result of contract being formed between parties (sponsor and contractor), which exclude the user and therewith losing focus on the organisational perspective over project delivery.

Research by Li, et.al (2018) involved a quantitative assessment of stakeholder influence and found end users of construction projects as the most influential

stakeholder after government representatives and owners. Importantly their main area of influence is considered the pre- and post-construction phases, the former to inform the needs and the latter to provide feedback on the project performance.

Designers (architects, etc.) have the difficult responsibility to translate these requirements into tangible designs of facilities. This involves the balancing of many pressures: fulfilling the multiple needs of users, design within budget, design within stipulations of regulations and standards, etc. Afacan & Demirkan (2010) found that the priorities are different on projects and so are the specific understandings and details of the requirements. In the context of research facilities, this has resulted in the development of a specialist area of expertise for designers (Huler, 1991). Since cost and time schedules are based on the design of the facility, it is of significant importance that the design is suitable to achieve the envisaged benefits.

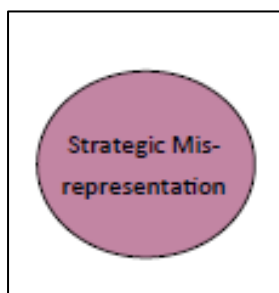
At this early stage, estimates for project costs and time scales have a relatively low level of certainty, resulting in higher contingency allowances. Kim, Seo and Hyun (2012) note that producing cost estimates at an early stage of a project causes uncertainty due to limited project information being available. They further point to traditional processes of estimation, such as the application square meter rates and refer to the influence of estimator's experience and preferences on the outcome of this activity. Kim, Seo and Hyun suggest the use of a hybrid method, which uses a mixture of information (historical and quantity-based) to overcome the lack of information at this early stage of a project.

Inception stages of projects ultimately prepare a project for the first and critical hurdle – the approval by relevant groups or individuals, mostly with the respective award of funding. Application for this is made in the form of a business case, setting out the benefit of the project for the organisation. The UK Government template for the development and submission of Business Cases (Great Britain, HM Treasury, 2015b) guides applicants explicitly (via explanations under the various headings) and/or implicitly (via the “sponsors” within the respective government department) on how to word the proposal and which aspects to emphasise or prioritise. However, my experience in the public sector is that evaluators rely to a significant degree on the statements of the bidder (particularly in highly specialist areas, such as fundamental science) that the project will provide a solution to the problem and deliver the identified benefits.

The overall funding availability for most of the UK public sector has continuously decreased and can be described as unpredictable or volatile over the last decade (Pope, 2017), intensifying a focus on effective decision making through improved certainty in the outcome of the projects. Failed projects take sparse funding from other projects, which may be more viable and offer more success.

Unfortunately, experience in the public sector is that early estimates are considered to be the final cost of a project and fail to acknowledge that they cannot not provide 100% confidence levels specifically within the public sector and with a fierce competition for available funds. It is human nature to gain certainty prior to making decisions, but this desire can result in just a perception of certainty and make judgement inconsistent as found in the research from Bazerman & Moore (2008). This issue affects both the bidders, in making sure they apply for enough funding to complete the project, and the assessors, who are seeking evidence in the applications that the estimates are accurate.

## 2.4. Strategic misrepresentation?



Literature provides an interesting range of views to the subject of strategic misrepresentation, specifically in relation to the extent and severity of its occurrence. Strategic misrepresentation is a term describing deliberate presentation of false data and it is argued by researchers that project teams would understate costs and overstate benefits

to gain approval of a project and/or gaining funding. My reading on this subject has found consensus that the phenomenon exists but opinions are divided over the level of influence and impact it has and what appropriate solutions can be employed.

Flyvbjerg, Holm & Buhl (2002) make the argument that strategic misrepresentation is common in the public sector, where the chances of project approval are increased by understating the costs and overstating the benefits. Similarly, Jones & Euske (1991) claim that strategic misrepresentation is a “standard procedure” deployed by project teams, suggesting systematic, rather than occasional use. However, this statement is not sufficiently evidenced. Systemic and wilful misrepresentation amounts to serious professional misconduct (Thurmaier, 1992). In fact, in the British Civil Service it would be considered a breach of statutory law, attracting heavy penalties (Great Britain, Civil

Service Human Resources, 2015; Great Britain. Constitutional Reform and Governance Act 2010).

#### 2.4.1. Evidence for strategic misrepresentation?

It is not easy to prove deliberate deceit in the context of project estimation, mainly because reasons for variances between project estimates and actual cost and programme of delivery are plentiful. Hence, the theory of strategic misrepresentation is not without critics. It is considered to miss the multidimensional project framework (Osland and Strand, 2008) and being ignorant to the variety of strong project environments and influences, such as political aspects. Criticism is particularly levelled at the statement that the misrepresentation is the major reason for the variances in project estimates and outcomes, despite recognition of the high complexity of large-scale transport projects and subsequent difficulties in developing estimates. Additionally, these projects have a long life-span of such projects, inevitably resulting in some changes (design, technology, regulatory, etc.).

The question of evidence is an important one. In the literature research, no study was found that reviewed the presence of strategic misrepresentation in estimates of projects, which have not been successful in gaining approval. It is therefore unclear if these projects were unsuccessful because their estimates were more accurate and/or indeed, whether strategic misrepresentation was even present.

#### 2.4.2. Deliberate?

The difficulty to detect evidence of strategic misrepresentation could also be the symptom of what is coined as “normalisation of deviance” (Pinto, 2014). It is manifested by a creeping, incremental deviation from good practice in organisations to the point where the deviation is no more recognised within the relevant organisation.

Key promoting factors for this phenomenon are optimism bias, superficial risk management and undue influences by senior management amongst others. There are also elements of “motivational reasoning” (Kunda, 1990), but the incremental nature of the deviation together with failure to identify faults in the system and processes are noted as main causes for the inaccuracies of project estimates as opposed to deliberate deceit.

Literature focuses mainly on large infrastructure or transport projects, presumably because they are prominent in the public domain, have high public interest and provide easier access to data. No similar literature was found to smaller public projects or, more appropriately, for this research, on projects relating to complex laboratories and research facilities, but it is assumed that some, if not all, of the problems identified above would apply to such undertakings.

### 2.4.3. Influences and causes of strategic misrepresentation

#### 1. Approval processes

The review of literature identified that the problem of strategic misrepresentation is not seen as the sole fault of project bidders. The publication of approval criteria, which favours a combination of low costs and high benefits, is considered an incentive to adjust project data accordingly. Publications, such as the Green Book (HM Treasury, 2015b), gives specific advice in this regard. It allows project teams to cater their business case towards the identified “success” criteria resulting environment of the “survival of the fittest” (Flyvbjerg, 2009) where the applications, which overstate the benefits and understate the costs and/or risks, are more likely to succeed in gaining funding.

Furthermore, these business cases compliant with the Green Book (Great Britain, HM Treasury, 2015b), require an extensive range of skills and expertise that are rarely found within a single organisation. Often, public sector organisations have to procure the services of commercial support and expertise to develop the business cases.

This results in a vested interest by these experts in promoting the supply of information which present the project as attractive and economically viable (McLaughlin, 2004), as the approval is likely to allow the continuation of the appointments in the medium to long term. Interestingly, McLaughlin is asks for integrity of the professionals to ensure that they give honest advice (such as to not take unviable projects further) whilst urging clients to use strategists to “sell” the project to respective funders. Other studies suggest, that the strategic misrepresentation is allowed to persist, because approvers believe external sources only, if they reinforce the existing believes (Dotti, 2018).

## *II. Financial and economic environment*

A project that provides important benefits should receive approval. However, the measure of the benefits tends to be set against the cost of the project (costs, time, resource, etc.) creating the notion of “value for money”. Unfortunately, this is often just a question of affordability rather than a considered, balanced judgement. After all, there is no point of approving a project when there is no available funding to pay for it.

Funding availability has a significant impact on the behaviour of bidding organisations. First and foremost, it increases the competition for these sparse funds, which in turn can cause project teams and senior management of a bidding organisation to make the business case more compelling by misrepresenting the funding need or the risk levels involved. If such an approach has been previously successful, then that will exacerbate this tendency. Undoubtedly, organisations within the public sector are competing for restricted resources and use available tools (including unethical ones) to gain funding approval. This has been acknowledged in the research by Edwards and Roy (2017), although it focuses on this subject in the context of inappropriate incentivisation and measurement of aspects, which result in unintended consequences, such as decreasing quality of research papers (when measured in output number) or increasing time spent on writing proposals than undertaking research activities (measured on external grant funding).

A further unhelpful aspect of public funding is that under-spending of budgets is considered more of a problem than exceeding available funding envelopes (Brian-Bland and Rasor, 1986). Departments and associated organisations tend to ensure all funds available will be expended within the relevant fiscal year. This means that projects are less likely to show any underspend/savings in their reports hence counteracting any attempt to incentivise projects to achieve savings. It also means that it is unlikely for unspent funds to become available to other departments and organisations.

## *III. Organisational culture*

Some organisational cultures lend themselves more to strategic misrepresentation than others. Environments where the personal or corporate interests override wider national concerns (Brian-Bland and Rasor, 1986) are deemed to be particularly



vulnerable to the promises of success via deviating practices with the US military being given as an example. Status of an individual is based on the size of budget under their responsibility and their ability to fully expend this within the given time frames (i.e. fiscal years).

This prevents the search for cost/budget reducing measures and increases the desire to use of strategic misrepresentation to expand this budget (and therewith influence) further. Sometimes this can also be observed in senior management following certain (often self-serving) agendas and their direct interference in the estimation and forecasting activities. Instructions to amend calculations for required resources and finances to make projects more palatable result in “death marches” (under-resourced project making extraordinary efforts to reach the completion stage) and unrealistic budgets or schedules (Yourdon, 1997).

#### *IV. Third party interests*

The complexities of construction projects introduce another dimension to strategic misrepresentation. The wide range of technical and economic factors of large and/or specialist projects require expert knowledge in various areas. Most construction projects employ many professional services (for example designers, consultants, project managers, cost consultants, etc.).

Designers have been accused to be unresponsive to the requirement to design within the given budget. Love, Edwards and Irani (2012) points out that mostly designers compete for work through the level of their fees, often resulting in rushed work and design errors. Once appointed, fees for these services are often based on a percentage of the cost ranges for the overall construction, motivating against the search for low cost solutions. Although they are required to design within budget most projects experience significant budget problems, usually when the design is put to the market for quotes (McLaughlin, 2004).

Consequently, many projects face having to carry out Value Engineering (VE) to recover back to their funding envelope. VE is aimed to find cheaper and/or better solutions for the same level of function and quality, although it often just results in scope cuts. This exercise itself attracts costs for re-design together with delays to the programme, making this a very inefficient way of managing a project (Flanagan and Tate, 1997).

## V. Complexity

Projects operate in complex environments. They are situated within one or several organisations, each with their own politics, governance, strategy, vision, culture and so on. In addition, project teams need to consider their internal and external environment addressing aspects such as market conditions, inflation, global and national politics, locations, skills availability, etc. Many of these are influences, over which the project team has little or no control or are not fully understood in the context of project performance (Love, Edwards and Irani, 2012).

These significant risks and issues to the potential outcome of the project are highlighted in business cases and thus may present the project as being high-risk. Therefore, there is a tendency by project teams to not delve into these aspects too deeply.

### 2.4.4. Potential solutions found in literature

Just like the range of views as to the causes of strategic misrepresentation, literature offers various solutions for curtailing this issue. Flyvbjerg, Garbuio and Lovallo (2009) suggests, that repeated “offenders” should face criminal charges. Considering the difficulties in proving deliberate deceit, establishing a case for criminal charges would be problematic, making this an impractical approach.

A common reaction to rising project cost and schedule overruns is to implement more rigorous controls and monitoring processes. Managers in the public sector are caretakers for public money, accountable for its expenditure and therefore required to take control. However, finding the right balance between control and empowerment of project teams is critical to ensure that the projects will not suffer paralysis of project activities and decision making.

The desire to improve project performance in general and in the public sector specifically, is reflected by the drive to seek out and implement formal Project Management procedures. In the example of the UK public sector this was focussed entirely on PRINCE2 and, more recently, Agile.

There is evidence that the one-fits-all approach is not working. First and foremost, despite the introduction of formal project management approaches and intense training of senior project staff (via MPLA) there has been no noticeable improvement

of the project performance in the public sector. Secondly, the defining characteristics of projects are their uniqueness and being activities outside business-as-usual (Office of Government Commerce, 2009) because scopes, project environments, dynamics and influences are different on each project.

Working within a complex environment and facing a multitude of risks and influences over their life cycle, a more adaptive style, such as with the management of complex systems might be more effective (Stacey, 2011). But project teams and professionals are not completely without tools for developing estimates and improving the quality of the calculations. Whether they are appropriately used is questionable. Research has shown that often models are used, which are known to have flaws or to be less accurate, in favour of more sophisticated ones (Næss, et al., 2015).

This as such may represent a strategic approach but without knowledge of the reasons for not selecting the kind of models reasons (for example, costs, lack of expertise, unfamiliarity) the accusation of strategic misrepresentation remains unproven. Some of these tools will be considered in more detail, after reviewing literature on two further main influences of project estimation – optimism bias and planning fallacy.

## 2.5. Optimism bias & planning fallacy



Optimism Bias and planning fallacy are two further influences on the estimation of projects. These do not represent wilful deceit, but a cognitive tendency to underestimate risks as well as the time frame required for completion of tasks.

### 2.5.1. Optimism bias

Optimism Bias is not only associated with pre-approval phases of projects, but affects the decision making throughout the life cycle of projects. Investment decisions are linked to the expectation of a certain value to be delivered by a project and this will determine the choice of options, such as the termination, persistence or escalation. But as Meyer (2014) notes, optimism bias results in a low likelihood for termination of failing projects.

As such, optimism bias is a key component of the escalation commitment by managers. Winch (2013) views this as the result of an either over-optimistic view on their own level of influence on the performance of the project or unrealistically positive perception of what benefits the project is capable to deliver. Other reasons for the reluctance to terminate projects include such as the argument of sunken costs or the desire by managers to be associated with successful projects and are evidence of a bias to adopt an optimistic forecast.

### 2.5.2. Planning fallacy

Planning fallacy is paradoxical in nature as it manifests itself through individuals maintaining an optimistic view despite knowledge of historical evidence proving otherwise (Buehler, Griffin and Peetz, 2010). This phenomenon represents an explanation for estimate inaccuracies, which is in direct contrast to the notion of wilful deceit.

Optimism bias and planning fallacy are aspects to which project teams are prone to, mainly because of an “inside view” (Buehler, Griffin and Peetz, 2010) by team members. Literature is not clear in the definition of planning fallacy. Yamini and Marathe (2018) found a wide field of definition, including some, which see planning fallacy and optimism bias as the same phenomenon. Key is that the cognitive process in predicting future events is closely linked with a perceived view over one’s control over events and overoptimistic risk assessments. However, planning fallacy as defined by Buehler et al. is the over-optimism despite opposing previous experiences and data. So why is this information not used for predictions?

The ignorance of historical information by project teams is rooted in several aspects. It is uncomfortable to admit personal shortcomings or one’s own contribution to the failure of a project. Common responses are to dismiss similarities or risk scenarios with the argument that failure was caused by some unforeseeable, external factor or that the circumstances of the project are completely different, justifying the dismissal of lessons learned. The fact that project planning and scheduling is inevitably a forward- looking activity and cognitively prevents the look backwards to historical information exacerbates the problem.

One further interesting aspect of planning fallacy is the degree of motivation the relevant individual or group may have. In the context of a bidding process for funding,

one must assume that the motivation of the bidder is great and consequently, the degree of optimism bias is greater. At the same time, a third person perspective, which would be held by an observer (auditor, reviewer), is less motivated, has less emotional attachment and hence more likely to seek out facts and comparisons to the project.

### 2.5.3. Risk and uncertainty



Both optimism bias and planning fallacy are inextricably related to the perception of risk and management of uncertainties. With uniqueness being one of the key characteristics of projects (Office of Government Commerce, 2009) outlooks on their risk levels must relate to the specific circumstances of such undertaking.

Uncertainty in the project estimation reflects the level of confidence in the calculations, which is different to risk, where the uncertainty relates to the chance of the risk occurring. However, both require similar tasks than project estimation and are consequently equally vulnerable to the influence of planning fallacy and optimism bias.

Some UK government departments, such as the Ministry of Defence have developed extensive guidance on both risk and uncertainty and implemented measures to ensure that these are adhered to. It has established the Cost Assurances and Analytical Service (CAAS) to test the project estimates (Great Britain, Ministry of Defence, Cost Assurances and Analytics Services, 2011).

But defence equipment procurement still suffers from significant issues in the project delivery, as the cost increase in the delivery of the global combat frigates demonstrates (Norton-Taylor and Brooks, 2016). Options for de-biasing are to benchmark projects (RCF) or inviting neutral outside observers. The suggestion to minimise motivation and reducing social pressures as a mitigation for bias will not only be difficult to achieve but can be counter-productive (Buehler, Griffin and Peetz, 2010). It is impossible to accurately predict the future thus preventing accurate estimation. The line between optimism bias and strategic misrepresentation is very blurred, making the search for relevant individual mitigation actions very difficult (Næss et al., 2015).

#### 2.5.4. Potential solutions found in literature

At this point, it is prudent to consider the view of practitioners on this subject. There are significant and detailed data from over 70 years of projects available to analyse and learn from, yet there is no noticeable improvement on the performance of projects. Planning fallacy is the result of human nature, evidenced by the fact that laymen and experts alike are subject to the effects of planning fallacy (Sample, 2015). An effective strategy to mitigate this effect may be the use of Reference Class Forecasting (RCF), invitation of external observers and task segmentation.

Guidance for project risk analysis and management (Naybour, 2014) aimed at project practitioners does not indulge in considerations of causes or effects of optimism bias. It must be highlighted that input data to risks identification and assessments need to be verified and assumptions are to be recorded to eliminate possible bias. This aims to promote a more realistic calculation. One of the techniques to get better views of the potential outcomes of projects is the Monte Carlo Analysis.

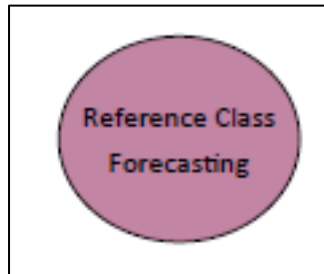
Software applications for this method will create vast amounts of random combinations of different risks, which may occur and provide a calculated potential outcome in form of an expression of confidence levels. This again heavily depends on the quality of the input provided and is only considered a good method in combination with other approaches (Miller and Szimba, 2015).

Caffieri, et al. (2018) have analysed the cost performance of major projects in Australia, which all show significant cost budget overruns. Their findings indicate that greater transparency results in the reduction of optimism bias. They make also clear that, even if this does not completely eliminate optimism bias or strategic misrepresentation, it increases the confidence in the knowledge of due diligence and scrutiny been applied to the project.

Other methods involve the assessment of uncertainty by producing an extreme pessimistic and then a similarly extreme optimistic scenario and then define width intervals to mitigate bias and anchoring effects. This process is also to be carried out for the probability scenario (Chapman and Ward, 2007). Supposedly this should cancel out the extreme views however, it is likely that with a strong tendency towards

the optimistic judgement, the problem would remain. Furthermore, looking at smaller projects, where less resource is available this approach appears impracticable.

### 2.5.5. Reference class forecasting (RCF)



Much of the literature agrees that RCF can provide some improvement to the quality of project estimates, but the views differ as to whether this approach on its own will be sufficient.

One view is that the key causes of inaccuracies of project estimates are either optimism bias or strategic misrepresentation. Flyvbjerg (2008) is an avid promoter of RCF and sees it as the ultimate tool to remove optimism bias but admits that it may not be effective, where strategic misrepresentation is present as there may be little interest in finding the accurate forecast.

RCF has been tested in a commercial environment by contractors, who require more certainty as part of their bid work. They have employed this method to estimate the price and schedule uplift required and found it a useful approach for improving the outcome of contracts (Bayram and Al-Jibouri, 2016).

#### Testing RCF

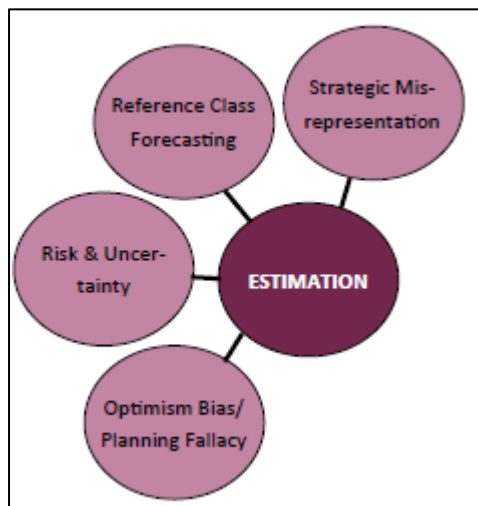
There are barriers to the effective use of RCF. Statistically, best results can be achieved when there are large amounts of project data available. Whilst this is the case on large infrastructure projects, other areas, such as in the education and research sector do not have this kind of information. Access to project data is difficult across organisations and even with relevant data available, constant attention and update is necessary. Furthermore, the data sets tend to range over a long-time span, which may result in the need for adjustments (such as for inflation), which would be self-defeating (Makovsek, 2014) as it re-introduces potential bias.

Comparisons of different approaches to estimation have shown that RCF outperforms (with regards to accuracy) other methods, such as Monte Carlo Analysis. It is considered more user friendly with the output remaining constant, unlike with Monte Carlo analysis, where each calculation will represent a different combination of scenarios (Batselier and Vanhoucke, 2016).

Further thought is given to the option of using the Monte Carlo analysis with historical details to achieve higher certainty and accuracy. This method can be applied in larger construction projects but requires expert knowledge and experienced project managers to provide appropriate and relevant information to feed into the model (Peleskei et al., 2015).

Some of the research indicates, that whilst RCF can provide an improvement of estimates, its full potential can be unlocked by using it in combination with other mechanisms. Most feasibility studies for construction projects of any type are carried out by experts, such as architects and engineers, often with the support of professional cost consultants. It is suggested that the combination of expert judgement in the form of three-point estimates together with RCF will provide the best results. Similar warnings in this area of research highlight again, that the result is heavily dependent on the quality of the database as well as reasoning and examination of each individual project that should form part of the RCF (Leleur, et al., 2015).

#### 2.5.6. Why does that matter for the subject investigated in this research?



Literature indicates that key influencing causes of cost and schedule inaccuracies are strategic misrepresentation, optimism bias and planning fallacy, although there are different views as to the extent of the influence of each or a combination of all.

The presented research demonstrates that the solution for these issues is neither simple nor restricted to the project teams alone, extending to the evaluators and assessors of project proposals.

Therefore, the tools to address these issues must be useful for both.

A step forward is provided by RCF but not considered the ultimate answer. To use RCF appropriately, a statistically substantial number of project details must be available. Additionally, selecting appropriate projects for the reference classes requires some skill and knowledge about this process. This is directly relevant to this



research project, as it provides an indication of the potential usefulness of chosen tools and a probable time span for the full implementation of any new methodology.

## **2.6. Project selection, evaluation panels and evaluation criteria**

The annual bid process in the MRC starts with an invitation to bid for funds and explaining the evaluation criteria (Jones, 2012). Criteria used in the MRC are aimed to ensure that only the highest quality of research is funded. Projects relating to construction or other non-science areas are assumed worthy, if they support or enhance research that has been judged to be high value. However, some of the criteria are not always suitable to assess estates related projects. Such projects often serve much wider purposes than supporting only one specific research programme and hence the assessment of “value” to research is more complex. Additionally, the judgement of panels is sometimes altered at the end of the process to ensure the total value of awards fits the funding envelope. The moderation and/or re-scoring tends to refocus on science programmes only and results in estates projects being judged in a different context than in the initial assessment.

Use of criteria and scoring mechanisms is a widespread method for selection in many areas (Human Resources, procurement, etc.) and literature is therefore sought to gather evidence for effective scoring mechanism and/or where shortfalls of this approach are.

### **2.6.1. Project selection and award process**

The public sector has long been criticised for its choices in the selection of projects, often questioning the value of them, as seen recently with the allocation of funds to foreign aid in full view of the financial difficulties of the NHS (Rogers, 2017). The MRC Royal Charter (Queen Elizabeth II, 2003) defines the purpose of the Medical Research Council as to “improve human health”, which is a wide ranging and non-specific target historically focussed on fundamental research.

Much of applied research is undertaken by other government departments, such as the NHS and PHE, which are closer to the application in practice and the pharmaceutical industry. These organisations focus on research directions, which promise a concrete outcome in form of therapies, medication, vaccination or other intervention.

The difficulty of establishing a definition of value in curiosity and knowledge driven research makes it equally difficult to develop criteria and find the best process to objectively assess its worthiness for funding. In the academic environment, Peer Reviews are the most appropriate way of assessing VfM for research proposals. It brings experts in the associated fields of science together to evaluate applications for research funding.

### *I. Commercial approach*

Commercial organisations, for example pharmaceutical companies select Research & Development (R&D) projects based on the potential of future profits (economic methods). It is reliant on existing knowledge gained from fundamental research and must promise the development of a treatment, targeting a sufficiently large group of potential users (market factors) and have acceptable risk levels for any investment in the project. Such criteria and the expected benefit (profit) are quantifiable.

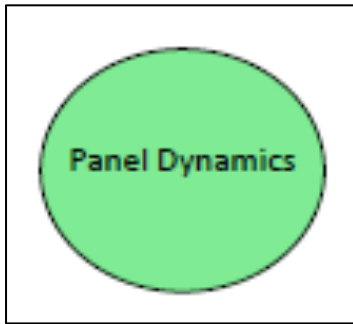
### *II. Public sector*

Generally, governments and industry focus on the funding of research of diseases and health issues, that affect a substantial proportion of the population, such as cancer, dementia, diabetes, malaria, etc. and this is reflected in the respective funding criteria. But there are calls to fund research into rare diseases. It is claimed that the summary of people affected by rare diseases is high and warrants funding and increased knowledge. Such research is often funded through charities and self-help groups (Wissing and Bruckner-Tuderman, 2017).

### *III. “Blue sky” research*

Fundamental research, particularly when venturing in new territories of science, lends itself to the use of qualitative criteria (Verbano and Nosella, 2010). This tends to be a form of scoring method that uses a set of criteria to arrive at a ranking for the relevant projects. It is a method that is more prone to subjective influences. There are increasing tendencies to prioritise on the fit into specific portfolios as opposed to consideration of a project in isolation, providing a much stronger strategic coherence. Scoring systems are “user friendly” methods but have disadvantages over non-qualitative methods, not least due to the potential bias influencing the decision.

### 2.6.2. Dynamics within evaluation panels



Many organisations (including the MRC) publish the evaluation criteria that are used for the assessments to provide transparency of the process and award results. The way in which they are applied is often implicit and depends on the background of the assessors, status or gender of the applicant or the applicant's organisation (van

Arensbergen et al., 2014).

These invisible dynamics and the subjective application of criteria are key reasons for the process of evaluation and the subsequent conclusion is perceived as a 'black box'. For example, the definition of "excellence" in the context of research has a wide-ranging interpretation: innovation, novelty, well-written, significance, interesting, presentation of a good track record and can vary with the discipline of science (Mow, 2011).

Panel reviews rely on assessors being impartial but there is evidence for panel members promoting applications, which are close to their own discipline or area of expertise as well as research applicants who they are familiar with or have knowledge and association with the respective organisation (Lamont, 2010). The increasing number of multidisciplinary research projects reinforces the need for panels to have experts in the relevant fields of research as members.

It introduces another unintended dynamic, in that panel members will be aware of the specialist expertise and rely the judgement of those experts. A tendency to make less effort by individuals to understand the various aspect themselves can be observed as a result (Langfeldt, 2004). But this can also have a positive influence in that the experts present their views and the panel discusses and comes to an informed decision.

A distinction between formal rules (for example impartiality and thoroughness) and informal rules can also be observed. The latter are consequences of constraints, such as size of the funding envelope and time frame available to undertake the evaluation. Some of these constraints can be in direct opposition to the formal rules. For example, the need for thoroughness can be constrained by a very restricted time frame available to undertake the assessment. Evaluators would sacrifice thorough research into the capability of an applicant, because he or she is known to the assessor and focuses

therefore more on those who are unknown. This process has therefore introduced bias.

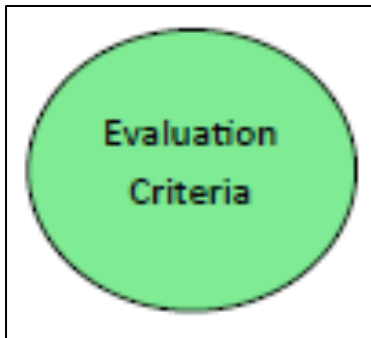
The closeness of a reviewer's expertise to the field of the application also has a direct influence on the result (Gallo, Sullivan and Glisson, 2016). It seems logical, that with more expertise in the relevant field the assessment is "harsher" than if assessed by a reviewer with less expertise in the area or a non-academic assessor. This is the key argument against the accusation of influence of social networks and cronyism.

#### *1. Power for the applicants or transparency?*

An interesting concept for achieving more transparency to peer reviews in science (particularly in the emerging interdisciplinary research) is to increase the empowerment of applicants in the review process (Laudel, 2006). Involving applicants in the selection of reviewers on panels is expected to encourage the discussion between reviewers and applicants. Administrative efforts to establish review panels are considerable and the practicality of such an approach requires testing. Furthermore, by allowing applicants to suggest reviewers may introduce a bias with the relevant panel member and result in a protracted process for the proposal reviews.

The way in which panel members are selected is not the only influence that can skew results. Constraints in the funding envelope require more moderation to be applied to the initial ranking. This means that once proposals are selected to be funded, panels would need to review and revise the scores to ensure that the awards match the funding envelope. Therefore, the decision making of the review panels is arguably only effective, and without impairment, when there is sufficient funding available and they are not required to reject projects, which they otherwise may consider viable.

### 2.6.3. Evaluation criteria



Peer reviews and panel decisions have developed over time and will continue to improve and change. A recent example of this is the inclusion of criteria relating to the use of animals in the funding assessment. Growing influence of the ethical standards identified and promoted by the NC3Rs have triggered a change in the thinking of funders, such as the MRC and other UK Research

Councils not only regarding the criteria used but involving experts in this field as part of the evaluation process (Xanthos, 2015).

#### 1. Approval process and establishment of criteria

Research grant funding starts with a call for proposals, identifying the direction of the research, funding criteria and overall process and duration. Guidelines for the evaluators are prepared in the form of checklists with an explanation of the criteria. Many use internal and external reviewers to assess the submitted proposals. The general approach of determining research funding is a two-stage process in which an initial review is carried out by individuals, the result of which is then discussed and concluded in a committee.

Criteria tend to focus on relevance for the call, amount of funding requested, track record of applicant, originality and methodology amongst others. Reviewers spend between 2 hours and two days on the reading and reviewing of each proposal. However, if external reviewers or individuals with specialist expertise are involved, committees will rely heavily on their judgement. Improvements to the process are mainly seen by increasing the transparency by allowing applicants to respond to reviewer's queries during the process, clearer definition of the criteria and how they are to be applied as well as identifying the qualification of the reviewers (Abdoul, et al., 2012). The latter, however, is somewhat controversial, if it identifies the individuals making the funding decision.

The reduction of public sector funding for research activity is not restricted to the UK only and many organisations worldwide have made adjustments to counter the effects of the harsher funding environment. However, there are warnings from unintended

consequences of changes in the award processes, such as peer reviews. Elias & Elias (2012) describe a range of negative consequences, which an amended funding strategy by the NIH triggered. This includes less distinction between the proposal scores as well as negative impacts on investigator development.

Literature does not unite in the support of peer reviews and panel discussions as the best method for the selection of research projects. Shortcomings are individual bias of panel members and that process demands unanimous decisions. Calls for amendments of the process by introducing machine-learned methods (Devyatkin, et al., 2016) or other combinations of peer reviews, expert opinion and panel discussion (Fogelholm, et al., 2012) are viewed to enhance the reliability of selection processes.

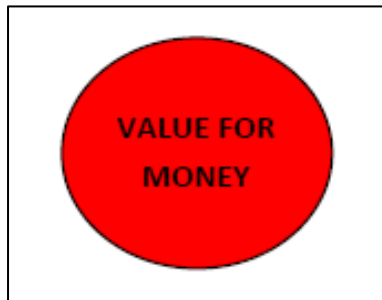
#### *2.6.4. Why does this matter for the subject investigated in this research?*

The way in which the selection process works is important for two reasons. First, it must ensure that selected projects are promising benefits that are relevant to the organisation's aims and vision and are viable to do so. Second, the selection process must be transparent and establish trust of bidding organisations in it.

Existing processes in the MRC need to be assessed in view of these two aspects. An understanding of the panel dynamics and/ or power relations will enable to create transparent approaches and therewith build trust of all relevant stakeholders. Similarly, the criteria for the selection should be examined in view of a general suitability in the respective environment (change of research focus, research landscape, national ambitions, etc.) and whether the panel experts are in a position to judge the bids in line with the criteria in an objective way. The literature review in this element has demonstrated, that the aspect of the selection criteria cannot readily be separated from the process and dynamics within selection panels.

## 2.7. Value for Money (VfM)

Most commercial projects are funded based on an investment appraisal, which includes assessments, such as accounting rate of return, payback, net present value (NPV) (Aston and Turner, 1995) and similar monetary criteria. Funding decisions in the MRC are based on how the investment would benefit the research activities.



Fundamental science is unpredictable in terms of its outcome and therefore the benefits can rarely be measured in monetary terms. The main benefits are mostly the contribution to knowledge, and sometimes discoveries, that enable development of interventions, medications, diagnostic tools, etc. (Medical Research Council, 2013). However, the latter is more the area of translational, applied or clinical research, which tends to be carried out by Pharmaceutical Industry, Universities, Charities and specific UK government departments and bodies, such as the National Institute for Health Research and Public Health England.

Effective approval decisions are ultimately seeking to achieve “Value for Money”. This phrase is often used but appears to mean different things to different people and organisations. Value is subject to framing, which has a significant impact on decision making (Bazerman and Moore, 2008). Without an agreed definition of “value” of fundamental research and supporting activities (such as estates projects) within the context of the MRC, no judgement of “Value for Money” can be made. Consequently, criteria employed to assess the proposals are arbitrary without this.

Ultimately, project approvers must judge the “value for money” of the presented proposals and it is therefore important to expand on this subject to gain an understanding of this term. Definitions of value are varied and subjective. Value of fundamental research is difficult to quantify as it cannot guarantee specific (or potentially any) outcomes for its efforts. The scientific community increasingly sees governments focus on funding of applied and translational research with the aim to be able to demonstrate delivery of benefits to the public within respective election cycles (dos Remedios, 2006).

Governments are ultimately accountable to the public and therefore value in the context of the public sector should be seen in the eyes of benefits to society, e.g. the

social value. The term is often used in the context of clinical research, but it is also difficult to define. One approach is to consider social value in terms of knowledge creation and effect of interventions to human health or wellbeing. To ensure this, the evaluation process of clinical research proposals considers potential social harm (ethical aspect of research activities) and aims to include social experts or members of the relevant community (Sibbald, 2014).

However, this is focused on research, which targets specific diseases or health issues. Clinical, applied or disease specific research has the potential to show more quantitative measures of outcomes, but this proves still to be complex when assessed relating to monetary terms.

### 2.7.1. Science funding in the UK

The UK Department of Business, Energy and Industrial Strategy (BEIS) distributes a significant capital expenditure to science projects, i.e. £5.9bn planned capital expenditure between 2016 and 2021. In 2014/15 a total of £1.1bn of funding was allocated to Science with £756m to Research Councils and the UK Space Agency, of this £427m related to capital projects (National Audit Office, 2016). Historically, there has been a distinct lack of strategy for prioritising projects. The decision-making process for the approvals was based on poor information with no details provided to bidders as to what information is required to inform the approval process. The National Audit Office also stated that some projects were approved without any assessment and no evidence was found as to ability of the department to assess the “scientific and economic benefits of projects”.

The NAO report does not only highlight issues with the accountability for the approval but identifies the absence of criteria to assess Value for Money in science projects. The NAO is the national “auditor” for government activities, specifically with the focus on VfM and provides guidance on VfM definition and measurement.

Reviews by the NAO are mainly carried out retrospectively, usually upon completion of projects or at least at a significant milestone during the lifecycle of a project. They do not reflect the information available at the point of approval. However, the definition of VfM by the NAO is taking this into account, as it refers to the “optimal use of resources to achieve the intended outcome” (National Audit Office, no date).



This definition has two aspects open for interpretation and are difficult to define: optimal and outcome. Both are heavily dependent on the context of the specific project, its aims and circumstances as well as events occurring throughout the life of the project, which may have an impact on the results being delivered. Consequently, the judgement of good VfM may need to be based on the potential alternative results (Scharaschkin and McBride, 2016).

Views on the best way in which governments should fund science varies widely. The importance of this funding is generally agreed to be the attraction of world class researchers and students as well as innovative and highly mobile businesses, as a direct benefit for the economy. The German and UK Governments have started to abandon the egalitarian funding approach and focus on the development and promotion of excellence in specific locations/organisations to ensure the best outcome. In the UK, funding of sciences is a dual approach, where academic salaries and support functions are funded via HEFCE and the Research Councils fund specific research programmes, which is said to have resulted in less marginal research and improved quality of research programmes (Group of Eight, 2010). This may now be changing with the establishment of UKRI, which has both Research Councils and HEFCE under its umbrella.

When the Haldane principle (Hughes, 2011) was established, it acknowledged limited expertise by policy makers on research activities. It resulted in the UK Government leaving the judgement on quality and worthiness of research proposals to experts, such as the various Research Councils. However, this principle has been challenged, for example, by the Chairman of the Innovation, Universities, Science and Skills Committee, who notes that there is a conflict between government policies and curiosity-driven research (Newman, 2010). There is an absence of a collective understanding of VfM between funders (Government) and the Science Community and looking at approaches of and other government departments may be of assistance.

### 2.7.2. VfM in applied medical research

National Health Services have data sets showing the cost of treatment, amount of sick days, cost of care, etc. and can hence show a quantifiable benefit of a potential drug or treatment. A different approach is used in the assessment of the value in view of their specific health benefits to patients, for example with cancer drugs. Views on the meaning of value in the context of human life is contentious and on opposing ends between patients and policy makers. Formulae, such as QALY (quality adjusted year) and ICER (cost per QALY) (Dilla et al., 2016), provide thresholds for approving bodies (i.e. NICE) to allow fiscal budgeting and considerations of approval of relevant drugs for free issue via the NHS. But different values are applied to these thresholds in different countries, which is unlikely to be an indication of their view of the value of a human life, rather a reflection of buoyancy of economy, government and health service budgets.

The research funded by the MRC is – with very few exceptions - not disease specific. It can therefore not claim to reduce treatment costs or sick days. Nor are the outcomes predictable or immediate. The path from fundamental research to clinical application takes many years.

There are, however, clearly huge benefits in fundamental research, as the example of the discovery of DNA demonstrates, for which no real application was available until 40 years later, when technology caught up (dos Remedios, 2006; Finch, 2008; Huxley, 2013). Researchers throughout the world undertake basic research, creating the knowledge that forms the foundation for applied and clinical developments. Without this, clinical and translational research has very little to work on.

A different method used to assess value for money is the judgement of effectiveness, looking at goal or cost-based efficiencies. The term of VfM is understood to achieve the same at lower cost or achieve better with the same cost. This is often misapplied in the public sector by focussing on low costs in preference to the need for quality or innovation by confusing it with “cheap” (McKevitt, 2015).

This is reflected in the UK Government guidance and regulations relating to procurement (Local Government Association, 2014, The Public Contracts Regulations, SI 2014/2705). Scientific high-tech equipment is expensive, cutting-edge technology and often procured whilst still in the development phase and can therefore

not be purchased via a competitive tender process. There is, in fact, a contradiction in the government messages in that it wishes to promote collaborative and innovative work with industry, however, actively prevents this through red tape and procurement rules. Design and construction of laboratories is an equally complex process, which relies very heavily on innovation, outstanding quality in workmanship and expertise, which come with a cost. Quality has a price.

Additionally, there is the ambition of the UK government to become a global centre of excellence in science (Great Britain, Office for Life Science, 2011). Aiming to attract high profile scientists and experts requires the best facilities to be provided and competitive salaries to be paid. Value in this context is the level of excellence, which one can attract, but also whether the scientists deliver results of the highest standards.

### *2.7.3. Why does this matter for the subject investigated in this research?*

The MRC is funded by the UK Government and uses public monies for research activities. It makes organisations responsible for funding activities and projects to represent a benefit for the public and good VfM. Literature identifies a wide range of interpretation and application of the term highlighting the various perspectives depending on an organisation's objectives. There is no established definition aside from VfM being a complex interaction of the micro and macro environments of organisations, ambition, competition, market conditions and many more, making it impossible to be defined in exact quantitative terms, which could provide a generic benchmark.

Fundamental medical research provides the basis for further applied and translational research but can be difficult to be measured in quantitative terms. In researching the potential for improvement of funding decisions, a view must be formed as to which perspective is to be taken for establishing the value of fundamental medical research and identify appropriate evaluation criteria.

There are very powerful stakeholders, such as the main funder (UK Government), science community, patients and patient groups as well as various charities, industry (pharmaceuticals, engineering, etc.) and the health service, whose perspectives would need to be considered. Not only is value difficult to define, but the context of VfM may require some comparison between different options or at least the consideration of the

benefit of action over doing nothing. Furthermore, such definition would require regular review and adaptation to the ever-changing environment.

## **2.8. Implication of the literature for the problem**

In undertaking this literature review the author was seeking answers to aspects, which are expected to be key influences on the problem of inaccurate project estimates and establishing a fair and transparent funding award process. Findings from this research have provided direction for this research.

Project estimation always works with assumptions, attempting to quantify the unknown future development and influences. Whilst strategic misrepresentation cannot be excluded as a reason for inaccuracies in estimates, it is unlikely to be the only cause.

The author has learned that estimation errors can not only be the result of genuine error, but a conditioning of the human mind to see things optimistically, when scheduling for future tasks (optimism bias) even in full view of previous experience to the contrary (planning fallacy) (Buehler, Griffin and Peetz, 2010). This is not a wilful deceit as suggested by Flyvbjerg, Holm and Buhl (2002), but something which requires a tool, benchmark or other “unbiased” measure to enable correction of this issue.

Reference Class Forecasting targets this problem by providing statistics from similar previous projects, which would provide this benchmark. The author considers this a valid tool, although caveated by the need for sufficient and high-quality details being available and a careful project selection for the respective reference classes. It might overcome the optimism bias but will not provide the ultimate answer to estimation inaccuracies. Collection of project details from the construction sector in life sciences to test reference class forecasting will therefore form part of this research.

Literature has shown that there are issues within organisations during the project development as well as influences from the approval process itself that motivate misrepresentation. Public sector projects are heavily regulated in terms of their financial performance, some of which are the fierce competition for very restricted funds and the difficulties relating to annularity of capital funding.

The author has discovered that the approval processes themselves can cause the tailoring of project presentation to fit best with the identified criteria for approval. Third party interests, such as professionals for whom the success of a business case

guarantees future income, target these criteria to maximise chances for funding approval.

These and further organisational and cultural influences (Brian-Bland and Rasor, 1986; Pinto, 2013), such as inappropriate governance, unnatural constraints to the project schedule and budget, etc., require careful consideration of potential measures to eliminate or at least reduce these influences.

One area, which is the basis for judgement in both estimation and approval of projects, is “Value for Money”. The literature research discovered a wide range of views on what represents VfM, depending on sector, organisation, even individuals involved. It has become clear that, like governance, needing to be suitable for each organisation and project, VfM considerations must be contextual to the relevant organisation – there is no “one definition”. This definition needs to be found for the purposes of the MRC evaluations.

In conclusion, the Literature Review has guided me to an understanding of the problem as something much wider than what my problem statement in Chapter 1 suggested. It will be necessary to approach this in a more holistic way by gaining better knowledge of the commissioning and approval processes and what influences them within the MRC.

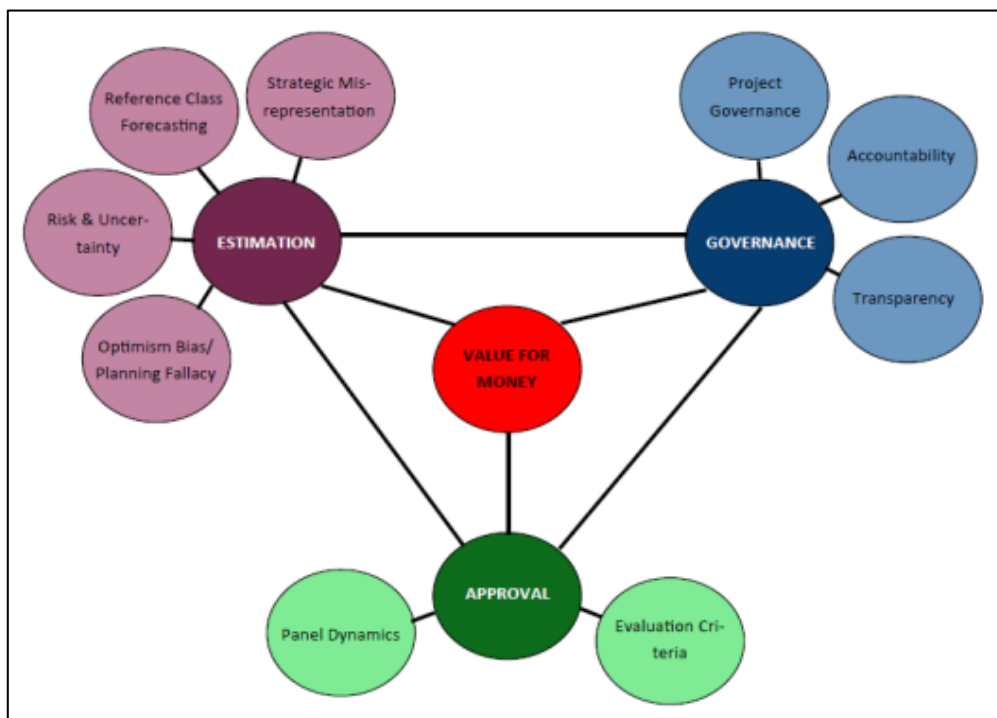


FIGURE 4 - COMPLEXITY OF ELEMENTS OF THE PROBLEM

Figure 4 indicates, how project elements, such as governance, estimation, panel dynamics, etc. are interlinked with each other and how they are all influenced by and affect Value for Money of an undertaking.

In view of the findings and learning from this literature review, the Author found that to fulfil the overarching aim to develop a fair and transparent processes for the approval of estates projects the following key questions need to be answered:

**What are the influences on processes and dynamics of project estimation and approvals in the MRC?**

**Would RCF provide a workable tool for project estimation and/ or assessment?**

**How can this knowledge be used to achieve a fairer and more transparent process for these aspects in the early project stages therewith achieving better Value for Money for medical research?**

## CHAPTER 3 - METHODOLOGY

### 3.1. Research framework

This research is seeking to address a real problem in the operations of the Medical Research Council. It is focused on workable solutions and the measurement of its outcome. Developing theories that may apply to some or most of the aspects identified in Chapter 1 make little sense, if they cannot be implemented. Finding measures from the research in this problem that would be palatable to the leadership and resolve the problem is paramount for the author as a practitioner and for the MRC, placing this research firmly in the scope of pragmatism. Practice-based research is particularly applicable to the testing of RCF, should it be considered for future use in the development or judgment of project estimates.

As Aikin (2018) considers pragmatism as the starting place for developing theory which is what the author believes is required to investigate the stated problem. Pedanik (2018) notes the emergence of pragmatism as key methodology for education studies. He points out that this methodology is seeking aspects of the relationship between humans and their environment and as such this should not be focussed on education alone but on the concept of problem-solving. Pedanik highlights the similarity of this principle with action research and demonstrate the application through linking a case study of action research with the aspects of pragmatism as identified by Dewey (1922).

The environment in which the MRC operates is heavily influenced by political aspects (government aspirations, formation of UKRI and the need to prove it can deliver the anticipated benefits, competition for funding, etc.) including pressure from the public, charities, patient groups, universities and so on. Specifically, the question raised in relation to the suitability of the process for evaluation and award of funding will need to consider different, if not opposing views (bidders versus approvers). In this context my own expertise and knowledge is not only less important, but unhelpful, as it may not reflect those differing perspectives.

The literature review has demonstrated that the subject matter has a multitude of viewpoints formed by stakeholders in relation to their own position in the processes. Their environment, experience and drives will result in different 'realities', which this research seeks to capture. From these constructs a bigger picture can be formed that establishes a more comprehensive understanding of the MRC as a whole.



The author is careful, not to subscribe this research to constructivism, being aware of the academic debate over the meaning of this term, but the learning process of the author as the researcher and the organisation is expected to create new understanding and knowledge from the views of participants and project data sets.

### **3.2. THE AUTHOR'S POSITION IN THE CONTEXT OF THE PROBLEM**

There are benefits and disadvantages in undertaking action research in one's organisation, some of which are discussed in the following. In her current position as the Director Capital & Estates the author is deeply involved in all aspects of the project development, estimation, evaluation and awards as well as being in a position of power to influence, how the organisation operates in these areas.

Challenges to the author's role are the three aspects of insider inquiry (Coghlan and Brannick, 2010). First, the author has a pre-understanding of the processes and organisational environment and therefore a view on what knowledge exists and what is missing. She has also access to relevant data sets (in this case the project information from MRC) and needs to ensure that she analyses with appropriate distance to project information.

Second, the author has a dual role in being a researcher and having a senior organisational role. Whilst this helps in gaining support from the senior management for actions that may need to be implemented, it can also cause conflict with the researcher role that should view the information without ties of loyalties, bias, preferences, etc. In terms of this research, which includes aspects of behavioural, procedural or political activities, the author sees inherent conflicts of interest.

For example, the author engages with teams in the development of project proposals, as well as being an approver (although not the only approver) for these projects. She could encounter conclusions of faults or failures in both of these aspects and must use her professional integrity as researcher to avoid a distortion of the findings for the benefit of maintaining a reputation as effective manager. However, the author has designed the methodology in a way that allows the scrutiny of anonymised information and decisions by the working group or others (senior management) that is mitigating this issue.

Third, the author has access to information that is difficult for external researchers to gain due to political aspects in the organisation (gatekeepers). Her seniority also supports the implementation of actions and gaining support from other senior players in the organisation.

The design of the research was very much aligned with the findings and recommendations by Holian and Coghlan (2013) to avoid pitfalls that this dual role of the author may pose. But in reflection of their work, it is apparent to the author, that this is much of the principle of decision making in the MRC.

For example, whether projects are “worthy” is a decision, which is made collectively. MRC RPG considers the benefits that the project will provide for the science or indeed if it is in line with the strategic direction of the unit research. Only then will a project be assessed in the wider perspective, such as technical solutions, cost and schedule estimates, risk, etc. Hence, the author’s potential interest in projects being successful is mitigated with the initial review being a science-driven one.

Being a member of the MRC capital bid panel as well as the MRC Management Board represents a responsibility for the overall capital project budget (i.e. ensure that awards are made within the funding envelope) and required to review all bids relating to construction or refurbishment of facilities and any associated works. The authors assessments are presented to the panel members to aid the decision between approval and rejection. It is a powerful position and comes with the responsibility to make the approved projects deliver the identified benefits.

In choosing to engage with groups of stakeholders as an action group, the author has been helpfully been challenged in her views and interpretations as well as been provided with a “third party” view from the outside of the organisation. Nevertheless, the author also sees advantages that her situation brings to the research. A deep understanding of the political and cultural environment within and outside of the organisation and how individuals deal with this environment allows to draw conclusions with a different perspective than an outsider would have.

The benefit of insider action research in a public sector organisation with multiple key stakeholders is highlighted by Chauhan (2018) seeing the insider researcher as a knowledge broker and this allows others to take the ownership for required changes, rather than being forced through one individual.

### 3.3. BACKGROUND TO THE CHOICE OF METHODOLOGY

In selecting the methodology for this research, the author considered the problem itself, the type of detail that would need to be collected, her position within the organisation and therefore the problem and practicalities to carry out meaningful research and produce actionable knowledge within the timeframe of approximately 12 to 15 months.

#### 3.3.1. ACTION RESEARCH

##### *1. Why action research?*

Having identified the problem and ascertained the benefits, which solving this problem would provide to the MRC, the core aspect of action research was considered – how can it be ensured that the research results in outcomes that will be implemented and achieve the desired benefits? This included aspects of the authors authority within the organisation, organisational processes, cultures as well as appreciating the way in which knowledge is developed and disseminated in the organisation.

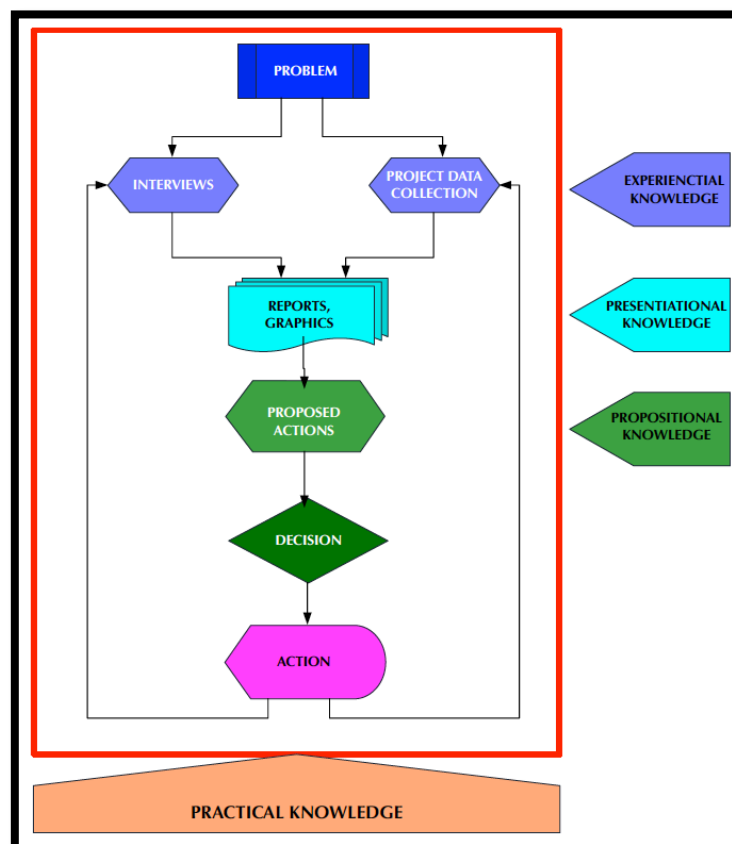


FIGURE 5 - PRACTICAL KNOWLEDGE CYCLE

To develop practical knowledge (McDonagh and Sullivan, 2017; Coghlan & Brannick, 2010) the research needed to incorporate experiential, presentational and propositional knowledge (Figure 5). This combination would enable the organisation to undergo a cultural transformation in terms of triple loop learning (Tosey, visser and Saunders, 2012).

➤ Experiential knowledge

This research was initiated due to the perception of a problem. MRC staff and scientists experience the problem of funding constraints and how this is managed in diverse ways and with very different perspectives. Capturing these experiences is an important aspect of the research and the qualitative methodology in the first research cycle used the free discussion to gain insight to the organisation's internal and external environment. During the second cycle the experiences were captured via questionnaires. Developing the experiential knowledge was a powerful contribution to the understanding of the problem and selection of effective actions.

➤ Presentational Knowledge

The way in which knowledge was presented varied throughout the research subject to the intended audience. Narratives (reports), presentations, meeting and individual discussions were used for this purpose.

➤ Propositional knowledge

Both experiential and presentational knowledge were used to arrive at proposals for measures to be taken in repeated research cycles. Undertaking two research cycles (and later further continuous improvement) enabled these areas to be tested and conclude in practical knowledge.

It also enables learning at different levels, that are noted by McDonagh and Sullivan (2017). Addressing the problem identified targets practical improvements in the organisation. The process of researching, analysing, enacting and reviewing (research cycles) results in my personal learning and understanding of my organisation. This research has a wider impact, than just the MRC. The development of RCF for projects around life science facilities (be it initially as a pilot study) is of interest to a wide range of stakeholders within the research community (universities, charities, pharmaceutical industry) and government departments (HM Treasury, BEIS, Department of Health, Ministry of Defence, etc.).

## *II. Action research cycles*

This research activity is only the first step in a cycle of continuous improvement seeking to achieve a refined process, which provides benefits to all involved parties. Therefore, the methodology includes repeated collection of information (annually), which looks at project performance and understanding of the stakeholder's views on whether the process has improved.

An important aspect of this research is that it targets actionable outcomes, which in turn will be reviewed as to their effectiveness. Action research cycles involve the repeat of research, information collection, analysis of information, deciding on the action and reviewing the outcome. This triggers the starting point of the next research cycle. In this, the action research cycle fulfils the requirement of structured actions and assessments of outcomes followed by further actions (Coghlan and Brannick, 2010). Beaulieu (2013) points out that action research is primarily a tool to improve a problematic issue and not to prove or disprove hypotheses, it does seek out the roots of a problem, better understanding of the truth through close engagement with stakeholders.

This understanding has been taken forward into a programme of continuous improvement that is to be progressed as a "Business as usual" element. Here the influence of action research continues in that evidence is gathered via surveys, project information collection, interviews, etc. to evaluate the effectiveness of measures and identify the next steps.

### *3.3.2. MIXED METHODOLOGY*

Due to the nature of the elements to be considered, different methods were required to gather data and the subsequent analysis. Hesse-Biber and Johnson (2013) point out that the use of mixed methods research is as varied as the problems they being sought to solve. Reilly and Jones (2017) note that this approach is particularly effective in research complex issues. In this research, each cycle contained the activities for each the RCF work and the organisational research. The two areas had different timings – one driven by the annual capital bid process and the second by the speed in which sufficient project detail could be gathered. However, both underwent two full research cycles, concluding in the establishment of a comprehensive understanding

of the issues surrounding the process of project start up, estimation and project approval.

The two strands of this research progressed independent. Both involved the collection of very different information and were subject to different time constraints. Work on the organisational research was bound to the cycle of the capital bid process, whilst the records for the RCF was collected and assessed without specific timelines. Furthermore, it was not intended to apply RCF to the capital bid process before it was tested and found appropriate. Figure 6 is a schematic visualising this approach.

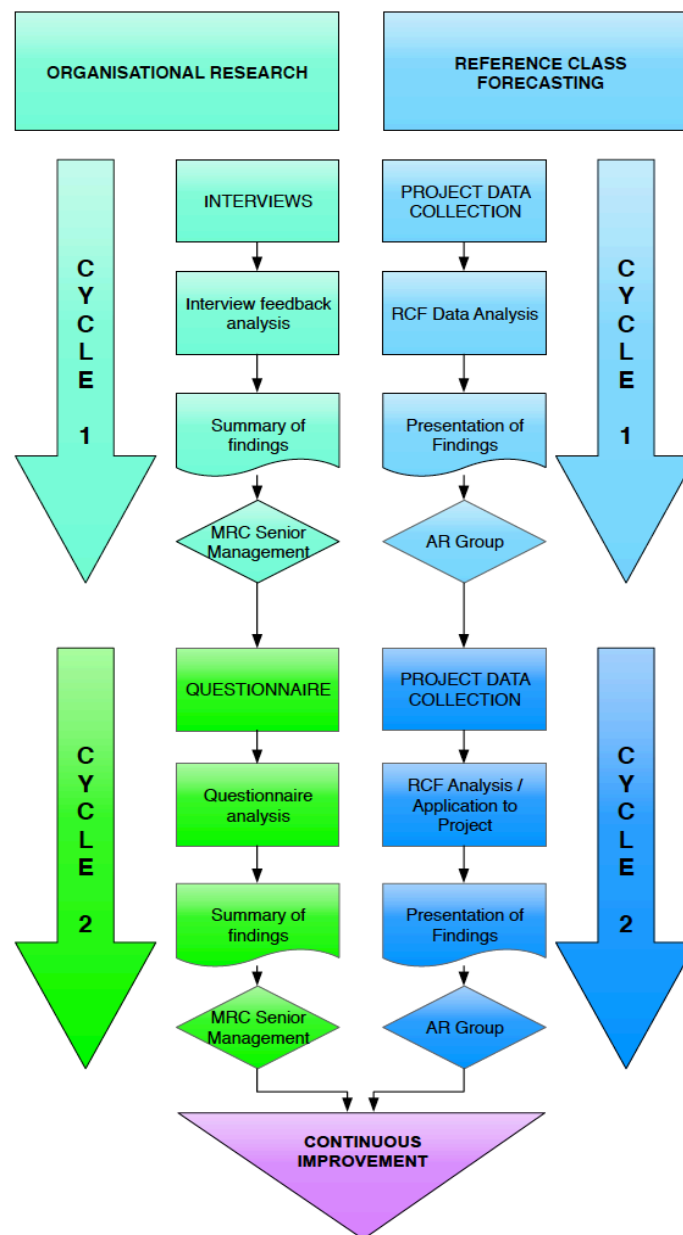


FIGURE 6 - SCHEMATIC OF RESEARCH METHODOLOGY

Views by stakeholders over a range of aspects were sought. It included specific feedback on processes, such as the capital bid process as well as more philosophical considerations of the meaning of value in the context of medical science. Such data sets were collected using qualitative methods (in the following referred to as organisational research), in interviews and questionnaires. The second strand of the approach was the investigation of RCF as a tool to improve the estimation of project costs and schedules. This required quantitative methods for information collection and analysis.

A further important aspect in choosing the methodology was the consideration of the audience. Undertaking action research in the MRC requires an understanding of what kind of output and presentational method would have the most impact and likely to be understood and accepted by the organisation. The MRC funds medical research, which in the majority is based on an ontology of realism using the establishment of hypotheses, undertaking of experiments and analysis of facts/ numbers to conclude in either confirmation or rejection of the hypothesis (Easterby-Smith, Thorpe and Jackson, 2012). Consequently, use of quantitative methods were felt to be more suitable for the analysis of some of the details. In the following the specific approaches for this research are explained in detail.

### **3.4. ORGANISATIONAL RESEARCH**

#### **3.4.1. INTRODUCTION AND GENERAL ASPECTS**

The purpose of the organisational research was to develop an understanding of the underlying processes and dynamics that exist in the MRC, which influence the project estimation and approval. From the outset, this was intended to be undertaken via interviews to allow a free conversation and exploration of areas, which participants thought to be relevant. As this aspect related to MRC only, the health organisation did not participate in this.

For this element of the research there was no formal action group established. However, the senior management team was involved to review the outcomes of the respective research cycles and agree the proposed actions. This added the benefit of the actions being supported by the top level of the organisation significantly reducing hurdles for implementation of the measures.

### 3.4.2. RESEARCH CYCLE 1

#### *1. Data collection*

Information gathered in this first research cycle was gained from interviews of a selection of participants. The development of the methodology for this first research cycle relied heavily on the guidance from Fontana and Frey (2005) in order to gather good information to provide a rich picture of the problem.

#### Selection of interviewees

Twenty-four individuals were identified and approached for the interviews based on their position in relation to project development and approval. These were categorised as

**Approvers:** Individuals, who are responsible for or involved with the approval of projects/ capital bids. These were expected to be exclusively staff at MRC Head Office.

**Bidders:** Individuals, who see themselves as involved with the application for funding only and have no role in any kind of project approval.

**Both** Individuals, who have responsibilities and involvement with both above. These are mainly people, who are in a senior position, which involves the approval role within their scope of authority, but also making bids to the hierarchy level above.

**Advisor** Individuals, who provide professional advice to any of the above. In the context of the approval process, such as business analysts, surveyors, engineers, etc.

The participants were selected based on their role as perceived by the author. It represented a similar proportion of bidders and approvers in existence in the organisation overall (see Figure 7). Twenty-two interviews were conducted of which Twenty-one as a face-to-face meeting; three were conducted via telephone with notes being made during the discussion.



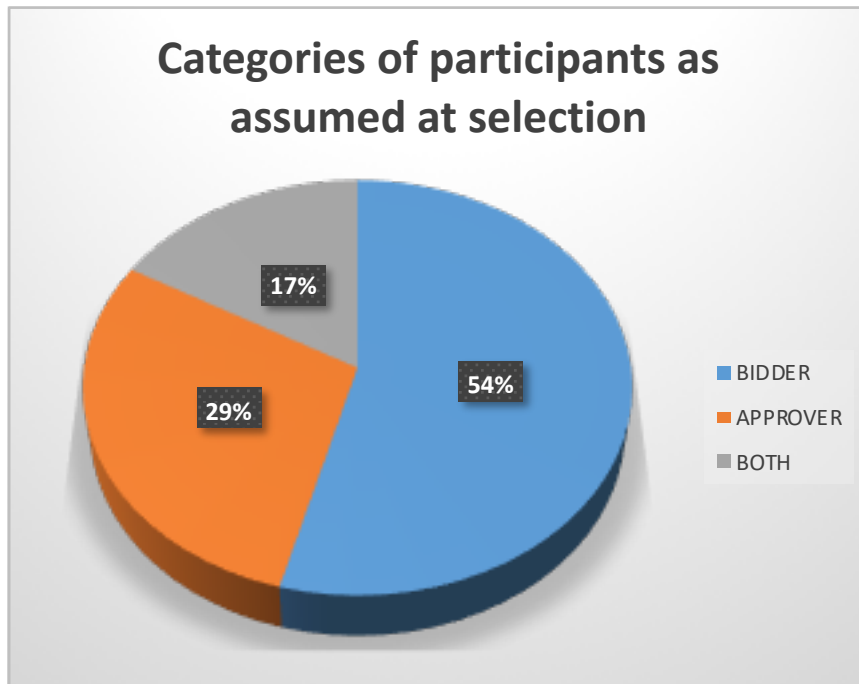


FIGURE 7 - PERCEIVED POSITION OF INTERVIEWEE ROLES

b) Interview content and structure

The interviews were conducted in a way that ensured that the relevant topics of interest are covered but leaving enough freedom to explore specific aspects or areas, which may be associated with the problem. Therefore, semi-structured interviews were chosen for the qualitative data collection (Wengraf, 2001).

The interviews were structured around a set of topics and questions (see 9.2. - Appendix B):

Position of the interviewee: Has the participant a role as bidder or approver?

Project Development: What is the experience of the participant with the development of cost and time estimation?

Project Approval: What is the understanding of the participant of the approval process in the MRC? Does the participant know the evaluation criteria for the bids? Do they receive or provide feedback (depending on position) of the outcome of the evaluation?

Value for Money: What does the participant considers to be good Value for Money in the context of funding of fundamental research? Is there a “tipping point” at which they would consider funding of a project not viable?

Project Performance: Does the participant consider projects to be delivered within the approved estimate of cost and time? Is risk management effectively applied in project management?

Due to the varying roles of the participants, not all participants could contribute to all aspects of the interview structure. However, sufficient response was expected for each element to draw conclusions.

## *II. Data analysis*

The analysis of interviews was based on a thematic analysis that allowed identification of themes arising from the conversations with the participants (Guest, MacQueen and Namey, 2012). However, choosing interviews for information gathering in this research cycle, the author had to acknowledge that the information gained would always be shaped by the participating individuals and the relevant situation at that point in time (Denzin and Lincoln (ed.) 2013). This is not considered as detrimental to this research but felt that aspects covered in the interview would provide insight to a multitude of aspects: cultural, political, personal, information about processes, power relations, rules, feelings, etc. for which the analysis would need to cater.

Elements, such as the establishment of position of the participant was noted and presented as a percentage of the overall participants. Similarly, the feedback about knowledge of the capital bid process was based on an affirmative or negative answer was recorded and expressed in percentage of overall participants.

Criteria identified by participants for VfM were ranked on the percent of participants choosing them. A further assessment was undertaken in comparing this output between participants from MRC HO and the Units. Responses to the project development and project performance question were not analysed statistically. The author judged that this information was valuable in its richness of individual experience and should be reflected on as a contribution to the consideration of future actions.

In undertaking the data analysis for the information received in the interviews, the author had to make judgements on aspects of importance for the purpose of solving the stated problem, identification of multiple issues and influences and eliminating or ignoring information that was interesting, but not relevant for the problem.

### *III. Review of outcomes and agreement of actions*

The findings from this exercise were summarised and presented to the MRC senior management. Areas, where results were considered to be ambiguous or inconclusive were suggested to be inquired further during the second research cycle. Other aspects showed clear sources of the problem or areas promising improvement for the organisation. Here, specific actions were recommended to senior management and agreed and supported. Results from the RCF were used to test some of the feedback from participants or to seek evidence for areas, which were highlighted as a concern. The database also enabled an overview over the extent of the problem (underperformance), to put the findings from the organisational research in a wider context.

#### *3.4.3. RESEARCH CYCLE 2*

Research Cycle 2 was driven by the feedback and agreements with the MRC senior management and the need for further clarification. This also influenced the choice of method for collection of the details.

##### *I. Data collection*

In order to gain more focused feedback questionnaires were used for the collection of the information with the questionnaires being designed to force participants to make clear statements or indications of preference (Wilson, 2013). The content of the questionnaires (Appendices D & E) was based on two issues. One was the assessment of impact of the actions taken in research cycle 1 the other was to target specific areas, where the outcomes from cycle 1 were unclear or no real trend was identifiable. Questions were posed with Yes/ No decisions or with specific options, of which a maximum number of selections would be permissible. This enabled clear prioritisation on the available options, such in the element of VfM. The same participants (24) were to be asked to complete the questionnaires to maintain consistency and enable measurement of improvement.

##### *II. Data analysis*

Results from this information was compared with the findings of the first research cycle to enable identification of potential improvements as consequence of the actions.

Furthermore, the selection of the options was to identification of clear preferences or majorities of views on specific subjects, for example in relation to Value for Money.

The nature of information collection in this second research cycle allowed a statistical evaluation of the details. Comparisons with the first research cycle – specifically on the aspect of the knowledge of the bid process were assessed in terms of percentage of participants giving affirmative responses, hence demonstrating improvement. Other areas, such as the VfM criteria and project performance elements were analysed by identifying those aspects, which were selected most and therefore representing preference.

### *III. Review of outcomes and agreement of actions*

The outcomes of this research cycle were again analysed and summarised for MRC senior management. Actions were proposed in view of the findings, but these were to be form the first activities for a continuous improvement process instead of a third research cycle.

At this point, both the organisational and RCF research concluded their second research cycle with more detailed and advanced findings. These were collated and assessed for a progressive strategy of continuous improvement that would be implemented in the organisation. Improvement cycles are to be repeated annually to provide some indication of the achievements and highlight potential new aspects to consider.

## 3.5. REFERENCE CLASS FORECASTING (RCF)

### 3.5.1. INTRODUCTION AND GENERAL ASPECTS

Throughout the recent years, the Medical Research Council has undertaken small, medium and large estates projects, ranging from refurbishments of individual laboratories to major projects, such as the Laboratory of Molecular Biology (LMB) in Cambridge (£212m) and the Francis Crick Institute (£650m) and has therefore some project information available, which can be analysed. This made a test of RCF a realistic prospect. Additionally, the health organisation showed an interest in the approach and offered to contribute details from their projects. In the following, the plan for the research in the application of RCF is explained.

#### *1. Action group*

In organising the work with another health organisation on the development of the RCF, an Action Research (AR) group was established with key stakeholders from both organisations under the guidance by an external advisor, with expertise of RCF.

The groups objectives were to:

- Engage the gatekeeper for the information from each organisation and provision of updates on progress and use of the details;
- Agree on the method which provides consistency of the data sets from two organisations, who manage their projects very differently, have very different approval methods and criteria;
- Consider of actions to be taken in each respective organisation in response to the findings and provide feedback to their success.

The meetings were planned to be held at key points during the research, particularly the following:

- Start collection of information to agree
  - general definitions for “project start” and “project completion”;
  - budget elements to be included (for example transition costs, design costs/ professional fees) and
  - the projects to be included in the initial information collection.

- Completion of initial details results to discuss
  - Methods used for analysing the gathered information;
  - Results and their meaning;
  - Potential amendments to the methodology and
  - Agreement on further projects to be added.
  
- Completion of full results to discuss
  - Results and their meaning;
  - Application of the results to current, ongoing projects or those in planning;
  - Responsibilities for continuation and extension of the database (inclusive data sharing) and
  - Continuation of the mutual support in applying reference class forecasting to projects undertaken by the organisations.

Decisions for the next steps were discussed by the group but not expected to be implemented in both organisations. This is due to the differences in the way the organisations work, their culture, reporting systems and requirements of their parent government department.

## *II. Project data*

### *a) Project cost*

Any cost information was compared on the basis of formally approved budgets only. Two key approval points were recognised; the outline business case (or earliest point of written approval) and the full business case. Estimates from these two key milestone documents were compared with the actual outcome.

The project costs were broken down (as far as reasonably possible) into design cost (where applicable), construction cost including fees of relevant professionals, such as project managers or cost managers, contingency or optimism bias allowance and transition costs (where available).

Transition costs were introduced by the MRC, as the organisation expects both the construction costs and any costs associated with moving into a new or refurbished facility to be stated in the business cases, although they are usually represented in

different budgets. This allowed better oversight over the total costs of a project, bar the operations once in Business As Usual (“BAU”) mode.

#### *b) Programme and Schedule*

A similar approach was taken to assess the performance of the projects with regards to scheduling. Again, OBC and FBC approval details were to be taken as checkpoints and for the project completion the date of the issue of Practical Completion certificate (or the nearest date thereof) was to determine the project duration. This approach accepts, that there may be an opportunity missed to capture facts on durations from point of practical completion to the occupants taking up BAU mode.

#### *c) Other information*

It was anticipated that this database will be expanded with new projects, which will improve the quality of the analysis over the years. As much relevant details as possible was collected as it would be impractical to get back to the original documentation to add other aspects of projects at a later point. This includes:

- Contract forms (JCT, NEC, others);
- Source of estimates (external professionals, in-house resource);
- Project specialism (generic laboratories, animal houses, data-centre, etc.);
- Project type (new build, refurbishment, infrastructure, demolition);
- Complexity: projects were given a score based on complexity in both design and construction ranging from low (score 1) to high complexity (5).
- Procurement path, such as whether the procurement was managed by Universities (being host for most Units), or through the procurement arm of MRC, which is a unique aspect relating to MRC.
- Geographic area of where the project takes place (to capture differences between regions, such as London, Scotland, etc.).

### *III. Information sources*

The collected information was based on documentation only – no anecdotal evidence was used for this part of the collection. For any projects, for which no evidence at OBC

was available only FBC would be used. However, projects for which no reliable details on the FBC was available have been excluded from this exercise.

Some of the information was derived by triangulations from various documents, rather than specific dates or statements over duration of the project.

#### *a) Documents*

Both the MRC and the health organisation have a significant amount of documentation available relating to each of their projects. Format and types of documents available to verify details varied amongst the organisation however, key documents used for arriving at details were:

- Project descriptions provided by the health organisation and MRC;
- Business case documentation (submission documents, approval correspondence, such as letters, email, etc.);
- Cost reports prepared throughout the project for reporting purposes;
- Final account reports;
- Project reports;
- Practical completion certificates;
- Correspondence referring to project specifics, such as the approvals from authorised parties, final account discussions with contractors, etc.;
- Minutes of meetings (progress meetings or board meetings);
- Gateway reports and associated documentation.

These documents exist in electronic copy or hard copy but were not copied or removed from the relevant sites (at the health organisation) as part of the agreement for access to the documents. However, notes with reference to the source of the information have been made.



### 3.5.2. RCF - RESEARCH CYCLE 1

The first research cycle for the RCF work was concerned with the establishment of an appropriate database and the relevant collection of the details. It was to deliver a first test of RCF in the field of projects for research facilities, determine if the method could be a useful tool and identify weaknesses and strength of this approach.

#### *I. Data collection*

The gathering of the information was undertaken via two different means. Details of projects from the MRC were collected from the MRC internal electronic archive. Information for projects from the health organisation was collected by visiting site and search the document archive for relevant information.

Due to the arrangements with the health organisation, no hard copies were removed from site and notes made refer to the respective documents, from which information was derived. Key focus in searching for relevant details was the information provided at the key approval points, such as OBC or FBC and evidence of the final project performance. Costs and schedule information was broken down in sub-sections of design phase and construction phase with the aim to support project teams with indications of expected performance on these key phases.

It was also necessary to establish the actual outcome of the various projects both in terms of schedule and budget. Information for these areas were not available in form of a particular set of documents but had to be validated and verified via other documents. During this phase the format for the database needed to be established, which would be flexible enough for a range of analyses and hold a significant amount of detail – potentially more than what was needed for the calculations under RCF methodology. This was produced as a excel spreadsheet, where details could be filtered and analysed using statistical methods.

#### *II. Data analysis*

The analysis of the information was based on the methodology used by Flyvbjerg (2008), Sovacool, Gilbert and Nugent (2014) and Batselier & Vanhoucke (2016).

A total of 31 projects were identified, of which only 3 were not finished at the time of the analysis.

The projects were assessed in view of the project types (refurbishment, animal facilities, infrastructure projects, new build laboratory, etc.) and complexities involved. The complexity was scored from 1 to 5 as follows:

- 1 – simple, standard type of facility, such as generic offices or stores;
- 2 – basic repair works (roof repairs, etc.) and refurbishments of very basic laboratory facilities;
- 3 – Refurbishment and/ or new build of standard laboratories (primary, secondary and write up)
- 4 – high complexity facilities, such as data centres, higher containment laboratories (CL3), animal facilities.
- 5 – highly complex facilities, usually with a mixture of animal facilities and high containment laboratories or fine-tuned manufacturing elements as well as highly regulated through statute or regulatory authorities (Environment Agency, Home Office, etc.).

Each of the category was assessed, calculating the average, mean, min, max and standard deviation for cost, contingency and schedule information. Due to the comparative small database the use of mode was not applicable.

Comparisons were made between the three key points of the projects: OBC, FBC and actual outcome. This was to enable project teams to make judgements of the estimates in the context at the stage in which their project is at the time of the exercise. For example, in developing cost estimates for the OBC, the comparison of the performance of RCF output from actual outcome over OBC forecasts would be used. Different confidence levels at the various stages of projects would therefore be reflected in the respective results. Due to the significant differences in value and scheduled timeframe for the projects, the key comparison was presented in per cent.

### *III. Review of outcomes and agreement of actions*

Findings from the analysis was summarised and presented and discussed at a meeting with the AR group. The full data set, any analysis and calculation and other relevant aspects were made available to the AR group for review.

The AR group formed a view of the applicability of the findings to their respective projects and considered specific actions and/ or focus for the work in the next cycle as well as potential changes in methodology. Review activities further included an assessment of how the findings of the organisational research informed the output from the RCF. Particularly, understanding of the processes applied for project estimation and approval were considered in explaining statistical findings of the RCF.

### 3.5.3. RCF - RESEARCH CYCLE 2

Research Cycle 2 was concerned in expansion of the database with further projects and reach a position where the data analysis can be applied to a life project as a test of RCF in the context of real project development and project approval requirements.

#### *IV. Data collection*

The information gathering in this second research cycle did not differ from the from research cycle 1. It was to add more projects, where available and/ or complete information on any of the projects which had not been completed by end of research cycle 1.

#### *V. Data analysis*

Analysis of information in the second research cycle was undertaken in the same approach as in cycle 1. An additional element was the application of the RCF to a life project using slightly different methods.

Method 1:

This involves the identification of any of the categories, which were applicable and identify a range in which the performance of the project in question was expected.

Method 2:

With this method all projects, which have similar characteristics were selected and the analysis (average, mean, max, min and standard deviation) used as a guideline for the expected performance of the life project.

## *VI. Review of outcomes and agreement of actions*

Similar to research cycle 1 the findings of the analysis were summarised and presented to the AR group for discussion. The benefits and disadvantages of the two methods were discussed and conclusions drawn as to which would be established in the organisations. Furthermore, at this point the AR group discussed the effectiveness of RCF overall and decided, whether the work was to be continued and if so, what the actions would be to expand the database to reach a position where the results would be statistically relevant. This would be necessary to ensure that the results of the application of RCF were more accurate. Last, but not least, the decision of the AR group as to whether implementing RCF as a tool in project development and approval would become part of the MRC plan for continuous improvement in combination with the outcomes and actions from the organisational research.

### **3.6. CONTINUOUS IMPROVEMENT PROCESS**

Although the research activities for the RCF testing and the organisational aspect in the MRC progressed by referring to each other at review points, they truly formed a cohesive and unified conclusion, which informed the next steps. The definition of the programme for continuous improvement incorporated the results of each of the research approaches for project estimation and approval processes in the MRC. Success of the measures are to be tested annually through further surveys and interviews with regular reports to the MRC senior management on progress.

### **3.7. ETHICS IN RELATION TO THIS RESEARCH METHODOLOGY**

Whilst this research methodology did some ethical considerations as required the collection of information, which could result in detrimental impact on the participating individuals and organisations, should it become attributable.

Key for this research – both regarding the information on projects and the views expressed during the organisational research – was absolute honesty. In terms of the project details, this was largely achieved through the principles established (see 3.4.3.), although it was noted by both participating organisations, that it would be highly undesirable would the extend of project under-performance become known to approvers, such as parent government departments.

In relation to the organisational research, the information was entirely dependent on the honesty and candour of the participants and reassurance was given that no source of information or views expressed will be released, published or in other ways be made available. It is for this reason, that neither individual participants nor the contributing health organisation is named in this thesis. Permission was given by the MRC to declare that details stems from the organisation, but no specific projects will be listed or named.

## CHAPTER 4 – FINDINGS

In this chapter, the author will present the findings from the research activities and tell the story of how these findings influenced the actions for the next research activity. The findings will be presented by following the research progression (see also Figure 6). This will start with the research cycle 1 of the organisational research concluding with the actions agreed and implemented as a result of the analysis of the interviews with the participants. The author will then highlight the results of the questionnaires, explain what conclusions have been drawn and actions agreed to progress to the continuous improvement stage.

Research findings from the investigations in the suitability of RCF will also be presented in following the two research cycles and respective actions agreed and implemented.

The author will conclude this chapter by bringing the findings of all of the research outcomes together to provide an overall overview.

#### **4.1. ORGANISATIONAL RESEARCH – CYCLE 1**

Research cycle 1 of the organisational research is based on interviews, which lasted approximately 1 – 1.5 hours. A total of 24 semi-structured interviews were undertaken. The author has coded the participants to maintain anonymity with a simple coding referring to a single number allocated to each of the participants.

##### **4.1.1. ROLES OF PARTICIPANTS**

Interviews started with a reflection by the participants on their role in relation to project awards. The feedback received on this subject established a different perspective than what the anticipation (see chapter 3.5.2.) during the design phase of the methodology suggested (see Figure 8). The graphs demonstrate the difference between perception of the author of the roles of participants and the view by the participants themselves.

50% of the interviewees identified themselves as both bidders and approvers, 33% as bidders and only 13% considered their role as an approver only role. Furthermore, many of the participants from MRC HO also felt that both roles applied to them. These interviewees are involved in the approval process for bids from units but also act as applicants for funding approval by the parent government department.

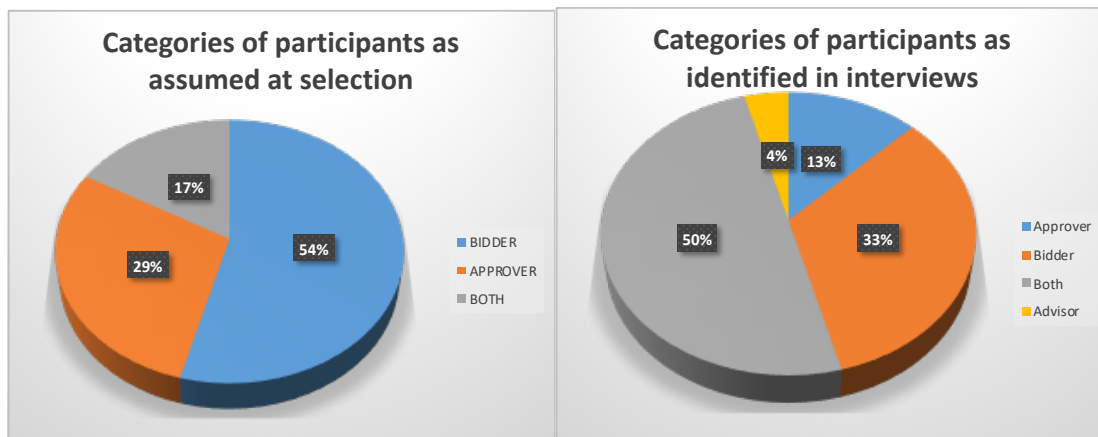


FIGURE 8 - COMPARISON PARTICIPANT ROLES

Unexpectedly, participants, who the author assumed to be approvers, see their responsibility as “advisor”. In their view they are providing advice for funders to make decisions on aspects of Value for Money and scientific benefits.

One participant described the responsibility

*‘...to ensure that the chair of the panel makes a robust decision which are in line with relevant guidelines of the MRC and therefore our awards are high value’. (Participant 8)*

That role is therefore more one of a gate-keeper without who’s approval and support funding approval would not be given. Participants, who considered themselves only as approver worked in government departments or were participants from MRC HO, who had not yet exposure to bid processes for government funding. Bidders only were exclusively laboratory managers, estates professionals or senior administrators from units and institutes.

Analysis of this element of the interviews made it apparent that the participants could not be clearly distinguished by their role as approver or bidder, but in terms of belonging to their respective organisation/ group (see Figure 9).



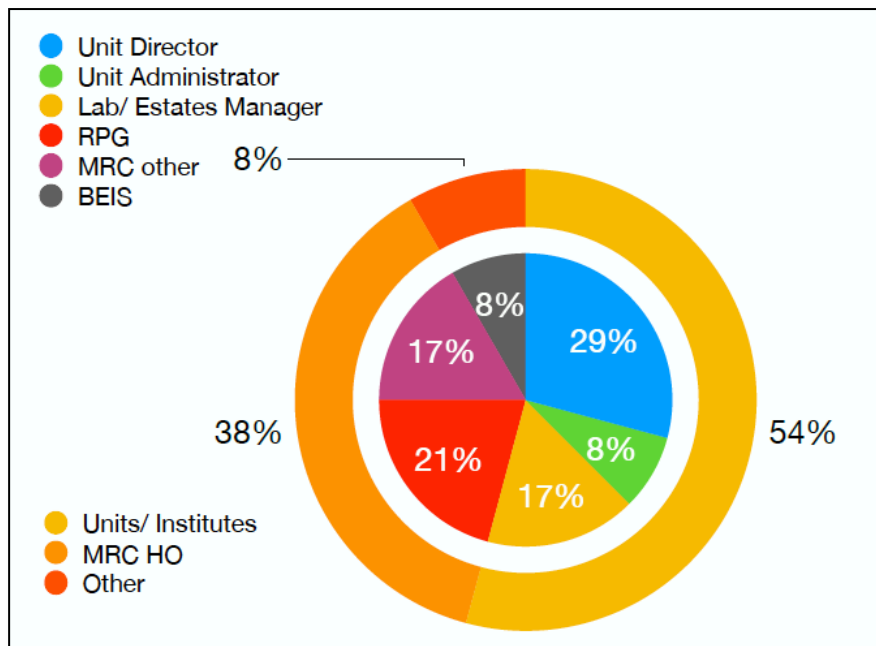


FIGURE 9 - PARTICIPANT'S ORGANISATIONAL BACKGROUND

From this perspective the participants were in the majority staff of units and institutes (54%) with a lesser amount (38%) from MRC HO and the clear minority representatives of a government department (BEIS). A high-level analysis of the professional backgrounds highlighted similar proportion with 37% having no scientific background (mainly laboratory/ estates managers, unit administrators and the participants from government department).

The outcome of this analysis required a review of the classification of the participants. An allocation into bidder and approver was correct in terms of understanding the capital bid process but was not presenting an accurate picture of where participants placed themselves. The latter presented a clear belonging to elements of the organisational structure (HO or Units). In the following the terms 'bidder' and 'approver' are maintained and it is to be noted, where the focus of the described issues is on the relationships between organisations rather than the approver and bidder context.

#### 4.1.2. PROJECT DEVELOPMENT

##### 1. WHAT DRIVES PROJECT INITIATION?

Three key sources for the initiation of projects were identified by participants:

- Specific research needs, mostly relating to equipment, which either provides new insight to a research area (such as Cryo-EM, Super Resolution Imaging

Microscopes, PET scanners, etc.); offers more efficient science work (higher throughput of samples, etc.) or is a replacement for aged existing equipment.

- Works or investments, which aid or are the consequence of recruitment of scientists (often regarding to Principal Investigators or Directors). This tends to occur after the QQR reviews, which allows to pursue new directions of research. Such recruitments result in the need to alter laboratories for the specific research requirements and tend to form part of recruitment offers for high profile scientist.
- Requirements of estates maintenance, due to complexity of the buildings and laboratory facilities. This demands a high level of maintenance and rolling replacement of major plant, such as Air Handling Units (AHU), cooling systems, generators, etc. Due to the transition of most of the MRC Units into Universities, much of this requirement has significantly diminished (now responsibility of the Universities) and should only apply for intramural research facilities. In practice however, applications for shared contributions (MRC and Universities) continue to be submitted for funding.

All three of the above represent essential needs for research activities. Without appropriate facilities, science cannot take place. Unstable environments, such as movement in temperature, changes in humidity or air pressures can have a significant detrimental impact on the validity of the research results, invalidate warranties for equipment or expose staff to health risks (for example pathogens).

Recruitment of world leading academic staff increases the reputation and ranking in terms of publications & citations and, of course, attracts grants and high performing students and researchers. Going hand in hand with the above, facilities must be able to provide for research environments, which are flexible and adaptive for new, innovative technology and enable high quality research.

Translating these needs in tangible requirements and specifications is difficult and often needs various reiterations before they are accurate enough to be of use for designers and project teams. Bidders identified, that most of the bids are urgent requirements that will ensure research continuation, rather than realisation of visions or strategies.

*'These projects develop out of a need. They are not to provide luxuries and therefore include what is necessary to cover the essential needs.'*  
(Participant 23))

Evidence was found in some rare cases, that projects were initiated on request by the government for specific initiatives against the advice by experts.

*'One thing is the situation where the government makes unilateral funding decisions in science/ research ... without the consultation with the organisation. However, we are asked to produce the business case to justify their decision, which we do not necessarily support, if not directly oppose. ... these directly appointed funds interfere with science investments. It puts us in a very uncomfortable position.'* (Participant 11)

## I. PROJECT FUNDING STRATEGY

Both bidders and approvers pointed towards problematics of developing projects estimates in an environment, which is deeply affected by the scarcity and annuality of capital funding. It was highlighted that certainty over capital funding exists only for one FY and any allocation of capital beyond that time frame is made at risk. Consequently, schedules for projects and lead times for procurements shown in bid proposals are generally fitted in a 12-month programme to present a lower risk. However, that means that schedules are often unrealistic and reflect on the need to complete within the annual time frame, as a constraint for the approval of any project.

Furthermore, there was a distinct lack of knowledge amongst units about potential approval processes outside the capital bid process. This includes an ignorance over levels of authority through which projects could be undertaken using the unit allocation of resource funding at discretion of the Director. Very little knowledge was found amongst bidders about what other paths are available at MRC to gain approval for major capital projects (over and above £3m). Bidders perceived this as a hurdle for developing an appropriate funding strategy.

## II. ENGAGING PROFESSIONALS

Bidders raised the issue that they had great difficulty to establish a realistic estimate for the project, as this often requires the engagement of architects, engineers or

surveyors. This was noted as specific problem in securing a budget for the fees of a professional team. Some of the estimates are produced by the in-house estates or laboratory management team or from quotes from suppliers. The latter are provided in the knowledge that the quote may not result in a works order. Often, these estimates are based on sqm rates from previous projects.

*'Most of the estimates are built by asking suppliers. The units ask suppliers although they tend to tell you what you want to hear, which is the lower margin... It is not a very good system, but it ring-fences the money.'*  
(Participant 14)

Most bidders agreed that larger projects need to involve professional services (design, quantity surveying, etc.) in order to establish a reasonable estimate. The conversations highlighted a clear gap in the knowledge by both Units and MRC HO of skills and expertise that is available across the organisation to gain support for specific aspects of producing proposals for approval or selecting the most appropriate funding approach.

*'If you don't know the answer, find somebody, who does.'* (Participant 6)

HO staff were largely unaware of operations and plans in the Units and hence failed to provide guidance on how to gain funding approval. It also means that they, as approvers did not access potential technical advice, they could apply to the project reviews.

### *III. CAPITAL PLANNING*

The majority of participants acknowledged the change in funding availability and hence the need to introduce a mechanism to allocate capital funding.

*'5 years ago, we had loads of money and we would just allocate funds. We would calculate the amount available versus the QQR promises. The Unit had the choice of how to spend it. I don't think, that was a good way to do this.'* (Participant 6)

Many bidders noted that the focus of the capital bid process is to enable capital investment in science, meaning scientific equipment. Estates related bids are considered by both bidders and approvers as a lesser priority, unless they represent urgent issues for the research continuity. This is evidenced in financial years in which

funding was particularly low, where estates bids receive only funding, if catastrophic failure has occurred or was imminent.

*'We apply for estates funding, when it is too late, partially, because projects get only funded when things are really at breaking point.'* (Participant 23)

Many of the Units stated that they had to develop skills for maintaining and repair plant and equipment to continue operations well beyond the respective life cycle. This also included establishing good relationships to manufacturer and suppliers to source spares, not available anymore under normal circumstances. It was mentioned that maintaining these essential relationships has become increasingly more difficult with the government's drive to force organisations into framework arrangements, on which specialist manufacturers and suppliers tend not to be represented.

#### 4.1.3. PROJECT APPROVAL

##### I. [TRANSPARENCY – TO WHAT DEGREE?](#)

This part of the interview was seeking to explore the approval process and any associated aspects. The invitation to bid is issued to Units and Institutes with a guidance as to what bids are eligible, how it will be assessed (scoring system) and guidance for the completion of the form. Despite this 43% of the bidders claimed to be unaware of how the process works and 64% did not know the criteria, which is used to evaluate the submissions. Those, who claimed no knowledge of the process referred mainly to the criteria and who may be on the panel, as opposed to the process as such.

*"I don't know the process, apart from us filling in the bidding document. I am not aware of the process in head office that is undertaken to assess the bids. Neither do I know the criteria.'* (Participant 15).

In analysing this section of the interviews, a clear gulf between the MRC HO and the Units and Institutes was apparent. MRC HO believed that the submission of the call for bids provides all necessary information about the process and the criteria, whilst the Units had mostly no or only vague knowledge about this and felt it was 'opaque'.

## II. EVALUATION CRITERIA GENERAL

58% of those claiming no knowledge of the evaluation criteria felt that these should not be disclosed. The reason given was that awareness of the evaluation criteria could result in bidders tailoring their bid to match the criteria. All participants, who represented this view, highlighted that they submit their bid based on the merit for the science undertaken in their Unit without a view of whether this fits the approval criteria. This aspect demonstrated another conflict in the views about the approval process. On one side it was suggested that the process has not enough transparency – described as a “black box”. On the other side is the opinion that a non-disclosure of evaluation criteria would avoid the tailoring of bids, suggesting that less transparency was preferred.

*‘...I think, it would be good to know the criteria. Because then we can tailor our bid to suit the criteria – it would help. But on the other hand, it would make it harder to separate them out, because everybody slants it to the same thing.’* (Participant 2)

*‘If everybody knows the game to play, it makes it that much harder to distinguish the cases. Would it not be better to have real hard case criteria, such as if it is not linked to the QQR, it goes out?’* (Participant 9)

*‘The units should absolutely know the criteria; they need to know the arguments to present for their bid. ... Applying for funds without knowing the criteria is like going into an exam without knowing the questions.’* (Participant 8)

Bidders with knowledge of the criteria highlighted that the criteria miss a critical category relating to replacement of equipment (both science and estates related), which is of high priority for research and its continuity. The criteria (see Figure 2) are clearly favouring applications for funding of equipment or estates projects that enable the science to significantly progress or “leapfrog”. However, much of the funding, for which Units must bid is for replacement of existing, essential scientific tools to maintain ongoing research. Unit directors expressed their difficulties balancing priorities between new, cutting-edge equipment and investments, which merely ensure research continuity.

### III. ROLE OF QQR RECOMMENDATIONS

All participants referred to the importance of the QQR in the capital award process however, yet its relevance was not clearly understood by bidders. Many unit directors considered the QQR recommendation as a funding allocation, whilst HO participants highlighted, that the recommendation is just a supportive statement from the review teams but powerful support for funding at the capital bid process. However, funding award depends on the overall availability of capital in the respective FY.

Evidently, this distinct difference in approach has not been clearly communicated to the Units and Institutes. Some bidders felt, that the QQR outcome had very little impact or that the time frame between QQRs was too long and science and/ or technology moved on after 2-3 years and require different investments.

*'I would not say that our experience is that the QQR has been helpful in gaining funding for estates projects. A lot of the things we did in the estates development...did not come out of the QQR. The institute changed through the QQR and as a consequence, spaces had to be used differently.'* (Participant 3)

*'Capital bid panel criteria... goes back to science decisions in the previous QQRs.'* (Participant 12)

### IV. SCIENCE OR ESTATE?

Some participants referred to a perceived bias of the award panel to wards scientific equipment. This bias was confirmed by many approvers.

*'Estates is an overhead for science and what you want to see is to have as lean overheads as possible with most money going into the science.'*  
(Participant 13)

However, as the discussion about VfM will demonstrate, the key criteria was that the proposal furthers the science and none of the approvers singled out either equipment or estates related proposals as being considered as better investment. Many unit directors highlighted that basic equipment is used well beyond its respective life cycle in the attempt to use available funds for cutting edge technology. After 6-10 years of

this approach “work horses” start to fail and need to be replaced. All bidders confirmed that they have such elements in their bid submissions.

Units, which have heavily serviced facilities, such as animal breeding facilities have suffered this more severely. Acknowledging the mandatory requirements for such facilities, the panel has in recent years not awarded any funds towards scientific equipment as it had to use funds for the continuation of appropriate maintenance of these buildings. Hence, the capital bid panel is increasingly forced to approve more bids of this kind to maintain research continuity as opposed to awarding funds for new, innovative technology.

#### V. IMPLICIT EVALUATION CRITERIA

Conversations with approvers identified underlying considerations, which are not related to the published evaluation criteria. These range from political to personal reasons as well as aspects of timing of bid submissions.

Approvers stated that the timing of a bid in relation to the QQR cycle had a considerable influence on the approval rate of a unit. Bids from units, which are either in the process of undergoing their QQR or the start of this process being imminent are less likely to receive approval. The panel wants to avoid making awards to research programmes, which could be considered as not high quality in the view of the QQR review experts. Units, which have just concluded a successful review, received a higher success rate in their bids than other units.

*‘Proximity with your QQR plays an important role – if you are in year 4 it is hard to say that you envisaged a particular piece of kit at your last QQR, when you then not bid for it earlier.’ (Participant 9)*

Approvers highlighted the problem of underlying political influence both within MRC as well as within the Universities. There was a perceived competition between different individuals within senior management and some science boards in MRC were considered as higher priority or as more powerful.

Some approvers stated that particularly prestigious units would receive much more positive scoring due to their respective importance for the MRC. Added to this, some approvers acknowledged that there was a consciousness of the implications of failing to award units with “difficult Directors”, resulting in continued objections and



questioning of the scores for the respective bids up to MRC Council level. It was accepted, that this resulted sometimes in a bias towards bids from these Units.

*'Unit Directors are tricky beasts and sometimes it is better to give them something than to give them nothing. It keeps them quiet.'* (Participant 13)

But it must also be noted, that there is a strong desire for equal treatment amongst the larger units/ institutes. HO staff highlighted, that all currently funded research programmes deserve equal consideration, as they have been judged to produce high quality science. The bid evaluation is concerned with an assessment of whether this particular bid will provide a significant benefit to this research, not a judgement of the worth of the science. Approvers noted, that the panel seeks to ensure that every unit would receive at least some funding.

#### 4.1.4. VALUE FOR MONEY

The discussion about VfM and what criteria would represent this in an academic research environment was free, unrestricted and enlightening. Participants were invited to consider the concept and discuss what this means in the context of their disciplines and the wider research field- political, national and/ or global health area. This resulted in presenting criteria that could be applied to the capital bid process.

Analysis of this feedback was encouraging, as many of the criteria were shared between bidders and approvers, although there was a distinct difference in how participants considered the measurement of these. Consequently, the graph (Figure 10) tells only a small part of the story. Nevertheless, the mostly shared view of what VfM represents was positive, as it provided a basis for selecting actions to improve the evaluation process with agreement of both bidders and approvers. In the following the author will provide more detail in the elements presented in the graph (Figure 10).

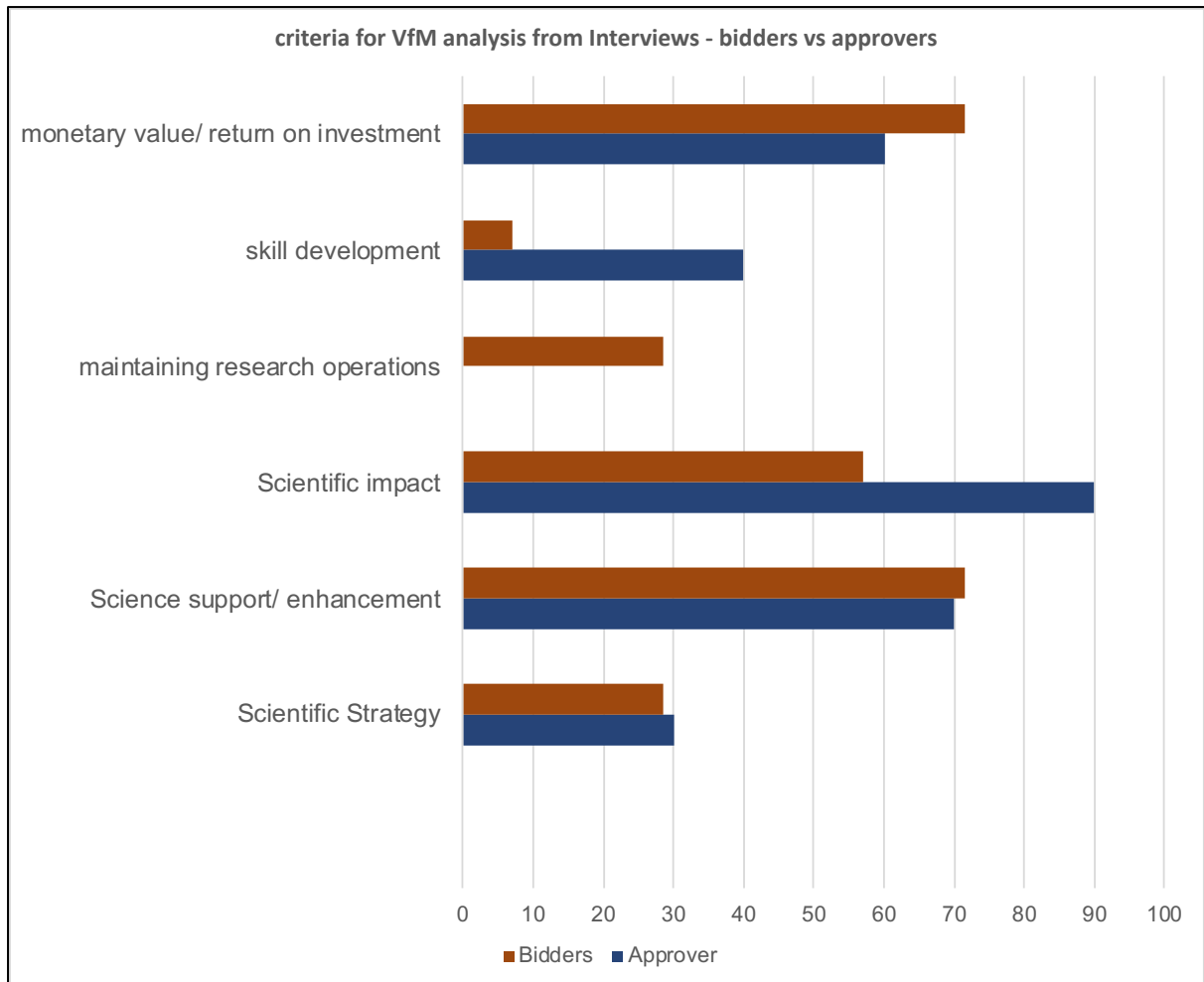


FIGURE 10 - ANALYSIS INTERVIEW FEEDBACK ON VfM

I. MONETARY VALUE OR RETURN ON INVESTMENT

Despite being shared by the majority of the participants on both sides (bidders 71%, approvers 60%) this criterium highlighted big differences in which it should be applied. It was stated by both bidders and approvers that the QQR reviews are stringent in testing the quality of the research involving international experts in the respective field therewith establishing the value of the research. Recommendations by this group can make or break a unit. However, the criterium of VfM has no benchmark or similar shared definition.

*‘If a unit is not making the grade, then we should not fund the unit.’*  
(Participant 11)

*‘Value added – that is something that we do think about a lot, because that is how we are judged. The number of times that we were told - in particular*

*by visiting QQR committees: we have given you £26m, why should we not give £1m to 26 researchers in different locations?’ (Participant 25)*

Only one participant calculated the VfM in relation of return on investment in clearly defined monetary terms. This acknowledged that some research is more expensive to undertake than others, specifically, if expensive equipment or access to CBS facilities is required.

*‘The average paper in the MRC cost £75k. ... That makes the papers very expensive. If you went to the people with this approach, they would maybe say that we should not do very many of those. ... This also means that the investment of £100k for a piece of equipment, which expects to see publication of about 10 papers, would add £10k on top. Is that a reasonable value? It is an interesting philosophical question. Computational simulation is very cheap, animal houses are very expensive.’ (Participant 22)*

However, many of the MRC HO participants referred to the cost of science without having a specific idea of what number would need to be attached, or how to calculate this. As such VfM is a concept that is not quantified. Both bidders and approvers noted the specific aspect of use of animals in research in the context of assessing value of research. Considering applications for funding of such programmes would include, whether the work can be done without the use of animals (for example due to increased accuracy of computer models) or if there are other research programmes already underway, which look at similar science questions.

*‘There is a good judgement amongst the board members, what the average research could cost. With new research, the first port of call is what resource you really need to do this. There would be ...occasional studies, where we are asked to fund a study on primates, which is hugely expensive.’ (Participant 13)*

Approvers also highlighted, that investments in equipment needs to consider, whether the proposed investment is expected to be used only by one research group or if it is shared with other scientists and research organisations for a wider benefit. No exact formula for this assessment could be established, only the experience and expertise of the panel members.

## II. SKILL DEVELOPMENT

This criterium demonstrated another split in perspective between bidders (7%) and approvers (40%) and presented an unexpected outcome. With training of highly qualified, skilled and innovative researchers being one of the key objectives of the MRC, it would be expected to feature in the thinking of the involved parties.

Despite this training taking place exclusively in the units, it was not highly represented in the consideration of the participants from the units. It is, however, an important aspect in the view of the HO staff. These participants noted, that the award of a grant to a young, promising scientist is often the start of a successful career.

HO participants also explained that it would be unusual for a young researcher at the beginning of his/ her career to be awarded a grant with high value, because there is no prior experience of successful managing such large research programmes. But it is a very important step in their career.

## III. MAINTAINING RESEARCH OPERATIONS

Maintaining research operations was not mentioned at all by approvers. It was exclusively raised by bidders and here mainly relating to estates issues. This was explained with the last decades have seen an explosion of technological advances in many areas, such as automation, imaging, artificial intelligence, etc. requiring a different type of research facility than historically provided.

Many research facilities in the academic environment are over 30 years old and did not anticipate the recent developments in technology, when they were designed. Therefore, bidders expressed a keen interest in altering facilities in a way that makes them more flexible for future technological developments.

*'There is an increasing disparity between the award of capital equipment and investment in facilities, resulting in an existing facility, which cannot provide for new technology and hence prevent the 'leap frogging' of the scientific work in the MRC. (Participant 20)*

In a smaller way, future proofing may just relate to increasing the power supply, higher server capacities or increasing flexibility in the use of the laboratories. Units felt that their science is too much restricted by the existing facilities, representing

hurdles to the acquisition and operation of innovative technology. Other considerations by bidders were Health & Safety and statutory requirements, which often need investment to maintain compliance.

*'I don't think, it is value for money by providing a return by providing a safe and reliable working environment, more of a return on Health & Safety. ...And you get to a tipping point where infrastructure gets so old and rough that it is not much a value for money aspect, but more a point of really feeling uncomfortable with the situation.'* (Participant 3)

Interestingly, compliance with statutory regulations ranked at a lower level. This represents a contradiction to statements that were made as justifications for many bids to gain approval. It also meant that whilst there is a clear consciousness of the need to comply, the contribution which this compliance provides for science is considered low. One bidder also stated, that the potential disruption, which a construction project would bring to the research would be weighed against the benefit the project would offer in the long term.

#### *IV. SCIENTIFIC IMPACT*

This criterium showed a clear disparity of views between bidders (57%) and approvers (90%). It was generally related to research providing answers to specific science questions, offering an efficient path for intervention, publications and what was called leap frogging. Many approvers considered scientific impact of fundamental research to be measured in terms of the reputation of the journal in which respective papers are published and citations of these papers in other publications. Approvers expressed their view that scientific impact has different measures depending on who's perspective is followed.

*'What the MRC does cannot be defended when you look at it in terms in which the NHS may look at this. However, it may reveal aspects of physiology and disease progress, which may inform of how you may treat the common cold or cancer. That is very hard to get across to people.'* (Participant 13)

A further important aspect raised was that value of research was as much about disproving theories as it was about discovery and testing new ideas. Both bidders and

approvers stated that it is important to gain knowledge about what not to spend effort on as has been proven to be ineffective.

*'We will look at whether the research will offer to provide a definite answer to a problem or just a fishing expedition. If we are going to nail a particular question, then that would be good value for money. The latter [fishing expedition, sic] would not really look good on value for money.'* (Participant 11)

Leap frogging was referred to by approvers as the ability to jump steps in the progression of the scientific development – mostly enabled by technological advancements (for example the cryo-electron microscope) or significant discoveries in other areas of science. This was consistently noted by participants as an important as it promises faster answers to scientific questions and a considerable advantage over competing researchers/ research organisations.

#### V. RESEARCH SUPPORT AND ENHANCEMENT

This aspect was considered to relate to promotion of collaborations, enabling scientific opportunity and making science easier. The latter was generally directed to the investment of equipment, which allows the automatization of research activities.

Both bidders and approvers agreed that medical research is no more based on efforts of one research group or scientist, but the connection and contribution of many different experts within science in general and medical research disciplines (Su et al., 2017).

*'How is this piece of equipment doing the widest good for the unit and includes different disciplines? ... Infrastructure should support the interdisciplinary approach. That is the value.'* (Participant 15)

It was also highlighted that the ability to make significant contributions to larger and world leading collaborations is an important aspect of organisational reputation and personal career progression. Access to high-tech, specialist equipment often opens the door to join multi-disciplinary research activities. Additionally, research opportunity was stated to be availability of equipment to other researchers within the unit or university therewith enabling different methodologies to progress answering important science questions. Again, this criterion was supported by both groups.

*'It will mean that ... being co-located with other colleagues in the University. ... It means we can widen our horizon with issues and researches, which we would not have approached as the MRC Unit on our own.'* (Participant 21)

Science support and enhancement was considered as highly important in equal measure by bidders (71%) and approvers (70%). Some of the other criteria, which participants identified, was “making research easier”, referring to automatization

## VI. SCIENTIFIC STRATEGY

Scientific strategy was mentioned by both bidders (29%) and approvers (30%) as basic funding criteria. Both bidders and approvers were aware of the MRC science strategy and had an understanding of what research is done in Industry and Universities to prevent duplication.

Most participants considered it inappropriate to award projects or pursue science, which would not align with the established research aims of the MRC. In this context, the relationship to MRC's main funder's (government department) interests was important. As one approver noted:

*'We have to be pragmatic. If we produce a strategy that is not acceptable to the government, then funding would not be forthcoming. The funding we receive needs to be spent on research that aligns with this strategy.'* (Participant 24)

### 4.1.5. Project performance and benefit measurement

Feedback from the interviews relating to this subject is based on a reduced number of participants. Out of the 24 individuals interviewed, 15 felt able to comment on project performance and benefit measures.

#### I. PROJECT PERFORMANCE

Discussions about project performance showed another split of opinions between MRC HO and Unit staff. This subject was mainly considered in relation to actual cost versus the approved budget value. Participants from units insisted that their original estimates were accurate as the project costs did not exceed the award. HO staff however, felt that the submitted estimates were rarely correct.

This represented a contradiction, which required further attention. When the subject of project development was discussed in the earlier part of the interviews, bidders raised concerns about a lack of access to professionals to develop design or cost estimates because it requires funds they do not have. Contrary, in the conversation about project performance and the accuracy of the estimates provided in the proposal only 20% of the bidders stated, that such support would be required.

Claims regarding the accuracy of initial estimates vs outcome of the project were also reviewed. It was a concern that there were directly opposing views on the performance, which required further investigation. Projects, which the respective participants were involved with were assessed and where found to be completed within budget and schedule. The author also found that the views of the HO staff relied on a specific bad experience with one particular project, which was generalised to be the result of ongoing experience.

## *II. BENEFITS MEASUREMENT*

In this part of the interview the conversation focussed less on the specific measurement of the benefits of project but more on why this would should or should not be done. Only one of the 15 participants declared that benefit measurement is undertaken for awarded projects. There was consensus that many projects were “too small” to justify separate benefit measurement. With a background of intense scrutiny of science performance in the MRC via the QQR and annual exercises via ResearchFish (Medical Research Council, 2013) benefit measurement was stated to be already in place. Most participants stated that they assume the benefits are achieved, when the respective projects are completed. It was pointed out that benefits feature heavily prior to approval but are not required to evidence at point of project closure.

Participants from HO and the Units had concerns about the level of resource required for thorough and accurate management and measurement of benefits. The average number of awards per annum (capital bid process only) ranges between 75 – 120. Much of these relate to scientific equipment that either supports, maintains or enhances scientific efforts. With rare exceptions, the benefits of a specific award cannot be singled out of the wider performance of the units and institutes. Where the



award was to replace so-called workhorses, the benefit would simply be to avoid disruption of research activities.

But there was also an acknowledgement on both sides (bidders and approvers) that estates projects that look at alterations, reduction or extension of facilities need a justification for the respective investment. Here, general acceptance existed that major investments of public money need to demonstrate that the promised benefits have been achieved. Many expressed the view that it was equally important to establish the failure to achieve benefits as proofing that they have. There was consensus in the view that senior managers, who headed up project, which did not deliver benefits should attract more intensive scrutiny on any future investment proposals.

All participants pointed out that measurement of benefits in fundamental research is difficult and highlighted that benefits of an investment should be identified in the business case but only at very large investments should carry out benefit measurement after completion.

*'I believe that we do well with delivering the scientific benefits, but we have got no evidence for it. The outcomes are really good, but could we have done it better in a different way?' (Participant 6)*

#### 4.1.6. COMMUNICATION

##### I. COMMUNICATION - GENERAL

During the interviews with both the HO and units significant time was spent discussing the level of communication between these parties. This is an area where the differences are not between bidders and approvers, but the MRC HO and its units. Considering the level of shared values (see 4.2.4.), it was unexpected to see such frustration expressed over the lack of meaningful contact.

*'I know they are busy. I find it really disappointing, how little contact we have with the programme and board managers outside the QQR. ... We go from the end of the QQR to the start of the new one without have any contact.'*  
(Participant 3)

Participants from RPG were mostly unaware of any project plans in the units they support. Where they were informed, they did not share this information with their

colleagues across MRC HO. Responsibility for estates issues in University Units (20 out of 23 MRC Units) rests with the hosting University. Consequently, there is no involvement by the MRC estates department with these units. However, the MRC needs to ensure that investment in these units through the core funding is protected and requires appropriate representation on the relevant project boards and often the MRC has to enforce the UU agreement terms with the University.

In reflection of this the author realised that the focus of the department of Capital and Estates was mainly on the intramural Units/ Institutes (i.e. MRC liability) and those University Units, where larger projects were ongoing, which are co-funded by MRC. Communication with others were unstructured and infrequent, with some of the Units being no interaction in place.

## *II. COMMUNICATION – BID PROCESS*

There was an obvious indication of a problem in communication in the lack of knowledge about the bid process shown by the bidders (43%). Following the interviews, the author reviewed the letters send out to the units requesting bids and found very detailed instructions for how to fill in the forms and a rough indication of timelines. However, they contained very little information of how funding decisions will be made.

Some conversations with bidders regarding this, indicated that they were interested in the dynamics and priorities in the panel, for example, whether there was a focus on imaging or data processing, etc. It was unclear whether this information would result in a different approach by the bidders, such as in the allocation of the priorities, as the bids should be driven by what scientists require for their research.

It was apparent that neither bidders nor approvers felt it necessary to initiate a discussion to inquire or clarify the bids prior to the evaluation. There was a clear expectation of the onus for action to be on the respective other side.

*'I don't talk to the Units about their bids prior to scoring. It could be argued that the programme managers should really talk to the units about that, but on the other hand the units could pick up the phone and talk to the relevant person in RPG when they send their bid in.'* (Participant 8)

Only one out of the participating units confirmed active communication with the RPG representative to ensure that the bid is fully understood, and the identified priorities agreed. Whilst that did not result in that unit receiving higher levels of funding, approvals were given in accordance the priority stated by the bidder. The author also observed that bids of this unit had an evidently smoother approval process in the capital bid panel.

*'We are making great effort to have an ongoing discussion with our programme manager in RPG. We want him or her to know what we are working on, what is needed, what we are good at, which new directions we may wish to take. This is not necessarily a targeted strategic approach, but just the way we are and how we work... Openness and approachability has brought us great opportunities so far.'* (Participant 15)

Although it seems obvious and despite widespread knowledge about importance of effective communication in organisations, stakeholders, etc., the need for keeping a good relationship was not very well established. Evidence of a “them and us” culture was found on both sides. It was very apparent that HO staff was unaware of the pressures that the unit operations are under. This was particularly evident in the low priority for funding criteria for indirect science support (estates, plant replacement, etc.)

Opposing this, some MRC HO staff felt that estates aspects received an unduly substantial proportion of the overall funding, therefore preventing new, innovative research investment.

### III. COMMUNICATION – FEEDBACK PANEL MEETING

Bidders unanimously expressed specific frustration about a lack of feedback from the capital bid panel. Although all acknowledged that a written approval letter is issued informing of funding awards, no information was provided regarding reasons for projects not being funded. This was particularly the case, when rejected bids were deemed by the bidder to be higher priority than those approved. Directors of units had no information on the panel’s reasoning for awarding projects without referring to the unit’s declared priority in the submissions.

*'There is no feedback on the outcome of the capital bid process. Feels, that it would be important to understand, whether they [the bids, sic] were close,*

*for example if affordability was the key decision factor, or if they have been way off and therefore should not bother bidding for this again.’ (Participant 10)*

This was reinforced by some approvers stating that bids are re-issued every year without ever having a chance of being approved. It was acknowledged that this has never been communicated to the bidders. Such a complete communication failure adds unnecessary irritation on both bidder and approver side and contributes significantly to a separation of MRC HO from its units.

#### 4.1.7. RESEARCH CYCLE 1 – REVIEW AND ACTIONS

The findings from this first research cycle provided a clear direction for actions to be implemented at the second research cycle. Senior management was particularly concerned about the failure to maintain close communication with the units and institutes. This lack of communication raised the risk of HO staff becoming detached from the science community.

Furthermore, further work was to be undertaken to identify clear values for the fundamental science carried out in the MRC in order to establish evaluation criteria that reflect the entirety of the MRC family. The agreed actions reflect this concern.

- 1) There is a need to clarify project approval pathways within MRC. First and foremost, Management Board should assess, whether the existing options should be reduced to two: The lower values up to £3m to be assessed by the Capital Bid Panel and any bids over and above this in accordance with the delegated authority (Management Board £10m, Council £15m, BEIS up to £50m, anything over that via HM Treasury).
- 2) The agreed approval pathways should include a clear description of what kind of project needs to follow which pathway and what steps each of these approaches require (including relevant evidence, documentation, etc.). Dissemination of this guidance should be published on the MRC portal.
- 3) As the problem of the financial annuality of capital funding is unlikely to disappear, its implications need to be managed. Projects, which are unlikely to be completed within one FY should not automatically be dismissed. It is proposed to manage any movement between budget years via close

communication and reporting with the respective project teams. This involves a higher level of risk to the organisation in terms of fiscal management but is offset by a reduction of risk in disruption of operations and science.

- 4) Active measures are to be taken to improve the communication between MRC HO and its units. The units are to be encouraged to speak to their respective programme manager and the estates team about their bids prior to the submission date. Similarly, the head office staff are to establish and maintain regular communication with the units and institutes.
- 5) The publication of the invitation to bid for the annual capital bid process presents an opportune starting point for this, where head office staff should explain and discuss the process with the bidders.
- 6) Upon conclusion of the capital bid process, more detailed feedback needs to be provided to the bidders about the respective decisions. Senior management expressed the view that this should be done personally rather than within the award letter and not be restricted to the awards made but providing insight of why other bids have not been successful.
- 7) Award criteria must be reviewed in light of the importance of replacement of equipment and plant (estate) the continuation of research and operations. The panel needs to discuss, what kind of score this criterium should attract and how this is used for improving science and promoting innovation.
- 8) Benefit measurement should be encouraged, and active support should be given to provide evidence for the impact of any investment in research. Knowledge that already exists in the organisation should be disseminated to the Units, other Councils and research partners to increase available information on benefits, therewith improving evidence available to approvers.
- 9) A decision should be made as to what type of non-science projects should undertake formal benefit measurement. Measurement of benefit can be a resource intensive activity and should therefore be focussed on areas, where the measurement provides meaningful information.

- 10) Research activities in cycle 2 should focus on gathering information to identify shared values, which can be utilised for revised evaluation criteria.

The above actions were considered by the Management Board and agreed to be implemented. They were to take effect as part of the capital bid process (starting December 2016 to panel meeting and decision in February 2017). The impact of this implementation was to be assessed during the second Action Research cycle with a view to return to Management Board with the findings.

## **4.2. Organisational research - Cycle 2**

During this cycle the author investigated the effectiveness of the actions agreed and undertook a survey of views via questionnaire to establish shared values between MRC HO and the units.

### 4.2.1. RESEARCH CYCLE 2 - GENERAL

In this research cycle, information was collected via a questionnaire to aid a more targeted approach to the information gathering. During the cycle 1 and in the approach to cycle 2 the MRC suffered significant turnover of staff (specifically in HO). As a consequence, the availability of the original participants was significantly curtailed. In total 14 questionnaires were returned, providing a much smaller pool of information than in cycle 1.

These returns were from a mix of participants, some participants from the previous cycle, some new, but still with a similar split between bidders (units) and approvers (HO). The questionnaires were structured in a general part, where both bidders and approvers answered the same questions. A further part was split out to gain insight from the approver's and bidder's point of view respectively (Appendix E & F).

### 4.2.2. ACTIONS IMPLEMENTED

All of the identified actions were implemented or instructed, be it with different levels of success. A full description of the funding pathways was developed and provided to all unit directors. Both units and HO staff were encouraged to increase the discussion about the bids prior to the evaluation process and a category for approval was added to cater for bids relating to replacement equipment.

Work relating to benefits measurement was initiated, with in close collaboration with the newly established UKRI assurance group and delivery profession group. Whilst this work progressed, it has not delivered any specific outcomes other than an ongoing discussion about benefit measurement. The following description will therefore focus on the review on the effectiveness of the actions on the communication and outcomes of the questionnaires.

#### 4.2.3. ANALYSIS OF JOINED FEEDBACK

The results from the questionnaire identified significant improvement on the awareness of both the bid process and the respective criteria (see Table 2).

	% of participating bidders Research Cycle 1	% of participating bidders Research Cycle 2
Participating bidders being aware of the process for capital bid rounds	57	86
Participants being aware of the criteria for the award of capital funding	36	86

**TABLE 2 - IMPROVEMENT AWARENESS REGARDING CAPITAL BID PROCESS**

This table shows a notable improvement of an increase of awareness of the process by 29% and of the criteria by 50%, although still identifying gaps. It is considered to be due to more explanation and a clearer description of both process and criteria in the letters issued with the call for bids, rather than to a closer engagement between RPG and the bidders in units and institutes.

The analysis also found that the continuing ignorance of the process originated from individuals, who were preparing the estimates for bids, but were not necessarily the recipients of the correspondence relating to details of this process or were not informed by their senior management.

## I. EVALUATION CRITERIA AND VFM IN SCIENCE

The questionnaire contained a multiple-choice section, which listed the criteria identified during the conversations in research cycle 1. Participants were asked to choose a maximum of 3 of the 19 options to highlight the highest priority in these criteria. This revealed a change from the results of the free discussion in the previous cycle. Figure 11 compares cycle 1 with cycle 2 in relation to levels of agreement between bidders and approvers on most appropriate and important criteria for the assessment of Vfm of bids submitted.

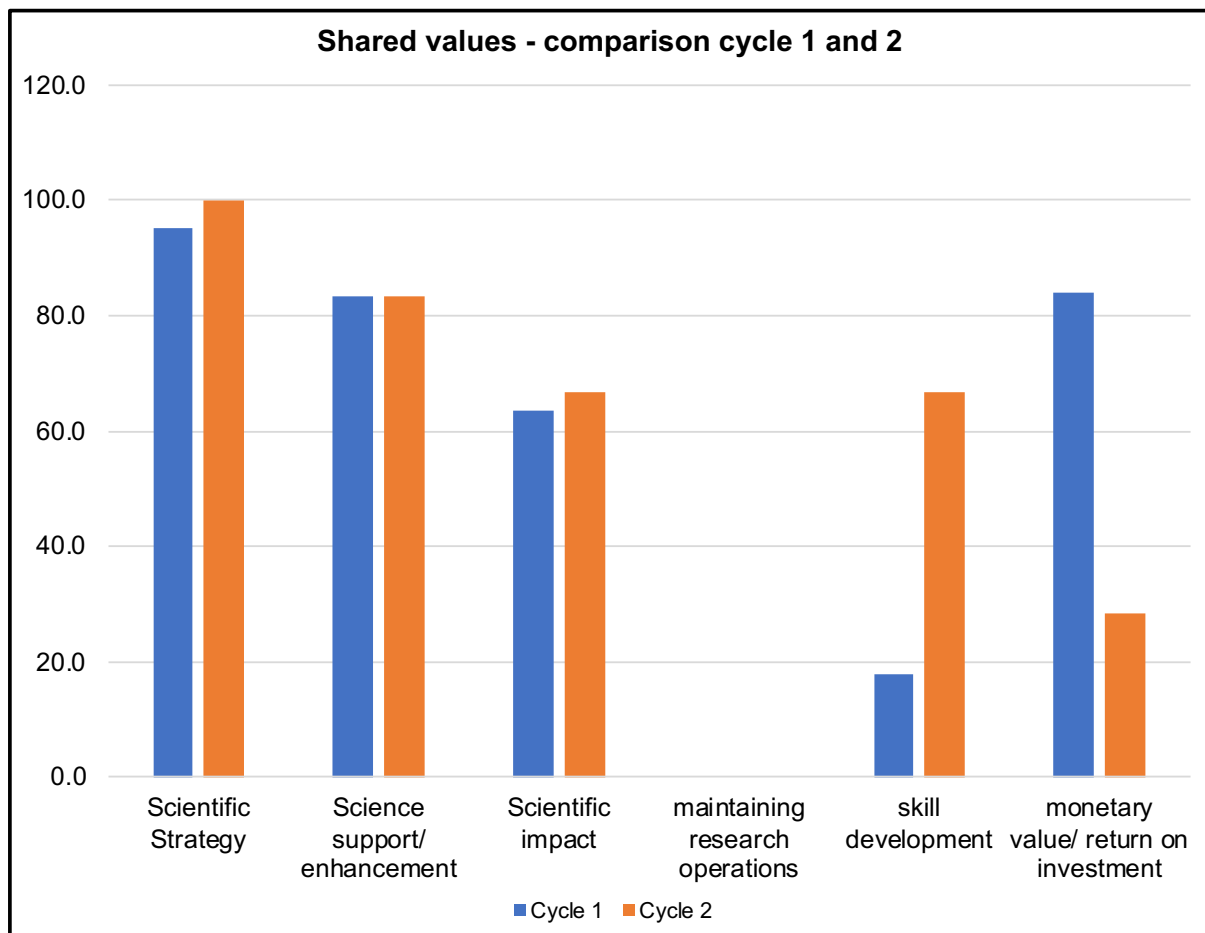


FIGURE 11 - COMPARISON VFM CYCLE 1 AND CYCLE 2 FEEDBACK

This outcome indicates the following issues:

- Both bidders and approvers have shared perspectives in relation to a wider definition of Value for Money in their area of science. This applies almost to a wider philosophy in science demonstrated by the consistency in strong response in area of scientific strategy – over 90%, science support - over 80% and scientific impact – over 60%), very much driven by academic values



(publication of papers, finding interventions, new technology allowing innovation in research, etc.).

- A strong increase in the selection of skill development as a strong value for fundamental research was noted (68%) in comparison with cycle 1 (less than 20%). More bidders considered this as a key delivery of their work (training next generation of scientists).
- The author notes the consistently absence of agreement on maintenance of research operations as a shared value criterion. Despite this aspect having been raised throughout the first research cycle and provided as one of the choices in the questionnaire, it was not selected by any of the approvers as a possible criterion for the assessment of bids. This emphasises the observation from research cycle 1, that MRC HO staff (and approvers in terms of the capital bid process) have very little engagement with the units and are therefore removed from the operational problems, which the units must manage.
- Significant decrease was found in the agreement over hard, monetary criteria for science. During research cycle 1 the difference between bidders and approvers was only 11%, notably with the bidders quoting this criterium more than approvers. Cycle 2 has shown a complete reverse of this view, with all approvers and only 28.6% of bidders selecting this.

Anecdotally, the inclusion of a new evaluation criterium for the replacement of scientific equipment made classification of bids in terms of award criteria easier but made no difference to the process outcome or the evaluation of individual bids as such.

#### 4.2.4. BIDDER RESPONSES.

In this part of the chapter, the author will highlight the findings from the element of the questionnaire, which was focused on the views and experience of the bidders. The focus of these questions was on seeking evidence of any improvement of the bid process.

One of the key actions resulting from research cycle 1 was to increase and improve the communication with the units, particularly about the capital bid process. This seemed to have had a significant impact by raising the basic awareness of the process and bid criteria amongst bidders by 29% (see table 2).

But whilst this demonstrated a clear positive impact, there were other areas where very little or no progress was made. This became apparent in the question about communication with RPG on the specific items in the submitted bids. Two thirds of units highlighted, that they had no discussion about their submission with the respective programme manager in RPG. Reasons given for this were showing that 50% of the respondents felt that their bids were simple and did not require explanation. 10% expressed an expectation of approvers to approach them if there were any queries. It was notable that none of the bidders thought that a conversation with the approvers about the chosen priorities may improve the chances of the awards being made in line with the Unit needs.

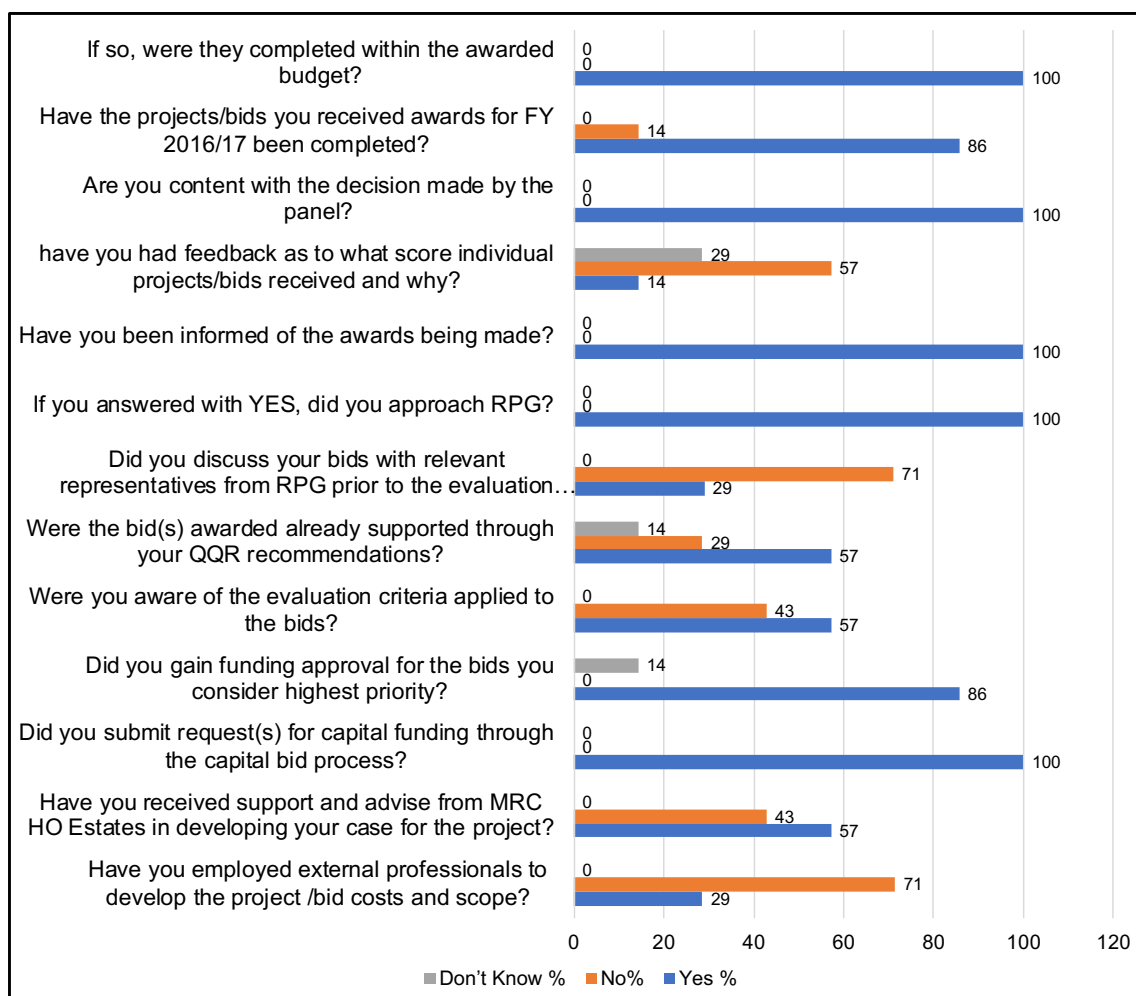


FIGURE 12 - BIDDER RESPONSES IN %

Figure 12 presents the feedback from participating bidders to questions about the engagement with Head Office in relation to the bidding process. It confirms that they were informed about the awarded projects with 86% stating that the award was consistent with the priority bids identified in the submission. However, 57% noted that no feedback was received on individual scores of each item submitted (included failed ones). Similarly, some bidders were not clear why identified priorities were not followed in the awards, therefore funding an item, which had lower priority for the unit director. A specific measure for improvement of the process was to provide background information why projects received high or low scores to enable better judgement for the next funding round. This was not actioned.

In relation to estates projects, 43% of the bidders confirmed that they had no support from the MRC Estates team in developing their projects, although they clarified that they have not requested such support. With one exception, bidders confirmed that their estimates were produced in-house without the use of external professionals.

A particular gap in the communication was identified between the HO estates team and extramural units (University Units, UU). Universities are owners and in charge of the facilities and estates related bids are only eligible if relating to direct science requirements. All bidders confirmed that all awarded projects of the previous funding round have been completed in time and within the given budget. The feedback provided by the bidders highlighted the following problems:

- Whilst an improvement in the awareness of the process and the criteria of the capital bid process was seen, there was still a distinct lack of communication relating to the specific submissions by bidders. Aspects of the capital bid process and respective criteria were communicated together with the letter inviting the bids, but individual conversations between bidders (units and institutes) and approvers (RPG) still does not take place. The reluctance of having a direct conversation indicates that the problem sits deeper and is embedded within the cultures of both bidders and approvers and would require a different approach to resolve.
- A similar result was found regarding the feedback on unsuccessful elements of the submissions. Large groups of the bidders had no feedback to these items and were not made aware in which way bids fell short of the criteria.

With no requirement in the questionnaires to identify reasons, it could not be clarified, why this communication does not take place.

- Whilst there was a greater awareness by the head office estates department over most of the estates related submissions, a large element of those were developed without any support by the estates department. A greater involvement by head office could provide improve quality of the estimates (for example by applying RCF) or as a minimum standardise the format and quality of the submissions.

#### 4.2.5. Approver responses

In the following the feedback received from the approvers is examined. The figure 13 below visualise their responses to more generic questions regarding the bid process.

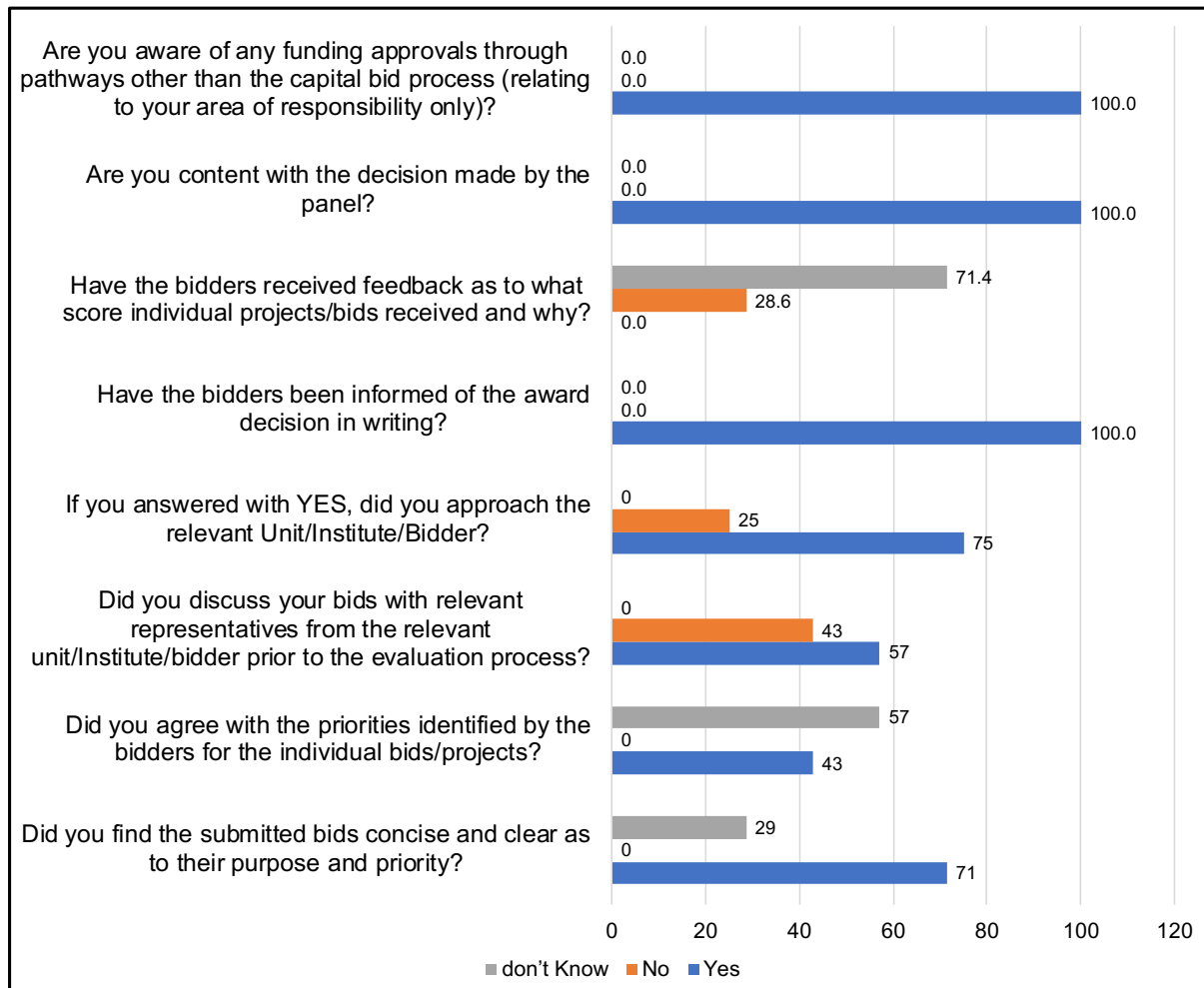


FIGURE 13 - FEEDBACK APPROVERS- GENERAL

28.6% of approvers stated that they have not provided bidders with feedback on individual scores for their submissions but 71.4% did not know whether such feedback

is given. That means that none of the approvers engaged in the de-brief of bidders on the capital bid process. All were aware that written communication had been issued to bidders confirming the awards.

Responses about engagement with the bidders prior to the evaluation process demonstrated that a small majority of the approvers (57%) discussed the submissions with the bidders. This view is clearly not shared by the bidders, of whom 71% declared to have no contact with approvers (RPG) prior to the process although not always have the participating approvers been matched with a participant representing their respective bidders.

Further investigation was undertaken to clarify responses to the last two questions shown on Figure 13 relating to judgements on quality of the submitted bids. This highlights that 57% do not know whether they agree with the priorities in the submitted bids and 29% could not know whether bids were concise and clear about the respective purpose and priority. It is inconceivable that evaluators would review the submission and not be able to state whether they agree with the given priorities or establish if the bids were concise. Participants, who declared a “Do not know” on these two questions were senior to the programme managers, who look after specific research programmes or Units. These senior individuals have relied on the briefing by programme managers, rather than reviewing the bids themselves. Questions about approval pathways also revealed some interesting feedback. All participants with approver responsibility in MRC HO were aware of various pathways for approval of projects outside the capital bid panel, but do not pass this knowledge to units and institutes.

There was more clarity over approval processes applied by BEIS. Approximately half of the participating approvers had experiences with projects being funded through decision by MRC Management Board or HO finance department. Only 29% of approvers confirmed that awarded projects having been completed within the given time scale and only 40% confirmed that they were completed within budget, whilst 86% of bidders stated that their project was completed in time and within the awarded budget. This is consistent with the results from the first research cycle, where a similar disparity was found. Again, upon investigation, the reason for this appears to be an experience by approvers with a specific project rather than a performance pattern.

#### 4.2.6. RESEARCH CYCLE 2 – REVIEW

The review of the findings from the second research cycle identified two key areas of interest. Firstly, the author noted the significant level of agreement between bidders and key measurements of the value of fundamental science (ranging between 60% and 80%) in the context of the MRC work. Despite significant efforts to raise the importance of facility maintenance amongst the approvers, this continued to be the area of greatest disparity between bidders and approvers, with none of the approvers selecting this as a potential criterium for a capital award. With an average of £2.5m bids received per annum for estates maintenance this poses a serious risk for the research continuity of the units. It highlighted the lack of understanding of local issues with maintenance and research continuity is the consequence of the lack of engagement between HO and ‘frontline science’.

Secondly, whilst the improvement of the awareness of the capital bid process was recorded (from 57% in cycle 1 to 86% in cycle 2), an unacceptably high proportion of participants were still unclear over the process and the criteria used (14%). The action to improve this was ‘completed’ by increasing the description on the invitation to bid, not through more informal approaches, evidenced by the fact that 71% of bidders declared to not discuss their bids with HO prior to submission. This raised concerns were raised over the persistent failure to re-connect with the units. In discussion with senior management a range of reasons for this were identified, such as heavy workloads preventing dedicated time for developing relationships, confidence of the individuals to initiate communications with senior unit staff, particularly in delivering not good news, etc. However, it was unanimously agreed that the relationships between MRC HO and its units has to be a priority for the future and more effective actions are to be taken to achieve this.

A clear disconnect was discovered between the perception of bidders over project performance. In fact, the findings from the exercises to develop analyse RCF data has demonstrated that in average 52% of all projects (across all categories) are delivered with a cost overrun and 69% of all projects exceeded their agreed schedule. It suggests that part of the continuous improvement programme must include an educational aspect for both bidders and approvers on the statistical findings on project

performance. These actions are identified and explained in 4.5. – Continuous improvement.

### 4.3. REFERENCE CLASS FORECASTING – CYCLE 1

Information used for the quantitative analysis contains exclusively estates related projects; none of the awards for the procurement and installation of scientific equipment have been used for this database. A total of 31 Projects was collected for this analysis, of which 26 were completed at the time of undertaking the analysis. The remaining 4 projects were still under construction and would not produce a final account or practical completion within the time frame of this research.

Some of the analysis was driven by the needs and specific interests of the AR group, but in the assessment the methodology identified in Chapter 3 was followed. Caution must be applied to all the following findings, as the number of projects included is still relatively small and consequently individual categories may only consist of less than 5 projects. Results will therefore only be indicative and serve as a “proof of concept” as opposed to statistically proven outcomes.

#### 4.3.1. COST - GENERAL

A first comparison was undertaken on how the various categories performed in terms of cost. Figure 14 shows the percent of projects overall and in each of the categories, which concluded with a cost overrun. This unveiled some unexpected results.

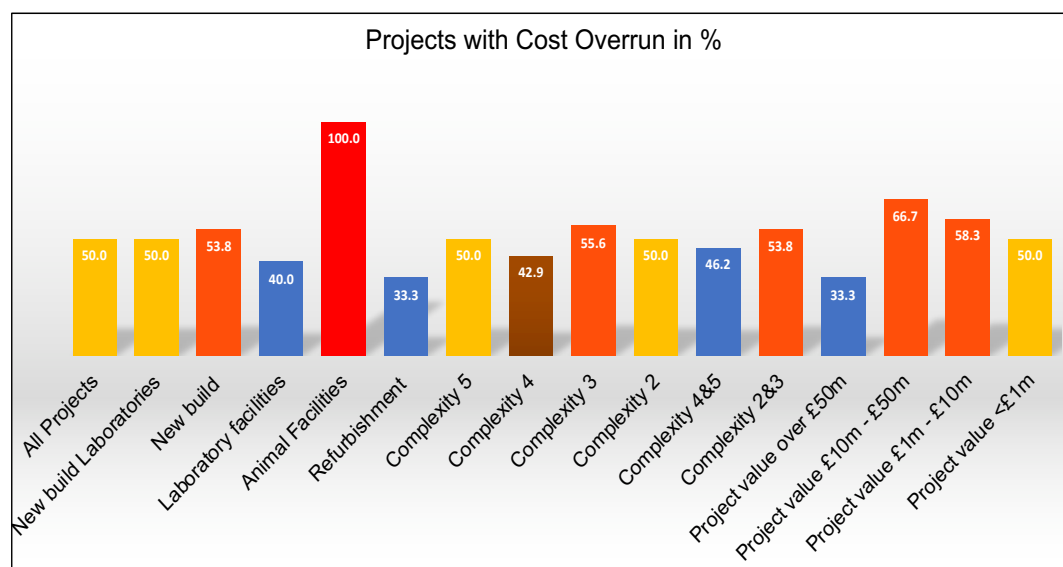


FIGURE 14 - % OF PROJECTS PER CATEGORY WITH COST OVERRUN

## *I. BEST PERFORMANCE*

Most participants in the Action Group are individuals with vast experience in estates related projects. The group was genuinely surprised to see refurbishment projects outperforming all other categories by having only 20% of the projects experiencing a cost overrun.

Refurbishment projects tend to contain significant elements of risk due to unknown conditions in, around and below the buildings. This may be the degree of deterioration of pipework or structural elements, presence of asbestos or, as in the example of research facilities, discovery of health hazards (such as elevated chemical, biological or radiation levels) that are remnants of the previous activities.

In discussion with the Action Research group and professionals about this finding, it was suggested that this performance may be due to the knowledge of exactly these risks leading to more conservative estimates with more allowances for such aspects in the various work packages.

The overall analysis (table in Appendix H) revealed that refurbishment projects had in average the lowest level of contingency (10.6%). This indicates that the views of the AR group were correct in that the uncertainties in refurbishment projects are included in more conservative estimates of work packages, rather than a generic uplift of the contingency.

## *II. POOREST PERFORMANCE*

The category of animal facilities is the one with the worst performance in relation to cost. All projects with animal facilities exceeded the costs estimated at FBC. This category did only refer to pure animal facilities. The MRC and the contributing organisation have facilities, in which animal holding facilities and associated procedure rooms are operated. Whilst these facilities are difficult to design and construct correctly, they pose less complexity (complexity 4) than those where facilities have generic and specialist research areas and CBS facilities combined (complexity 5).

Design and construction of animal facilities is complex and subject to very stringent and precise standards and regulation. These are tested and enforced by authorities or regulators, such as the Home Office or the Environment Agency (depending on the work carried out) and licenses are issued with clear identification of accountability for



the appropriate operation of these. Key reasons for the strong regulatory approach are the concern for welfare of staff (exposure to pathogens, etc.) and the animals (temperature, humidity, air changes, mental stimulation, cage density, etc.).

Not only is the design and construction of such facilities complex in its own right; there is also a need for various backup options to avoid a risk of single point of failure. The complexity of the technology involved, relevant regulations and standards plus the ways in which different animal facilities are operated provide a higher risk of cost overruns. However, the knowledge of this has seemingly not helped to inform the estimates and its assumptions.

So why the inferior performance in this specific category? To understand this, the author reviewed the respective projects and found some decisions and milestones in the project, which were not be visible from the reference class approach only.

All projects in this category made an original case for funding, that showed significantly higher costs than what was eventually approved. They were all approved via a government department and this process involved numerous versions of the OBC and then FBC to be submitted, until a definitive version was agreed. These negotiations did not relate to discussions about scope or validity of the cost or programme estimates but adjusting the case to fit a general funding availability. Consequently, the requirements and estimates were made to fit a pre-assigned budget rather than realistic requirements. During the life of the project, reality would force these costs back into the project. A further indicator for this issue is the very low average contingency in this category, which is approx. 3%- 6% below the average level of contingency in other categories.

### *III. SIMILARITIES*

Whilst significant differences could be found within the categories of types of buildings and those of different values, very little difference was found between the different complexities of the projects / buildings. The success rate in staying within the approved budgets sits consistently around 50% (two of the six categories being slightly below with 43 and 46% respective. This appears to be a direct contradiction to the view that complexity is a potential cause for poor performance of projects in the category of animal facilities.

### 4.3.2. COST - DETAILED ANALYSIS

The above analysis is very crude and high-level and provides very little insight to the actual performances within and across the categories. In the following the analysis will look at specific aspects within the database, which may provide further explanations.

#### I. COST VARIANCE

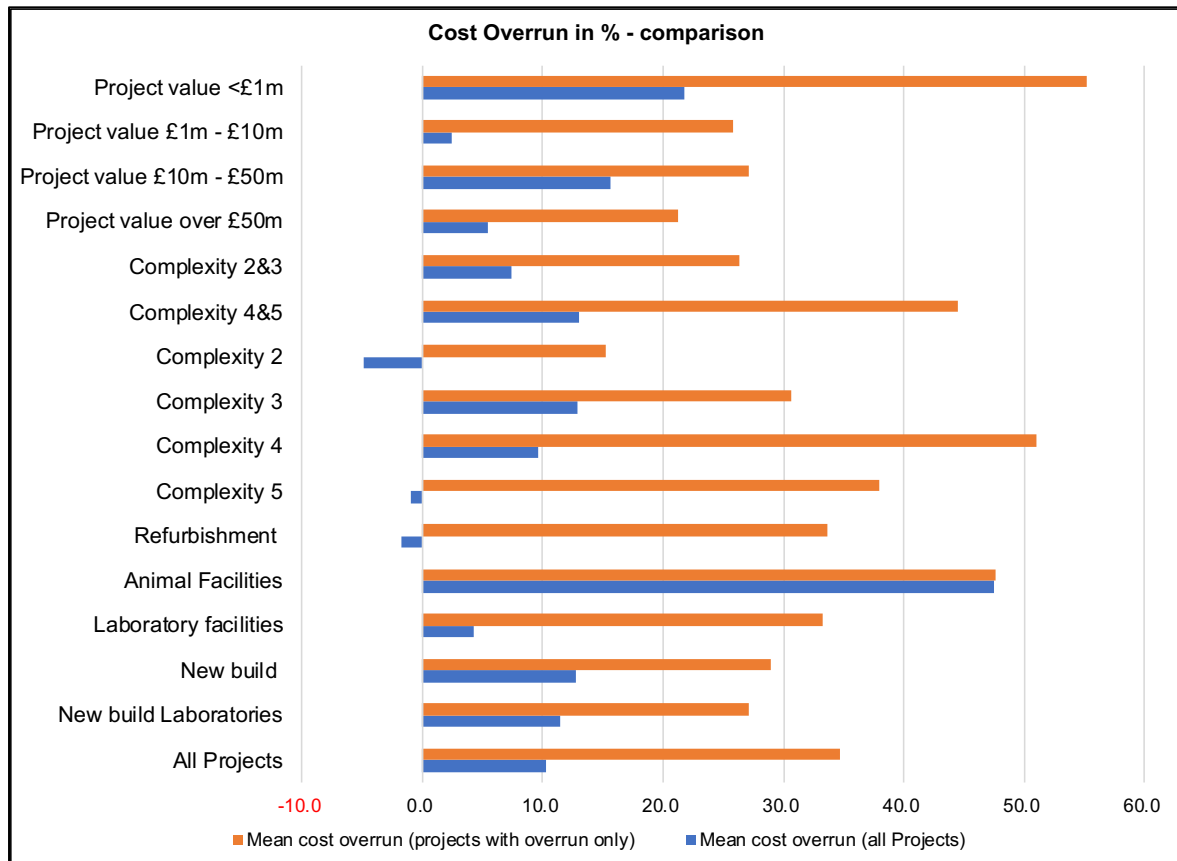
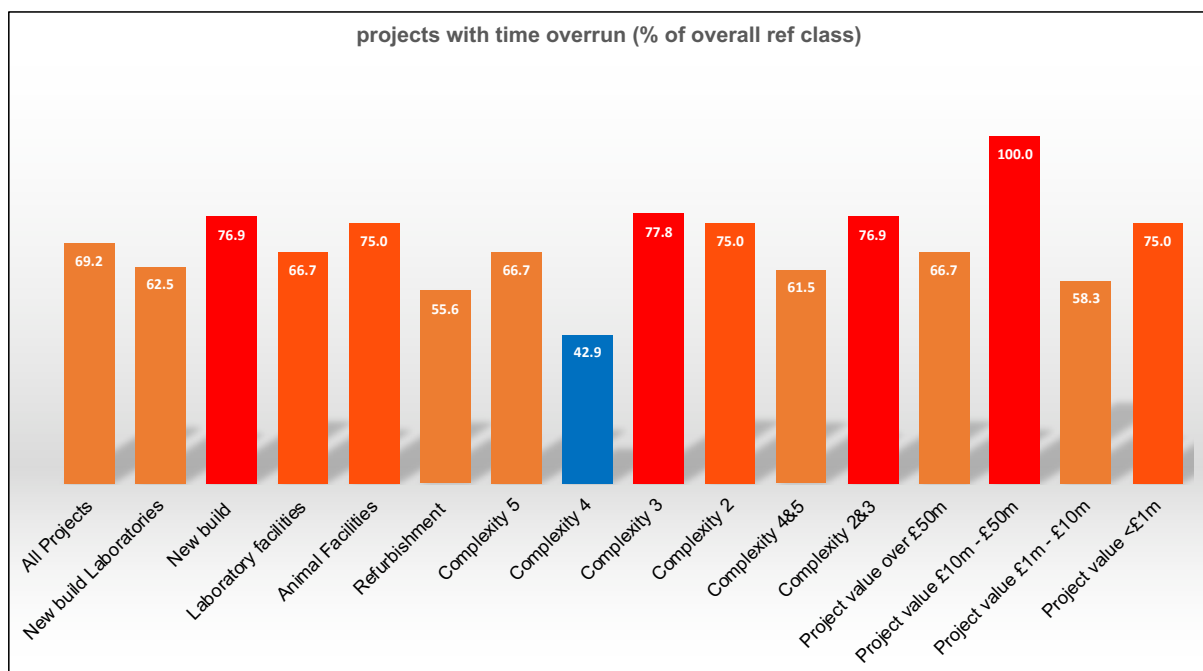


FIGURE 15 - COST VARIANCE RCF

Figure 15 shows a comparison of the level of cost variance between all projects in each category and those with cost overrun. The largest disparity exists in the categories with complexity 4, 5 (and the combination of the two), refurbishment projects and those below a value of £1M. Due to all projects with animal facilities having exceeded their budget, the comparison is meaningless in this class.

### 4.3.3. SCHEDULE PERFORMANCE - GENERAL

The assessment of project performance in relation to schedule was very difficult, because much of the projects had no direct statements of time schedules. Except for three projects, none had a final document, such as a project closure report, which should hold verified (i.e. approved by project board) performance measures on cost, time and quality. However, with the help of project team members and wider searches within the documentation, information has been triangulated and the author am satisfied that all schedule related information is accurate to the tolerance of +/- two months.



**FIGURE 16 - SCHEDULE PERFORMANCE OF PROJECTS IN % OF RESPECTIVE REFERENCE CLASS**

Schedule overruns are much more frequent in all project categories than it is found in the cost aspect. In average across all projects 69% exceeded their approved programme and variances between the individual categories are less significant than it is apparent with the cost details (Figure 16).

#### I. MORE QUESTIONS THAN ANSWERS?

One category (projects with value between £10M and £50M) showed none of their projects completing within the estimated time frame. These projects are also represented in the category with the highest level of complexity and the ones in this category with cost overrun. Two of the projects in the category of £10M- £50M value

also contain small animal facilities. The combination of animal facilities with a value range of £10M to £50M appears to be the highest risk projects in relation to delivery within given time frame.

The information relating to scheduling seems to prove the theory of planning fallacy (Buehler, Griffin and Ross, 1994) and/ or strategic misrepresentation (Flyvbjerg, Garbuio and Lovallo, 2009). With projects, which conclude within an approved time frame being in a significant minority, more information was necessary to review to draw conclusions.

#### 4.3.4. SCHEDULE PERFORMANCE - DETAILS

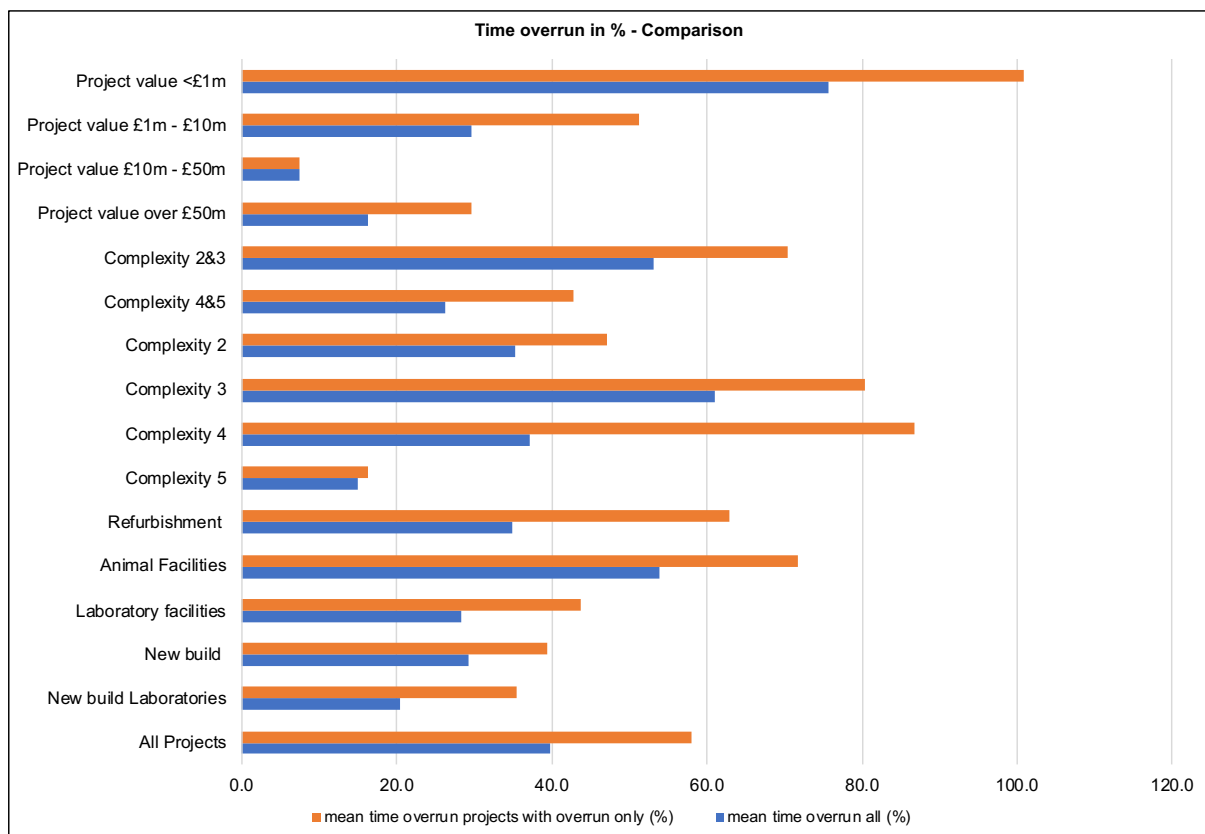


FIGURE 17 - COMPARISON TIME PERFORMANCE IN %

#### I. DATA COLLECTION

Developing the database regarding the scheduling aspect has been a real challenge. Documentation is usually quite unclear as to when a project started and when they officially concluded. Much of this information gained by triangulating information from a range of documents, such as minutes of board meetings, dates of cost reports, certificates (payment or practical completion, etc. and this provides me with sufficient

assurance that the information used is correct within a tolerance to up to +/- two months.

A further issue was the breakdown in various elements of the project schedule. The intention was to have details that allows comparisons of design development versus construction and how this varies across the various categories and groups. However, use of this information is limited. In a traditional procurement approach, a client would have a design team developing the full design, then tender the works. That approach provides a clear separation of the design and construction phase. This type of approach is now rarely used in public sector and in the two organisations involved. Historically, medium to large projects are procured as Design & Build projects, where the contractor provides a significant element of the design work, usually with the client design team being novated to the successful contractor. Consequently, the design and construction phase overlap and merge in that some elements of a facility would be designed quite late during the construction phase.

## *II. BEST PERFORMANCE*

The best performing category in terms of project delivery on schedule are those projects with a complexity of 4. This is closely followed by refurbishment projects and projects with a value between £1m to £10m. There is overlap (i.e. some of the projects are represented in all three of these groups) due to the small sample size and no general similarity in the projects that are contained in each of these groups.

Considering the performance in relation to the % overrun on schedule the lowest time overrun was found at projects with a value of £10m - £50m (7.5%). It is notable, that the refurbishment projects again perform well in comparison with other project types, which is early evidence (subject to further project details in the collection) for better awareness of potential risks in planning refurbishments.

## *III. POOREST PERFORMANCE*

Categories with the highest percent of projects exceeding their schedule was seen at projects with a value between £10m to £50m. Whilst all projects in this category did not manage to complete within estimated time scale, the extent of that overrun was the lowest that could be found amongst any of the categories (7.5%). However, looking at the performance in terms of average % overrun within the category, the results are

quite different. The category with the highest percent time overruns is the group of projects with a value up to £1m (75.7%) and if looking only at the projects with time overrun this goes up to 100.9%.

In reviewing these projects and respective details, the author has not found specific reasons, why these small value projects have such significant overrun (when they do). Nevertheless, there is an assumption that the planning, which goes into the development of these projects may be less thorough due to lower values involved or higher frequency of such projects taking place. In discussions with bidders, there was also the view that due to the low value of the projects there is a reluctance of spending funds on external sources, such as designers, engineers or estimators.

It also must be noted, that projects with value over £50m experienced the majority of their delays during the approval process (general about 12 months), rather than during the construction and commissioning phase. Again, there is some, but no significant overlap in projects across the groups.

#### 4.3.5. RESEARCH CYCLE 1 – REVIEW AND ACTIONS

If it was assumed that a larger database provides the same results, the outcomes would enable a prediction on cost performance and subsequent determination of required contingencies. It suggests that the argument that projects with higher complexity require larger contingency is flawed. The complexities levels made no difference in the project performance based on this database.

The above findings were presented to the AR group in a meeting and discussed. General concern was raised about the size of the database and it was agreed that focused effort is to be made to increase the contributions by adding more projects or securing more contributing organisations. A target was set to double the number of projects included (to 60) but with a focus on larger projects, preferably with a value of over £50m.

Hence, a key action was to approach other organisations with significant science estate and secure their contribution to the project database. Relevant procedural details, such as protecting anonymity, mechanisms for access to the information and responsibility for data maintenance were to be considered.

Furthermore, the AR group agreed that whilst the generic high-level analysis of various groups/ categories of project was interesting, its value for application for the improvement of project estimates and/ or decision making was limited. Research cycle 2 was therefore to test the use of RCF (be it with limited information available) to a life project and report back to the AR group with the findings.

## **4.4. REFERENCE CLASS FORECASTING – CYCLE 2**

### 4.4.1. IMPLEMENTED ACTIONS

Research Cycle 2 was concerned with the expansion of the database and testing of the RCF against a life project. The expansion of the database was presented with some significant hurdles. Work commenced in both MRC and the health organisation to collect details from more projects however, since the initially selected projects provided the most complete information, no further projects could be identified so far. Those projects, which were incomplete at the conclusion of the first research cycle will be added, when completion is achieved.

More difficult was the activity to recruit other organisations with significant scientific estates who could provide project information. Universities, NHS Trusts, Ministry of Defence, etc. were considered to be appropriate and where approached. Discussions with these have resulted in a better understanding of the complexity of developing a database.

The biggest issue was how the anonymity of the contributing organisation would be maintained when using details, which is likely to be known in the industry. This drove the willingness of said organisations to provide information. In order to validate the organisation, the author would need to have sight of relevant documentation, which was denied by the respective gatekeepers. Provision of just the details as identified in the methodology, would not allow an informed selection of projects suitable for the comparison.

Further aspects were the responsibility for holding, maintaining and expanding the database in the future, the cost and the format of this database. Similarly, questions of who will undertake the analysis, in which form would the database be made available, etc. for all of which no consensus could be achieved. Whilst this is a very disappointing result, it has provided a very good basis for developing plans for the

future and a realistic assessment of capability of RCF in the field of science related projects.

#### 4.4.2. APPLICATION TO A LIVE PROJECT

##### I. INTRODUCTION TO THE MRC LONDON INSTITUTE OF MEDICAL SCIENCES (LMS) BUILDING PROJECT

The LMS is located at the Imperial College Health Care Trust (ICHT) Hammersmith hospital campus. It is accommodated by Imperial College London, who the MRC and the LMS have a long association and collaboration relationship with. After long service, the buildings in which the Institute is located are aged and not capable of housing new innovative technology required for the continuation of the research undertaken.

The MRC (through funding from BEIS) are co-funding with ICL the design and construction of a new facility, which is to provide the home of the LMS with a total budget of £75m. This facility will include generic lab space, write up, social areas as well as a highly flexible and high-tech imaging centre, which will enable the Institute to accommodate new, innovative technology, such as Cryo-Electron Microscopes, super resolution microscopes, etc. Additionally, the facility will have one floor dedicated to animal (mice) holding and procedure rooms allowing longitudinal research activities.

With these parameters, the project would fall in the following categories:

- Animal facility
- New build facility
- New build laboratory facility
- Complexity 4 and 5
- Projects with value over £50m.

Contribution by government funding (£50m) is attached to the respective approval requirements. OBC has already been approved in December 2017 and the Final Business Case will require approval prior to concluding the procurement exercise. Furthermore, the project must get approval by BEIS or Cabinet Office for the procurement strategy, since the value of the contract exceeds £10m.

At the point of undertaking this analysis, the project had received approval of the OBC and the procurement strategy by Cabinet Office. This procurement has commenced



at the point where design stage RIBA 3 was completed (for review, approval and submission for planning approval).

## II. COMPARISON WITH REFERENCE CLASSES

Table 3 shows a comparison of the project (LMS actual estimate at OBC) with categories with the most similarities of characteristics with this project. Due to the LMS project not being completed, no cost or time variances could be compared, however these figures from the categories gave insight in potential outcomes of the LMS project. It showed that the average contingency (at that point held at OBC) was much higher than those held in projects of all categories at FBC (in average 6.9%). This was a very healthy situation as with the increasing certainty on the design and construction cost (generally combined with the rise of the construction costs) the contingency was expected to decrease. The example of the categories of animal facilities highlighted however, that the level of contingency was by no means a guarantee for avoidance of cost overruns. It was also notable that all categories showed significant overrun on the schedule (average of 32.2%) suggesting overly optimistic planning and has impact on the cost performance (preliminaries, etc.).

Description	ALL NEW BUILD projects	ALL NEW BUILD LAB facilities	ALL ANIMAL FAC.	COMPL. 4 projects	COMPL. 4/5 projects	PROJECT VALUE OVER £50m	LMS ACTUAL ESTIMATE AT OBC
Average cost variance in %	12.8	11.5	47.6	9.6	13.0	5.5	
Average contingency in % at FBC	13.0	13.2	7.2	10.9	13.1	12.0	18.5
Average time overrun in %	39.3	20.4	53.8	37.2	26.3	16.3	

TABLE 3 - COMPARISON CONTINGENCY

Naturally, one would compare projects at similar approval points (i.e. OBC in this case) however, there were a number of problems with this approach.

- The LMS project had quite advanced estimates at the point of OBC, based on design and construction logistics, which exceed the detail usually available at concept design (RIBA 2). OBC information for most of the projects in the

database is at much higher level and associated with much more assumptions than the LMS project.

- With the procurement exercise and the conclusion of the RIBA stage 3, a comparison with other project's FBC details would provide direction or guidance in the preparation of the FBC of the LMS project.
- As a consequence, all figures in the respective categories were taken from FBC stage to determine what the target levels should be for the LMS building project.

There were no details on cost or time overrun for the LMS as it just embarks on the delivery phase. Table 4 provides a breakdown of the comparison between LMS and comparable categories.

Description	All new build	New build lab	animal fac.	Compl. 4	Compl. 4/5	Value over £50m	Est. LMS (OBC)
Average % design cost of overall project cost	8.99	4.21	6.64	9.57	5.81	4.11	12.8
Average variance % (design) actual vs FBC	113.26	-8.08	42.22	-9.24	15.15	107.41	
Average % construction cost of FBC	66.56	79.51	63.56	70.68	68.28	70.42	68.7
Average variance % (construction) actual vs FBC	142.07	82.02	71.42	25.74	141.82	26.18	
Average % contingency of overall FBC	23	13.23	7.16	10.87	13.15	13.25	18.5
Average % design programme of overall FBC	29.66	27.19	31.41	23.61	29.67	29.3	26.67
Average variance % (design) actual vs FBC	59	110.63	0.44	0	-2.74	22.89	
Average % construction programme of overall FBC	70.99	73.68	68.59	76.39	82.62	70.7	76.67
Average variance % (construction) actual vs FBC	38.9	46.1	56.27	40.42	35.68	15.86	

TABLE 4 - COMPARISON WITH RELEVANT REFERENCE CLASSES

Again, the author has used FBC figures for the respective categories, because the design was more developed at the LMS at the time of OBC than in other projects at that point. The comparison confirms this with a higher percentage of design costs at the LMS project (3.23% above the highest and 6.3% above average design costs of the categories), since the proportion of the programme for this work is within the range of the given categories (23.61% - 31.41%).

Whilst the cost of the design and the contingency at the LMS is higher than the average of these in the categories, it is unlikely to cover the potential gap represented by the respective overruns. Two of the categories show over 100% cost overrun in design costs or construction costs. Regarding the programme for the project, this applies too, especially, since the proportion estimated for the LMS is located within the range provided by the categories with no “buffer” incorporated. As a result, the author had to assume that the LMS project has made no sufficient allowance for the overruns in both cost and time, which similar projects clearly experience.

### *III. COMPARISON WITH SELECTED PROJECTS*

The author then tested an alternative approach by selecting individual projects with similar characteristics to the LMS, i.e. new build laboratory facility, complexity of 4/5 and value of over £50m. Only 2 projects were applicable to these criteria. The Table 5 below shows the comparison derived from this approach (again on main aspects of cost, time and contingency).

Description	RCF	Variance actual vs OBC	LMS OBC
Cost variance in % of actual total cost vs OBC		24.9	
Cost of fees in % of overall cost estimate at OBC	10.6	39.9	12.8
Cost of construction in % of overall cost estimate at OBC	60.7	77.9	68.7
Contingency in % of overall cost estimate at OBC	28.6		18.5
Time variance in % of overall time actual vs OBC		26	
Design programme in % of overall programme at OBC	29.1	22.8	43
Construction programme in % of overall programme at OBC	70.9	27.2	56

**TABLE 5 - COMPARISON WITH SIMILAR INDIVIDUAL PROJECTS**

Table 5 paints a different picture. Most apparent is that the level of cost contingency is much lower than what was allowed in these projects. Additionally, these projects also had a very significant cost overrun when comparing between actual outcome and OBC estimates (77.9% on construction alone). Further disparity was found in the difference in the scheduling. The ratio between design and construction programme at the LMS is almost equal, whilst the sample projects had a short design phase and a longer construction phase (1:3). With the details derived from this last approach, a prognosis was made of where the LMS project would arrive, should these figures be accurate (Table 6).

Description	LMS Estimates at OBC	LMS forecast without budget constraint	LMS forecast within approved £75m budget
Total project cost	£74,879,317	£93,501,803	£75,000,000
Design fees	£9,605,261	£11,154,765	£8,947,500
Construction Cost	£51,410,000	£80,897,760	£64,890,000
Contingency	£13,863,500	£1,449,277	£1,162,500
total time in weeks	192	302	241
Design programme in weeks	84	129	103
Construction programme in weeks	108	172	137

**TABLE 6 - PREDICTION OF PROJECT OUTCOME BASED ON COMPARISON WITH SIMILAR PROJECTS**

In this table, the author has made predictions by applying average increases in cost and schedule derived from the average overruns identified at similar projects (table 5). It estimates the accurate costs for the project to be over £93m and significantly longer time scales for both design and construction programme than set out in the OBC of the LMS building project. Since this is based on the requirements not increasing, one must assume that by keeping within the approved project (last column table 6), significant cuts in the requirements would need to be made to deliver within the funding envelope.

### 4.4.3. RESEARCH CYCLE 2 - REVIEW

#### I. GENERAL

The results from the activities to expand the database and the practical application of RCF to a live project were presented to the AR group and discussed. It was acknowledged by the group, that the development of the database under the protection of the ethical approval of a research activity and specific consent agreements helped with a fast and uncomplicated progress. All participants highlighted that contractual agreements with similar, if not more stringent protection of data would need to be developed, if this database was to accept information from other organisations.

Strategic decisions will need to be made as to who will own and manage this database in the future, which will require resources and expertise. Appropriate storage facilities would need to be identified (cloud, etc.) where information would be accessible to participants on other interested parties. Discussions as to the level of analysis that would be provided need to take place. Agreed actions are identified in 4.5. – Continuous improvement.

#### II. RCF APPLICATION

The findings from the application of RCF to the LMS project were discussed with the Action Group. There was general interest in the findings, but due to the small database the results were considered only indicative. In presenting the results, the following issues were highlighted with the calculation itself:

- In comparing the project directly with those of similar characteristics, the statistical basis of the calculation was severely restricted (to two projects only). Therefore, the results cannot really represent statistically sound evidence on which one should base one's assumptions for a project. Nevertheless, there was a view that this approach could be reasonably accurate (provided it is based on a larger number of projects).
- The calculation itself does not allow for aspects of political influences and similar unpredictable issues. For example, the budget of the LMS project is not derived from a build-up of the requirements, feasibility study and then

relevant cost estimate, but from an arbitrary allocation by the government based on funding availability. This is exacerbated by an established funding stop in March 2021 (end of 5-year spending review), which forces an unnatural and accelerated programme on the project. Consequently, the comparison is not done between projects of similar constraints, only of similar design/ construction characteristics.

- The actual outcomes of the projects do not show levels of contingencies, because they are used up by the respective cost overruns. A comparison between actual vs OBC (or indeed FBC) should take into consideration the contingency plus the overrun of the respective categories to arrive at an appropriate contingency level. However, this cannot be broken down to the individual elements (for example design or construction), as it is not apparent, where these overruns occurred, nor is it feasible to establish this in a larger database.
- RCF is to be tested in future capital award panel decisions by providing a statistical comparison for medium – large project proposals to understand, how this can support the award panel decisions.

## *II. LONDON INSTITUTE OF MEDICAL SCIENCES PROJECT*

There were also positive aspects in relation to what the author learned from the comparison on the LMS project.

- A high ratio of the design phase to construction phase at the LMS was based on a “waiting time” for approvals from various government departments. Whilst this seems reasonable, it was also discovered that similar large projects (and therefore with similar approval processes) tend to have between 9 – 12 months delay due to this specific issue. Consequently, the project must either include more time for the approval processes or, as it will be the case with LMS, raise this as the key risk for both corporate and governmental level, with funding availability restricted until March 2021.
- The findings from the comparison have triggered a risk review on the LMS project. Individual risks were reviewed in terms of time and cost impact as well as the issue of probability (considering the comparison with the categories)

and ownership. Using statistics has challenged the views by the team members on risks and has led to a more realistic risk assessment.

- Whilst the project team has been aware of the aggressive programme for this project, it did not consider it to be 12 months short of what similar projects would require to be completed. This is now being addressed by seeking agreements with the co-funding organisation for the project to fund the extended programme, rather than the contribution towards the beginning of the project. It is thought that this will largely mitigate the issue.

### *III. EXPERIENCED PROBLEMS IN APPLICATION OF RCF*

In discussion with the Action Group the following problems were identified with the use of RCF.

- There is inconsistency in the quality of information. That does not only apply to different organisations, but different project teams. If RCF was to provide more accurate results, the collection of details must account for these differences. This may be done by establishing a quality threshold, such as that only direct evidence could be used (not triangulated from various sources) or similar. However, this poses a problem in how the database is maintained and increased (responsibility, quality check, etc.). As a result, there may be a reluctance by potential other contributing organisations, as they would need to disclose more details than they are prepared to.
- The author found several approval routes for projects. Most notably, the different organisations have reporting lines to different departments, who themselves have a range of approval pathways. Some projects go through an OBC approval, some just have FBC, some (particularly smaller projects) produce none of the above but submit justification through the capital bid panel only. It is very difficult to establish all three “check points” (i.e. OBC, FBC and actual performance at completion). As a minimum, projects to be included in the database would need to have gone through an FBC and a final assessment at completion.

- The process of selecting similar projects for the example of the LMS has the potential of introducing bias. This in turn negates the effect, which RCF is supposed to have on the accuracy of estimates according to Flyvbjerg (2008).
- The action group was unsure over the required size of the database to provide statistically meaningful results. It was agreed to actively work on growing it, but regular testing would be needed to gain more certainty of the use of RCF.

## 4.5. Continuous improvement

Over the two research cycles both in the organisational and RCF research a significant amount of details was collected, analysed and reviewed. Progress was made in some areas, less so in others. Whilst the conclusion of these two cycles define the end of the research as anticipated in the constraints of this thesis, they represent the beginning of a continuous improvement process at the MRC.

In this approach the two methods come together to form a cohesive strategy for the improvement of the quality of decision making in the organisation. This section will explain the actions taken forward to the continuous improvement process and successes already achieved.

### *1. ACTIONS ESTABLISHED*

This research set out to improve the quality of the decision making in the organisation. Progress has been made in identifying evaluation criteria, which are shared by within the community. A database has been started to provide some historical information for an assessment of viability of proposed projects. Better communication between bidders and approvers, HO and units has been agreed, which should support the understanding of the mutual positions, be it the need for equipment or the lack of funding availability.

The continuous improvement strategy aims to combine all of these aspects by taking the following actions:

- a) All estates related bids will be tested against the RCF database. Whilst there is acknowledgement that this database is not yet statistically significant, it can provide some guidance on viability of projects or indicate, where weaknesses



in the estimation may be. Particular focus will be on the size of the contingency proposed for the project and potential time scale. The work to expand the RCF database will continue and senior management will actively support and promote this with other partner organisations.

- b) Capital bid evaluation criteria are to be reviewed on an annual basis to ensure they represent the circumstances and priorities of the MRC overall and the research community in particular.
- c) Details is to be collected to establish evidence for the state of the science equipment overall. Asset registers are expected to provide the best basis for this information, as these are standardised across the organisation and have to be updated annually by the units.
- d) The estates team will undertake a tour of all intramural and extramural units and institutes, discussing with the respective directors three key subjects: ambitions for the future, science equipment concerns, estates related concerns. These will be summarised and discussed at MRC Management Board. Actions resulting from this will be communicated back to the Units.
- e) Both RPG programme managers and unit directors will be actively encouraged to discuss the capital bids prior to the evaluation, if not prior to submission. Similarly, personal feedback of the outcomes of the process to each unit is encouraged.

## *II. ACTIONS IMPLEMENTED AND INITIAL FINDINGS*

Some of the above actions have already been implemented and are now in a process of reiteration. The most successful of these has been the visit to the units. These were undertaken in 2018 and resulted in a collection of information, which supported the development of the MRC science strategy. Here the feedback from the units relating to

- **Scientific vision:** This includes the view of the Director of whether the direction of their science needs to change or be fine-tuned prior to their next QQR or in preparation for it. Part of this discussion was also to look at

aspects, which arise from some of their research activities, which may indicate to other areas or elements of science, that would be worth exploring. The outcome of this discussion is to be collated and presented to the MRC Strategy Group and Research Programme Group to review and select those, which should be actively supported and/ or flow into the UKRI capital road map.

- **Replacement capital scientific equipment:** Evidence is needed to establish the minimum capital requirements to maintain the research activities at a status quo plus the level of funding required to make the UK research world-leading therewith establishing the UK as a global centre of excellence in medical science. This work will be presented to UKRI and the government departments to lobby for higher and more reliable levels of capital funding levels in the mid- to long-term future. Basis evidence for this aspect will be the asset registers of units and institutes.
- **Estates maintenance capital funding:** Like with the scientific equipment, there is a need to determine minimum funding levels for capital plant replacement as well as larger investments, such as when the life cycles of research buildings come to an end and the need for major refurbishment or replacement must be considered. Units and Institutes for which the MRC has estates responsibility have been asked to provide a rolling plant replacement plan for their facilities in consideration of replacement time and cost. Additionally, head office records will be consulted to establish ages of various research facilities and establish, which would need to be refurbished/ replaced in the next 5-15 years.

A database of capital science equipment was established, which contains the information from 17 units. It has permitted an analysis of the status of MRC science equipment, evidencing the aged equipment that all units have to work with. Basic estimates of capital funding requirements to rectify this situation has been submitted as part of the details for the government's spending review to underline the importance of increasing the capital funding for fundamental research. Agreement has been reached to repeat the visits annually with the estates team being joined by the relevant

RPG programme managers. Initial feedback from unit directors has been very positive, welcoming this way of re-connecting to the science base.

The questionnaires used in research cycle 2 will be re-issued to all MRC HO staff and the unit directors on an annual basis. It is expected to amend the questionnaires in view of arising issues during the previous year or seeking evidence of the effectiveness of actions that are implemented. A programme of visits by the estates team to all MRC University Units and MRC Institutes must be established to develop closer relationships with the units and gather more information and evidence to inform the strategy of the MRC.

#### 4.6. Summary – findings of organisational research and testing RCF

In completion of the two research cycles in the organisational research and the testing of RCF for the purpose of estimation and approval has provided the author with significant insight in the organisation and the dynamics of the bid process. And whilst each of the research streams were undertaken individually and separately, they contributed to an overall benefit of better understanding of causes of the problem identified or areas, which exacerbate it.

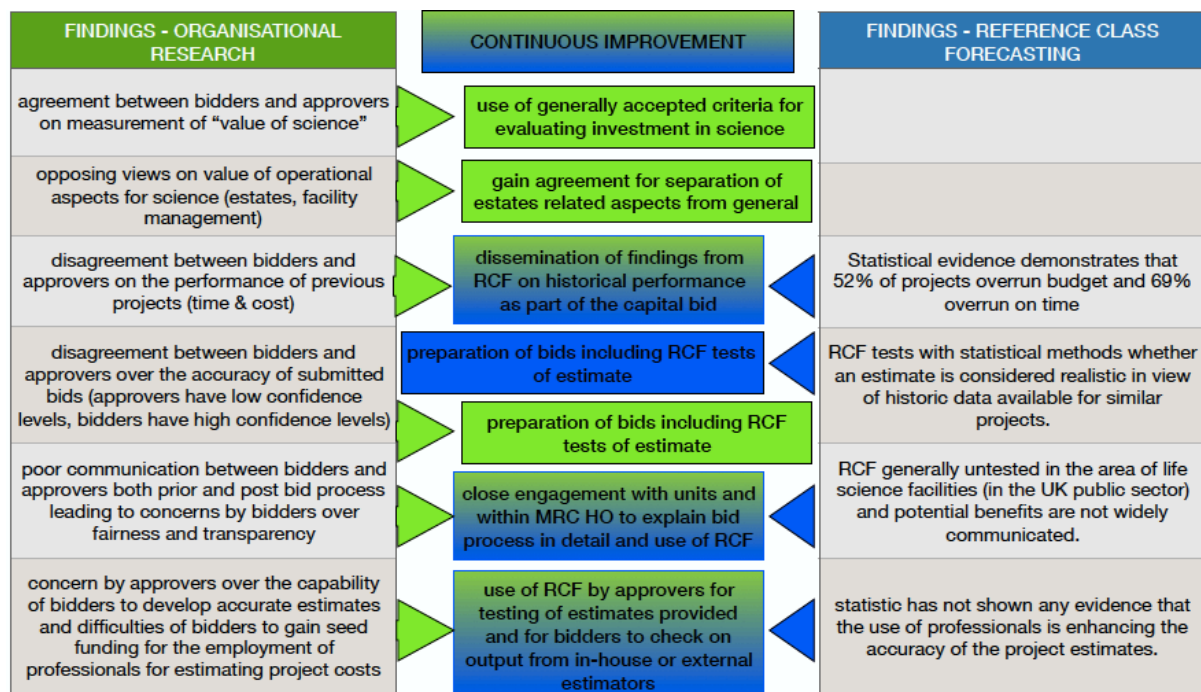


FIGURE 18 - SUMMARY FINDINGS

Figure 18 demonstrates some of the key findings of each research element and how they come together to inform the actions on continuous improvement. Throughout the

organisational research the author noted the very positive view that both bidders and approvers had over the activity in general and that they felt that this will lead to a closer relationship between parties in the MRC.

The combination of the more social aspect of the findings with the statistical approach of RCF is expected to provide more transparency and confidence in the process. With the total lack of acceptance of operational needs by approvers poses a risk to the research continuity in that scientific equipment is generally promoted over capital estates issues unless it is already impacting on the scientific activities. Hence, the preferred way forward should be a separation through a separate process avoiding direct competition between science and estate.

## CHAPTER 5 – DISCUSSION

This research started out with the aim of

**Developing a fair and transparent processes for the approval of estates projects by establishing more accurate estimation and assessment tools for bidders and approving bodies.**

The author then researched in literature about the problem and realised the complexity of influences on the early development of projects is significant and resulted in three key research questions expected to identify effective actions to achieve the said aim:

- What are the influences on processes and dynamics of project estimation and approvals in the MRC?
- Would RCF present a workable tool for project estimation and/ or assessment?
- How can this knowledge be used to achieve a fairer and more transparent process for these aspect in the early project stages therewith achieving better Value for Money for medical research?

The discussion is structured around these three questions and how the author believes the findings to contribute to the target. With this the author also reflects on how this compares with her insight from literature on these aspects.

## **5.1. INFLUENCES ON PROCESS AND DYNAMICS ESTIMATION AND APPROVALS**

Both the research in the organisational aspect and the collection of information for RCF have provided insight in this area of concern.

### 5.1.1. STRATEGIC MISREPRESENTATION AND OPTIMISM BIAS

Findings from this research have identified a very complex situation of organisational and economical influences. The key driver for projects in the MRC is the progression of science. Science breakthroughs and high-quality research results support the outcome of the quinquennial reviews and hence the continuation of the research programmes and units as such. The author has found strong passion by both bidders and approvers over the social benefits of fundamental science, sometimes not understood or shared by funding government departments. This is leading to opposing pressures, in that the funders support projects that support their policies (Dotti, 2018) whilst the bidders (in the MRC case) fight for the approval of their projects with the belief that this serves the wider public and with the careful management of information

in their applications (Steinel and Dreu, 2010), partially evidenced by the view of some bidders that evaluation criteria should not be made public, as it would be used strategically.

All of the above are reasons for both bidders and approvers to adjust estimates to align with the most suitable circumstances. However, this research has also found a declared disinterest in knowledge by bidders that would provide higher chances of success for bids. They have highlighted concern about potential misrepresentation, should they be aware of the evaluation criteria. This indicates a high integrity of the bidders within the MRC and suggests, that the inaccuracies of project estimates are less the result of strategic misrepresentation than other influences and therefore confirm the findings of critics of the theory of strategic misrepresentation, such as Osland and Strand (2008).

Continuous strain on capital funding over the last decade has resulted in deterioration of science estate and equipment, leading to situations, where the research continuation is threatened. Annuality of funding allows public sector organisations certainty for only one financial year, resulting in a bias towards projects, which do not exceed 12 months duration. Deliberate misrepresentation was suspected as an influence on estimates, particularly in view of the time restrictions of funding certainty, but it could not be evidenced.

Anecdotal evidence was provided in interviews that the cost estimates from third parties, such as suppliers, would be low due to the desire to be looked at more favourably at a later tender stage or to enable the start of the project as such. That aligns with the findings of Love, Edwards and Irani (2012) that the combination of competitive fees, failure to project manage by designers result in rushed work and design errors. Yet, the author has found unexpected evidence of strategic misrepresentation, which was initiated by approvers, particular in the context of projects being initiated by government departments resulting in funding applications being made to suit the government proposal despite differing views on the effectiveness or delivery of the solution. From the interview results this research sees political influences as a significant cause for strategic misrepresentation, similar to the findings of Steinel & Dreu (2004) on the social motives of strategic misrepresentation and Dotti (2018) on political actors promoting projects within their policy area.

The findings from this research does not support the view of strategic misrepresentation being 'standard procedures' (Jones & Euske, 1991), rather than confirming the view of Osland & Strand (2008) that the complexity of projects and their political environment result in the variances of project estimates and outcomes. Stronger influences were found to be optimism bias and planning fallacy. Significant disparity of views over the performance of projects highlighted that perceptions of project performance depend on the position as bidder or approver. RCF analyses suggested that projects in the science environment generally perform poorly with high percentage of cost and schedule overruns.

RCF analyses however, relate to larger projects, which cannot be designed constructed and completed within one FY. Smaller projects, such as those that feature regularly may be subject to a combination of the need, the desire to complete within 12 months and the believe that this is possible. This is considered to be triggered by the implicit constraint of the funding being only available within the current FY. Bidders, who are developing estimates have noted, that they use information from previous projects, yet this does not extend to performance data. This would suggest that in offering the RCF analysis as opportunity to benchmark the estimates at an early point could be a successful strategy.

### 5.1.2. DYNAMICS OF PROJECT APPROVALS

Information gathered during the two research cycles provided some information on the underlying dynamics of the approval process. Evaluation criteria for the capital bid process are published with each call for bids but does not communicate the exact process or the representation at the panel. The criteria are focused on science benefits and as such closely related to the shared values that were identified in the second research cycle. Feedback from bidders indicated, that their view of the process being not transparent is related to the detailed methodology and the understanding of the panel membership, which is not identified to bidders. This lack of transparency is a cause for questioning the legitimacy of the decision (Kieslich and Littlejohns, 2015) and loss of trust by bidders into the process if not the approvers themselves (Lyrio, Lunkes and Taliani, 2018).



The author has found considerable confusion by bidders, over the role, which recommendations from the QQR play in this process. However, approvers were very clear, that the QQR recommendations are an important influence on the decision for approval. Furthermore, the point of time of the bid submission between QQRs is also an important, indirect aspect of the approval decision. A unit, which will undergo such a review in the following year, will have considerable difficulties to get funding approval than one which has just completed this process, where the research has just been reaffirmed to be worthy of funding. Reasoning for this is that these reviews set out a new vision for the next 5 years, which may change the direction of science and therewith the requirement for respective technology. Items procured in the last year of the existing review cycle may be not contribute to the new vision. The author found, that this contributed significantly to the perception of bidders that the process is a 'black box' where the actual evaluation process and considerations are unclear (Mow 2011), because they felt unreasonably harshly judged despite their science being of unchanged quality.

There are also dynamics between panel members, the most obvious one is between the representative of the estates team and RPG. The process is considered to be mainly for science benefits and the role of facilities is considered to be secondary. One approver referred to it as "overhead to science" and with the majority of panel members being representatives of RPG the panel overall has a bias against science support aspects, such as estate (Lamont, 2010). Additionally, some units, specifically intramural ones, have heavily serviced and expensive facilities and struggle to balance the need for updating the facilities with the need for new innovative technologies for research. Overall, findings have shown that panel members are not necessarily exerting their expertise but promote the case of their specific interest. The author has therefore dismissed the concern by Langfeldt (2004) that assessments are not fully undertaken by each panel member because they rely on the judgement of experts on the panel.

Anecdotal evidence was found that there are implicit rules for the approvals of projects at the capital bid process as identified by van Arensbergen et al. (2014) although in this study they relating to difficult and powerful directors was made, implying that they needed to be appeased to avoid uncomfortable discussions and additional work. On

the other hand, the research has also found that approvers considered all ongoing MRC research was worthy of further investment, as is undergoes rigorous scrutiny to gain research grants. As a result, there is a desire to ensure that all bidders receive some funding.

### 5.1.3. Evaluation criteria

Research on the subject of the evaluation criteria is closely related to the aspect of VfM. It was positive that criteria of values of research was generally shared between bidders and approvers, hence providing a base for explaining approval decisions with a mutual understanding. However, as the findings from the first research cycle indicated, interpretation of many of the criteria was different, for example, in which way scientific impact could be measured. With the views ranging from measuring publications to finding effective health interventions demonstrate that there are potentially very different approval decisions being made, depending on the opinion of the respective approver. This is consistent with the findings by Mow (2011), who highlighted the difficulties to interpret criteria in the context of the evaluation, but from a perspective outside the evaluation team.

In this context the research from Laudel (2006), who suggested increasing transparency through active involvement of bidders in the process or the increased use of peer reviews with the introduction of experts on particular subjects (Fogelholm et al., 2012) , become potential solutions. Kieslich and Littlejohns (2015) see audit tools as an efficient method to establish transparency and consistency in decision-making. In consideration of the desire by MRC HO to have much closer engagement with the units, engaging of unit representatives by way of rotating membership on the capital bid panel will open the process to more scrutiny and enforce the accountability for the decisions made. Also, the bidders would develop much more understanding of the financial pressures that dictate the decisions (for example, that generally there is only £1 capital funding available for every £3 to £4 of submitted bids). A counter-argument would be that this would introduce an obvious bias and so the alternative would be to seek agreement over the criteria amongst bidders and approvers.

## **5.2. RCF as a workable tool for estimation and assessment?**

The work of gathering information for and the development of a database for RCF has identified benefits and shortcomings of the method as a tool for more accurate estimation and approval. The AR group considered this work as a successful proof of concept, however with some caveats.

### *I. BENEFITS*

RCF is based on results of fairly simple statistical calculations, such as mean, average, maximum, minimum, etc. The detail, which is required to be used to build the database is understood easily by project professionals and laymen and can be very clearly defined (Batselier and Vanhoucke, 2016). The output of data analyses can be tailored to the preferences of respective project teams and/ or approving organisations and bodies. The methodology allows the expression of ranges represented in various categories or specific benchmarks on similar projects. This would be a feature, that makes RCF very desirable as a tool for approvers to test the viability of projects that are proposed for funding.

More importantly, it has the potential of providing forecasts for the outcome of a particular projects, based on this historic information. Such details can be used to scrutinise the estimates for costs and schedules for evidence of bias or gaps. The application to a live project has also shown that RCF could provide details for the high, medium and low confidence estimates and in combination of a risk analysis (such as Monte Carlo) allow information, which is triangulated between different methods of calculation. Key to the use is a clear definition of baseline, which depends on what the user wishes to understand (Flybjerg et al., 2018) therewith proving highly desirable flexibility for approvers, although this comes with a risk of re-introducing bias by showing the desirable aspects of the project.

### *II. DISADVANTAGES*

Whilst RCF showed great promise for the improvement of estimation accuracy, the work in the two research cycles has also identified its limitations. In order to become a reasonably reliable tool, it requires a more comprehensive database. By experience from two significant research organisations, the establishment of a sufficiently large database would need the collaboration of a number of large organisations, such as Universities, etc.

This leads to the next difficulty. Both the MRC and the health organisation were conscious that details contain evidence of what could be considered a failure by their respective funders and a detriment to the organisation's reputation. Whilst input information that is required for the calculations can easily be anonymised, the detailed knowledge of the projects, which is required to understand its categorisation and/ or selection for specific groupings is difficult to achieve without risking the identification of the project and owning organisation. Mechanisms could be agreed between a group of relevant organisations to overcome this problem. Quality of the information being used in the database will have significant impact on the output. It is critical that the input detail is accurate and validated to have assurance on the output and therefore requires experienced individuals to understand the data provided (Peleskei, 2015).

The claim that RCF removes bias (Flyvbjerg, 2008) is questionable. As mentioned above, the database must have a sufficient number of projects and there is a risk that these will cover a medium to long-term of project history. This means that adjustments may be required (such as for inflation). Additionally, the activity of selecting specific projects for comparisons and statistical analysis as well as the most appropriate and possibly challenging baseline (Flyvbjerg et al., 2018) is based on the judgement of the individual that undertakes that selection. Both activities have the potential to introduce bias to the process (Makovsek, 2014). Last but not least it should not be forgotten, that the estimates for the cost and schedule of a project will reflect a project, that is well managed and has a clear target in terms of performance. Failures in establishing good governance in all levels of the organisation (Brunet and Aubry, 2019) and inappropriate use of project management methodologies (Ng, 2018) will undo even the best of estimates.

### **5.3. How does this contribute to fairness and transparency for the capital bid process at MRC?**

In section 5.1 and 5.2 the findings were considered in the context of identifying specific tools and actions, which would improve the accuracy of the project estimation or decision-making during approval process. These are valid actions and mechanisms in themselves but will not provide a comprehensive and transparent solution for the project approvals.

Throughout the research cycles, particularly in the organisational research, the frustration over lack or quality of communication within the MRC was expressed and the findings have shown, how this affects the perception of both the project estimation (as perceived by approvers) and the approval process (as perceived by bidders). The way in which this research was received by both MRC HO and the units demonstrates the desire for more unity as an organisation as whole. It should be noted, that none of the participants chose not to communicate for principle reasons, but it appeared to be the lowest item on a list tasks with higher priorities. Heavy workload, uncertainties of future structures (UKRI) and roles were considered to be contributors to this situation. Many participants expected the respective other party to initiate the communication in a case of need. Whilst this is a usual approach in managing by exception, it contributes to a growing gap between the MRC HO and its science community. Furthermore, it results in a failure to understand the needs (both operationally and scientifically) of the units and subsequent misjudgement in approval decisions.

This causes issues for the governance and accountability. MRC HO should make the decisions in the knowledge that they will need to justify these decisions to the Units. Absence of transparency reduces this accountability to the units and raises concern or suspicion over the methods of decision-making by MRC HO. In summary, the application of most of the measures and tools identified as useful, will not be effective, if not a significant improvement of the communication amongst the MRC is achieved.

The unit visits undertaken as part of the continuous improvement process have demonstrated the power of making the first step. Good communication and the development of better relationships should be the highest priority in resolving the problem.

## **5.4. Summary**

The findings of this research have provided results, which have contributed to the understanding of the influences of decision-making in the assessment of funding allocation for projects at the MRC. It has highlighted strong dynamics within the organisation, which affect approval decisions. Whilst there is an overarching agreement on the greater purpose of fundamental science, views on the respective criteria or measurements of this vary.

Findings of this research have also identified strategic misrepresentation in the context of development of projects. However, this was not a simple issue of making a bid fit the evaluation criteria. A complex environment has been discovered, where funding constraints (such as the annuality of capital funding), stakeholder interests, political pressure, requirement for research continuity, etc. forced projects into being or directed in their strategy for project planning and approval. Anecdotal evidence was discovered, that projects have been initiated by approvers against the judgement of the experts, who then had to apply for funding for this initiative.

The author discovered a split in the organisation with a clear demarcation between the head office and the units and institutes. General reluctance on both sides to initiate conversations was identified, although both sides confirmed that a closer relationship would be helpful. Furthermore, evidence of a culture, where head office staff has distrust of the actions of the units – although only in relation to operational aspects, not science – which were almost mirrored by the opinion of units that head office staff makes decisions and strategies, which do not work for the units.

This lack of communication was found to be one of the detrimental influences on the quality of decisions for capital awards. Distance between evaluators and the units and therewith ignorance of operational needs, contribute to failure to understand priorities set by the bidders. Neither the bidders nor the evaluators made efforts to improve the understanding of the context of the submissions prior to the scoring.

It was promising that in the process of completing two research cycles, the desire by both the units and HO to improve relations was very apparent, providing a basis for the further work in the continuous improvement. Findings from this research identified a disparity of views between HO staff and units over the accuracy of the estimates or the capability for delivering projects. Cautions by HO staff over this issue were evidenced by the results of the RCF analyses, which demonstrated the majority of projects to overrun either budget or programme schedule or both. Development of tools to assess project viability during the evaluation of a bid would therefore be of immense benefit.

Considerable progress was made in developing a database for RCF and assessing this as a tool for both bidders and approvers to improve accuracy of estimates for project proposals. It was found that RCF is a very useful method providing guidance

and benchmarking for project estimates on overall cost, contingency and programme schedule. Therefore, the aim of testing RCF as a proof of concept has been achieved.

However, the work in this research has also identified considerable conditions to the appropriate use of RCF. Results discussed in research cycle 1 and 2 acknowledged the small database and the need to expand this to gain more confidence in the statistical analysis. Quality of the contributing information and the knowledge of circumstances and specifics of the relevant projects are critical to allocate the right class and category consider the analysis in the context of the project in hand.

The process of collecting information also identified some details as being unsuitable for RCF analysis (for example the breakdown between design and construction phase) as they could not be clearly defined and validated.

RCF was found to be useful but would not eliminate strategic misrepresentation or planning fallacy entirely. However, it was considered to be a useful tool if not used as the sole judgement of the viability of a project. All of the above cast a view on the level of transparency of decision-making in the MRC and associated organisations and how or if individuals are accountable for their actions. Outcomes from the interviews and questionnaires suggest a close relation between those two, in that a lack of transparency for the decisions and actions allows individuals to not be accountable. This was particularly the case with the capital bid panel, where decision makers sit behind that term are therefore not identifiable as being responsible for decisions.

The continuous improvement process is supported by all parties within the organisation as a result of this research, particularly the effectiveness of some of the actions taken. This process is working on all of the above aspects an annual review of the improvements and developments are planned and agreed.

## CHAPTER 6 - CONCLUSION



## 6.1. INTRODUCTION

This research set out to develop a fair and transparent process for project development and approval by mitigating strategic misrepresentation. With this it was seeking out and test potential tools for better estimation by project teams and assessing viability of a project by approvers.

The reading of literature refined the research question and resulted in three areas on which the research should focus:

- Understanding the influences on the process and the dynamics of estimation and approval of projects;
- Testing of Reference Class Forecasting as a tool for project estimation and approval and
- Using the results of the former two areas to implement processes in the MRC to achieve better VfM for projects.

These questions drove the design of the research methodology, resulting in a mixed methodology of qualitative and quantitative data collection and analysis.

Organisational aspects were researched through interviews in research cycle 1, which were analysed and summarised for review by MRC senior management. Specific direction was given on proposed actions and for further detail on aspects, which were shown to be inconclusive. These actions were implemented in research cycle 2, where a questionnaire provided feedback on improvements. It also collected more detailed information on those areas, that required clarification.

Research activities for the testing of RCF were also undertaken in two research cycles, but with the involvement of an AR group, consisting of stakeholders from MRC and the contributing health organisation. It resulted in an initial database of projects and tests to provide a proof of concept for RCF to be viable in the field of science estates projects.

Upon conclusion of the two research cycles in each strand, the findings informed the proposal of actions for a continuous improvement process at the MRC.

## 6.2. SUMMARY OF FINDINGS

Quality of decision-makings depends on the quality of information that is available to the decision maker. Of course, the accuracy of the estimation of project proposals is a significant element of this, but it is also important to consider the wider context of the project proposal and environment of the decision-maker.

### 6.2.1. COMPLEXITY OF THE PROBLEM

Details from interviews and questionnaires indicated the view by bidders that project estimates have generally been accurate, whilst the evidence from the RCF database showed the majority of projects being delivered over budget or schedule. This is a powerful example of planning fallacy. Buehler, Griffin & Peetz (2010), describe the phenomenon in the context of planning of future activities. However, findings from this research evidence that the reluctance to acknowledge or consider past project performance (if negative) is evident, even in a retrospective context.

It confirms what Buehler, Griffin and Peetz (2010) described the 'inside versus outside view'. Project teams need to have external input to challenge assumptions and risk assessments. Difficulties in accessing or engaging with professionals in particular fields, such as cost consultants, results in an exclusive reliance on 'inside' sources for the project calculations.

Inaccuracies of project proposals Flyvbjerg, Garbuio and Lavallo's (2009) concept of strategic misrepresentation was present in the organisation based on the feedback from the interviews, but in a very different context. His definition of this strategy by bidders to a deliberately underestimation of cost and overstatement of benefits to make the project more suitable for approval. My findings have identified, that strategic misrepresentation can be found in a much wider scope and in more subtle forms. Projects are sometimes initiated upon suggestion by organisations or bodies with approval responsibilities, despite or against the advice from the bidding organisation, considered to be the experts in the relevant area.

This strongly confirms the views expressed by Osland and Strand (2008) that project environments are subject to very significant political, economic and other pressures. Individuals, who approve funding are therefore custodians of the relevant public moneys, makes the reduction or elimination mere impossible and call for better

governance at all hierarchical levels, as indicated by Brunet and Aubry (2019) and Loch, Mähring and Sommer (2017). Simplistic approaches, such as Flyvbjerg's suggestion to 'cap grant for local projects at the estimated cost at the time of the decision to build' (2008, pg. 19) do not cater for the event that project approvals are based on the available funding envelope rather than realistic budget need to fulfil the requirements or political pressure. Flyvbjerg's approach required proof of strategic misrepresentation, which in the context of the multitude of influences is unlikely to be produced and, more importantly, his statement that Reference Class Forecasting will eliminate deliberate deception is unconvincing.

### 6.2.2. TRANSPARENCY AND ACCOUNTABILITY

In view of this it is even more important that findings from my research also confirmed the co-existence of explicit and implicit evaluation criteria that drive the decision by the panel as discussed in the literature review (Verbano & Nosella, 2010; Lamont, 2010; Langfeldt, 2004, van Arensbergen et al., 2014). The desire to appease particular personalities or ensure that every unit would receive some funding out of the process inevitably result in scores that do not reflect the viability of the proposals. Such issues raise concern about the accountability of the approver. Assessment of proposals for funding requires independence and integrity of the evaluators.

Individual preferences, loyalties, closeness to specific disciplines or even the expectation of responses from unsuccessful bidders should not have an influence on the assessment. Within a restricted pool of experts however it may be very difficult to find individuals fitting all of these parameters.

Furthermore, the process as such was considered by bidders to be a "black box" (Mow, 2011), referring to membership of the panel and the process of the evaluation itself. This research has found evidence of a 'harsher funding environment' (Elias & Elias, 2012) but also general agreement that the use of an expert panel is the best approach to separate bids with regards to their benefit to science through discussion by experts (Foeglholm, et al., 2012).

Within a healthy organisational environment, the membership of a panel, such as the capital bid panel should not need to be kept hidden, as suggested by Abdoul et al. (2012). More transparency of membership or even a rotation of attendance by unit

directors at this evaluation process would greatly contribute to a higher level of content with the decisions. This would expose any of the aforementioned implicit criteria and arguably prevent these from occurring. Findings from this research confirm that the increased transparency and a consistent approach to the evaluation – including processes for challenging or appealing the decision will legitimise the decisions in view of the bidders and wider scrutiny (Kieslich & Littlejohns, 2015).

The findings from this research have demonstrated the very importance of communication on all of the problems initially highlighted. There is a keen awareness by bidders of the potential of tailoring bids to fit evaluation criteria, if such criteria are made available. Similarly, this has also shown a determination by bidders to gain funding on their own terms – on merit of benefit to their specific research.

In a wider context, higher levels of transparency can present risks. Identification of evaluators could result in these individuals being put under pressure, subjected to attempts of bribery or risking reprisals as a consequence of unfavourable decisions.

### 6.2.3. COMMUNICATION, COMMUNICATION, COMMUNICATION

Communication, or the lack of it has been an unexpected, but most significant influence on the problem overall. A deeply rooted reluctance to have face to face, open and frank discussions between HO and unit staff was discovered by the author. This can be considered the cause of all of the issues identified in the outset of this research.

Unawareness of the availability of historical details or individuals with expertise in the organisation is due to failure to talk about projects that are proposed, in development or just on the horizon. Unwillingness or lack of time to visit the units has resulted in a management of the research from a distance without understanding of the operational local pressures. This in turn resulted in establishment of evaluation criteria, that do not allow for a score for critical equipment replacement – a high priority for research continuity. In the preparation of the proposals, neither bidder nor approvers thought it to be helpful to discuss proposals, their context, background or priority, resulting in decisions being made that potentially do not suit the bidder's priorities. Additionally, no information is provided to bidders to explain the decisions made.

Detailed feedback about the reasoning for funding decision increases the transparency and therefore forcing accountability of the evaluators. It also offers the

opportunity to learn from the experience – it applies to all approvals or application panels, be it for funding, job applications, planning applications and so on.

This short outline of failure to communicate demonstrates the chain of processes and decision points, which have detrimental implications on operations and mutual trust within the organisation.

Good and effective communication within organisations is an area, which is generally well known and arguably understood by organisations but often not practiced Hersey, Blanchard and Johnson (2013). It is based on the two elements of effectively submitting and receiving information, both of which have found to be inadequate in the MRC.

But it goes further. The issues around the subject of perception and reality of strategic misrepresentation are strongly coloured by the position of the relevant party in the process. Approvers assume that bidders are misrepresenting, bidders feel they are forced to provide bid due to instructions or circumstances of the funding environment. Similar to the increase of mutual understanding of drivers, pressures, financial and economic constraints also contribute to a higher level of acceptance for decisions being made and trust in the decision makers (Lyrio, Lunkes and Taliani, 2018).

#### 6.2.4. CONTRIBUTION OF ACTION RESEARCH

Finally, there is a further significant conclusion from this research. The application of Action research has been a major contributor to the success of this research. Not only, was the use of research methods to practical problems a way of gaining a true reflection of the underlying issues for my problem, but the feedback, direction by and interaction with the experts in the AR group and the senior management of the organisation has been instrumental in choosing the next steps.

Ownership for driving the process of AR is expected to sit with the researcher. This is implicit Coghlan & Brannicks (2010) explanations of how AR works. Therefore, decisions as to what methodology to apply rests exclusively with this person. However, the contribution of stakeholders and participants to the selection efficient actions, adjustments of research methods and/ or analysis of information cannot be underestimated.

In this research the true collaborative nature of the approach and an open-mindedness on all sides (researcher, stakeholders and participants) has resulted in a better understanding of a wide range of perspectives – internal and external to the organisation.

### **6.3. FUTURE RESEARCH**

This research set out to find ways to improve the quality of decision-making in the context of project approvals in the MRC. Whilst the progression of the continuous improvement programme is providing more and more solutions, there are significant questions, which this research has raised.

The most future research area arising relates to the complex environment surrounding the initial stages of a projects. Much of the evidence provided for strategic misrepresentation is derived from anecdotal evidence and would benefit from a thorough research relating to the drivers and expected benefits of the behaviour labelled as strategic misrepresentation. Such research would include a consideration of the different perspectives of organisations in an approval hierarchy and their respective aims and strategies. We know that national interests override organisational ones, but in which way does it differ in the judgement of effectiveness and benefit realisation. Can the effect of being seen to do something about a problem be higher than the effect of an action as such and for whom is this most beneficial?

Offerings of an analysis of numbers as a solution (RCF) seems to address only a minute element of this wider context and hence the application as a comprehensive solution that is currently suggested by the UK government is unproven and unlikely to be effective.

The mixed method of research as undertaken in this research has highlighted the effectiveness of this method in finding root causes for problems therewith enabling more appropriate actions for their solution. Joining up the multitude of disciplines in researching, risk, RCF, project performance in preparation in connection with organisational research and understanding of a wider organisational, social, political, economic and financial context could close a significant gap in knowledge both for academics and practitioners.

## 6.4. THE FULL CIRCLE

This research set out to find a way to develop fair and transparent processes that would mitigate inaccurate estimates in estates projects. It was to find tools, which would be used by both bidders and approvers to assess the calculations, adjusting where necessary or include in the considerations of project approval or rejection.

Through the literature review this aim was further refined by finding answers to key questions, which looked at the underlying influences in the organisation that may affect project estimation and approvals and whether Reference Class Forecasting may be an appropriate tool for testing accuracies of estimates.

My journey through the studies in the preparation of this research and the research itself has been deeply influential for a change in my approach to my work, in particular in relation to decision making. Essentially, it has widened my horizon, forcing me to delve deeper into the real roots of problems and allowing me to consider the position of others in relation to the problem. But it has also provided me with a better understanding of reasons for the failure of practitioners and academics to connect and interact.

This research gave me a very deep understanding of how my organisation approaches project initiation and development and what constraints and underlying dynamics influence the approval of projects. It includes an appreciation of the concerns of unit directors, who need to progress science at the highest possible standards with very limited funds and the pressure on approvers in HO to allocated very small budgets to the most promising proposals.

I have developed a database for projects in the technical estates area (focus on laboratories), which is promising to be a useful tool for the project teams to test their bias and approvers to test the viability of proposals. This data allowed me to step back from my own view of the performance of our projects and start to analyse other areas of concern in the organisation with similar statistics and the presentation of evidence-based information proved to be a very powerful argument, not easily defeated.

For example, I have initiated a review of all asset registers, analysing type and age of equipment, which has led to an evidenced based assessment of the requirement for capital allocation for replacement of scientific equipment as a contribution to the submission by MRC to UKRI as part of the spending review. It has provided a strong

argument and better comprehension of the problem as opposed to the plain statement, that fundamental research is underfunded and that other countries spend a higher percentage of GDP on this than the UK.

I was surprised about the extent of communication breakdown between MRC HO and its science community. In discovering this significant missing link, I unlocked a key element to the improvement of transparency and fairness. Without feedback from approvers regarding the funding decisions, bidders viewed the decisions as arbitrary and lost trust in the process. Equally, by promoting and encouraging Units to discuss their bids with the relevant Programme manager at HO prior to submission a much better understanding of the importance of proposals could be established, informing decisions for approval.

Regular visits and face-to-face communication have hugely improved the perception of the process and the amendment of the evaluation criteria to allow replacement of equipment has given units the confidence that their concerns are heard and acted upon. I am seeing more engagement by my colleagues with the units, be it with still a very formal (structured) way.

Is the process fairer? Not necessarily, but it is more transparent and the level of satisfaction and acceptance by bidders is significantly improved just by been given an understanding for the reasoning behind rejections for proposals. I have now initiated a consultation for a thorough review of the bid process and with a view of removing the estates related aspects from the competition with science focused bids, much supported by the units and the majority of the panel members themselves. This research formed the first step on a road to a much-improved situation in the organisation. It has identified action research as a very useful tool to approach larger issues in an organisation through structured fact finding to inform appropriate measurements as solutions.

Reflecting on the overall process of AR to solve the stated problem, I feel strongly that it has provided a higher level of acceptance for the findings and therewith support of the actions within the senior management of my organisation. It may be, because it reflects the approach in science and what our senior management (with a science background) consider to be thorough and robust. The interviews have been hugely beneficial in that I took a significant amount of time to talk about an area of concerns



by all participants and a way for them to express their views without the worry of being identified and seen as difficult or obstructive. I found a vast range of views of the problem, all valid in their own right and many of them not identified or considered by myself in my work.

However, as a practitioner, I recognise the need for speed in making decisions in the management of organisations. There is a place for AR in solving wicked problems, rather than applying a response that is suggested in management handbooks. It is not however, a method that should or could be applied to all aspects of organisational management as it takes time.

I see a gap between practitioners and academics in the lack of flexibility. The academic need for establishing a specific philosophy feels alien to me as a practitioner, who seeks to find ways to solve the problem. However, the requirement for establishing a robust methodology with a clear view of what kind of information is collected and how it will be analysed is important for the validity of the results and the acceptance of the findings.

There was a huge benefit in undertaking the literature review. It has alerted me to potential sources for the problem that I did not consider before and altered my route in this research (breakdown into three key questions). I have found myself diving much more often into online libraries to find articles on other issues I am facing in my work, but not to the extent as I have done as part of the research presented in this thesis.

I do note a significant aspect of difference in language between practitioners and academics, that may account for some of the barriers. As a practitioner, I like to write straight to the point avoiding long explanations as I need to focus the audience on the key problem and proposed solution. Lengthy papers are counter-productive in a management environment as they tend not be read thoroughly or draws readers to the areas, they have an interest in, therewith diverting from the real issues. Academic writing is very different to this and I could imagine that it prevents practitioners from submitting papers to a wider academic audience.

Personally, I have hugely benefitted from the engagement with the academic approach and believe that this could be mutual, because practitioners apply the theory in practice and can contribute to a debate with the experience from this.

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## 8. APPENDICES



## 8.1. APPENDIX A – LIST OF DOCUMENTS

<b>Document Description</b>	<b>document type</b>
Approval by School of Management, DBA Ethics Committee, dated 28th March 2016	hard copy
Consent forms (completed and signed by participants)	hard copy
Participant information form	electronic
recordings of interviews	electronic
transcripts/ notes of interviews	electronic
responses questionnaires (bidders)	electronic
responses questionnaires (approvers)	electronic
Interview list	electronic
MRC capital bid approval data	hard copy
notes from project files (information from contributing organisation)	electronic
project data MRC	electronic
database for RCF	electronic
presentation to working group RCF - first analysis	electronic
presentation to working group RCF - full analysis	electronic
Capital awards 2012	electronic
Capital awards 2013	electronic
Capital awards 2014	electronic
Capital awards 2015	electronic
Capital awards 2016	electronic
Capital awards 2017	electronic
report to MRC senior Management (findings from interviews in cycle 1)	electronic
notes of meeting working group RCF, dated 7th April 2016	electronic

notes of meeting at health organisation, dated 4 August 2016	electronic
notes of meeting with working group, dated 03.01.2018	electronic
notes of meeting with working group, dated 18.04.2018	electronic

## 8.2. APPENDIX B – INTERVIEW STRUCTURE

### 1. Position of the individual:

- Are you making applications for funding to the organisation?
- What is your involvement with the development of the project proposals (Project team member, SRO, SU, etc.)?
- Are you choosing the project team?

### 2. Project Development:

- Can you explain your experience with the inception (start-up) of a project?
- Are you involved in the development of the project estimates?
- If Yes, can you describe your experience with the development of the estimates?
- If No, can you explain, what your understanding of the estimates is?

### 3. Project Approval:

- What do you understand to be the process for approval of projects in your organisation?
- Are you aware of or do you understand the scoring criteria?
- Do you receive/ give feedback regarding failed project bids?

### 4. Value for Money

- How do you define Value for Money from your perspective?
- Can you establish a generic tipping point, where you would feel a project does not provide Value for Money?

### 5. Project Performance

- How accurate you experienced the project estimates to be?
- How effective do you feel the risk management at projects to be?

### 8.3. APPENDIX C – INTERVIEW SCHEDULE

ID	key reason	Date interview	comment
1	unique position to see the issue from the bidder and approver side	11.07.2016	complete, face to face
2	project member from inception to completion and beyond.	13.06.2016	complete, face to face
3	Project member from inception to completion and beyond. Key individual for the development of	15.06.2016	complete, face to face
4	Senior User for this project and applicant for funding	13.06.2016	complete, face to face
5	bidder for funding and Senior User for these projects	15.07.2016, 11.00am	complete, face to face
6	Senior User for this project and applicant for funding	16.08.2016 10.30am	complete, face to face
7	initiator for bids and key initiator for project estimates	09.08.2016, 9.00am	complete, face to face
8	bidder and key team member for the project from inception to completion and beyond	20.07.2016 3.00pm	complete, face to face
9	Senior User for this project and applicant for funding	16.08.2016 1.00pm	complete, face to face
10	key player in approval process and knowledgeable of approval processes in BIS	12.07.2016 11.00am	complete, face to face
11	project team member	13.06.2016	complete, face to face
12	Member of MRC Capital Bid Approval Panel	28.06.2016, 12.30	complete, face to face
13	Member of MRC Capital Bid Approval Panel	05.07.2016	complete, face to face
14	SRO	05.07.2016, 3.00pm	complete , via teleconference
15	Member of MRC Capital Bid Approval Panel	28.07.2016 12.00 hrs	complete, face to face
16	Senior User and applicant for the project funding	08.07.2016 1.30pm	complete, via skype
17	Project Manager for MRC and Transition manager	14.06.2016, 12.00	complete, face to face
18	finance director during major projects applications and member of approval panel	27.06.2016, 10.00am	complete, face to face
19	Unit Director/ senior User.	12.07.2016, 3.00pm	complete , via teleconference
20	business analyst	11.08.2016,	complete, face to face
21	policy maker	21.07.2016, 9.30am	complete, face to face
22	member of capital bid panel and programme director for DRI (application to BIS)	11.08.2016, 2.00pm	complete, face to face
23	Member of MRC Capital Bid Approval Panel	25.07.2016, 1.00pm	complete, face to face
24	initiator for bids and key initiator for project estimates	13.07.2016, 10.30am	complete, face to face

## 8.4. APPENDIX D – RETURNS QUESTIONNAIRES

ID	key reason for selection (for interviews Cycle 1)	Questionnaire returned	comment
1	unique position to see the issue from the bidder and approver side	Yes	complete return
2	project member from inception to completion and	Yes	complete return
3	Project member from inception to completion and beyond. Key individual for the development of project	Yes	complete return
4	Senior User for this project and applicant for funding	No	left organisation
5	bidder for funding and Senior User for these projects	No	no comments given
6	Senior User for this project and applicant for funding	No	no comments given
7	initiator for bids and key initiator for project estimates	Yes	complete return
8	bidder and key team member for the project from inception to completion and beyond	Yes	complete return
9	Senior User for this project and applicant for funding	No	left organisation
10	key player in approval process and knowledgeable of approval processes in BIS	Yes	complete return
11	project team member	Yes	complete return
12	Member of MRC Capital Bid Approval Panel	Yes	complete return
13	Member of MRC Capital Bid Approval Panel	Yes	complete return
14	SRO	No	left organisation
15	Member of MRC Capital Bid Approval Panel	Yes	complete return
16	Senior User and applicant for the project funding	No	not available
17	Project Manager for MRC and Transition manager	No	left organisation
18	finance director during major projects applications and member of approval panel	No	left organisation
19	Unit Director/ senior User.	Yes	complete return
20	business analyst	No	not applicable (external to
21	policy maker	No	not applicable (external to
22	member of capital bid panel and programme director for DRI (application to BIS)	Yes	complete return
23	Member of MRC Capital Bid Approval Panel	Yes	complete return
24	initiator for bids and key initiator for project estimates	Yes	complete return

## 8.5. APPENDIX E - QUESTIONNAIRE BIDDERS – RESEARCH CYCLE 2

1.1.	Project Approval Process	YES	NO	Don't Know
1.1.	Did the capital bid call (for funding 2017/18) clearly identify the process of bidding, evaluation and award?			
1.2.	Have you noticed an improvement of the process for capital award in general?			
1.3.	Are you aware of available approval pathways for funding within MRC?			
1.4.	Do you consider the evaluation criteria applied for the capital bid awards to be fair and relevant?			
Tick relevant box				

What criteria represents "value for money" in science? **(Please choose**

**up to three criteria).**

a)	cost of science			
b)	enabling career development			
c)	providing a definite answer to a specific scientific problem			
d)	achieving a "wow" factor			
e)	providing research opportunity			
f)	enabling future proofing			
g)	supporting the science strategy			
h)	reducing level of disruption			
i)	enabling the publication of papers			
j)	enabling / increasing grant funding			
k)	offering an efficient path to intervention			
l)	economic/ monetary value			
m)	offering scientific impact			
n)	making science/ research easier			
o)	providing pay back/ return on investment			
p)	enabling leap frogging of science			
r)	providing business continuity			
s)	enabling compliance with statutory regulations			
t)	enabling compliance with Health & Safety			
		YES	NO	Don't Know
1.6.	Did the submissions identify the benefits, which the projects/bids provide?			
1.7.	Have the benefits of awarded projects/bids for FY 2016/17 been measured?			

<b>2</b>	<b>BIDDERS ONLY</b>	<b>YES</b>	<b>NO</b>	<b>Don't Know</b>
2.1.	Have you employed external professionals to develop the project /bid costs and scope?			
2.2.	Have you received support and advise from MRC HO Estates in developing your case for the project?			
2.3.	If your answer is "No", have you requested that support?			
2.4.	Did you submit request(s) for capital funding through the capital bid process?			
2.5.	Did you gain funding approval for the bids you consider highest priority?			
2.6.	Were you aware of the evaluation criteria applied to the bids?			
2.7.	Were the bid(s) awarded already supported through your QQR recommendations?			
2.8.	Did you discuss your bids with relevant representatives from RPG prior to the evaluation process?			
2.8.1	If you answered with YES, did you approach RPG?			
	Tick relevant box			
2.8.2.	If you answered with NO, can you explain, why you did not approach RPG (tick appropriate box):			
a)	bid too simplistic/ straight forward, needed no explanation			
b)	time constraints			
c)	expect evaluators to approach me, if they need further information			
d)	don't wish to comment			
		<b>YES</b>	<b>NO</b>	<b>Don't Know</b>
2.9.	Have you been informed of the awards being made?			
2.10.	have you had feedback as to what score individual projects/bids received and why?			
2.11.	Are you content with the decision made by the panel?			
2.12.	Did you receive funding approvals through pathways other than the capital bid process?			
	Tick relevant box			
2.12.	If so, please identify, how /who provided approval			
a)	Management Board			
b)	BEIS			
c)	direct approval from MRC HO Finance			
d)	other			
		<b>YES</b>	<b>NO</b>	<b>Don't Know</b>
2.13.	Have the projects/bids you received awards for FY 2016/17 been completed?			
2.14.	If so, were they completed within the awarded budget?			
2.15.	If not, has HO Finance or RPG been informed?			

## 8.6. APPENDIX F - QUESTIONNAIRE APPROVERS – RESEARCH CYCLE 2

1.1.	Project Approval Process	YES	NO	Don't Know
1.1.	Did the capital bid call (for funding 2017/18) clearly identify the process of bidding, evaluation and award?			
1.2.	Have you noticed an improvement of the process for capital award in general?			
1.3.	Are you aware of available approval pathways for funding within MRC?			
1.4.	Do you consider the evaluation criteria applied for the capital bid awards to be fair and relevant?			
Tick relevant box				

What criteria represents "value for money" in science? (Please choose up to three criteria).

a)	cost of science			
b)	enabling career development			
c)	providing a definite answer to a specific scientific problem			
d)	achieving a "wow" factor			
e)	providing research opportunity			
f)	enabling future proofing			
g)	supporting the science strategy			
h)	reducing level of disruption			
i)	enabling the publication of papers			
j)	enabling / increasing grant funding			
k)	offering an efficient path to intervention			
l)	economic/ monetary value			
m)	offering scientific impact			
n)	making science/ research easier			
o)	providing pay back/ return on investment			
p)	enabling leap frogging of science			
r)	providing business continuity			
s)	enabling compliance with statutory regulations			
t)	enabling compliance with Health & Safety			
		YES	NO	Don't Know
1.6.	Did the submissions identify the benefits, which the projects/bids provide?			
1.7.	Have the benefits of awarded projects/bids for FY 2016/17 been measured?			



		YES	NO	Don't Know
2.4.	Have the bidders been informed of the award decision in writing?			
2.5.	Have the bidders received feedback as to what score individual projects/bids received and why?			
2.6.	Are you content with the decision made by the panel?			
2.7.	Are you aware of any funding approvals through pathways other than the capital bid process (relating to your area of responsibility only)?			
Tick relevant box				
2.7.1.	If so, please identify, how /who provided approval			
a)	Management Board			
b)	BEIS			
c)	direct approval from MRC HO Finance			
d)	other			
		YES	NO	Don't Know
2.13.	Have projects/bids that received awards for FY 2016/17 within your area of responsibility been completed?			
2.14.	If so, were they completed within the awarded budget?			
2.15.	If not, has HO Finance or RPG been informed?			
<b>3.</b>				
		YES	NO	Don't Know
3.1.	Did you find the submitted bids concise and clear as to their purpose and priority?			
3.2.	Did you agree with the priorities identified by the bidders for the individual bids/projects?			
3.3.	Did you discuss your bids with relevant representatives from the relevant unit/Institute/bidder prior to the evaluation process?			
3.4.	If you answered with YES, did you approach the relevant Unit/Institute/Bidder?			
Tick relevant box				
3.4.1	If you answered with NO, can you explain, why you did not approach the relevant Unit/Institute/Bidder (tick appropriate box):			
a)	bid too simplistic/ straight forward, needed no explanation			
b)	time constraints			
c)	expect Units/Institute/Bidder to approach me, if they wish to provide more insight to their submission			
d)	do not wish to comment			

## 8.7. APPENDIX G - TABLE WITH SUMMARY DATA FOR REFERENCE CLASSES

Description		All Projects	New build Laboratories	all New build projects	All Laboratory facilities	All Animal Facilities	All refurbishment projects	All projects with Complexity 5	All projects with Complexity 4	All projects with complexity 3	All projects with complexity 2	All projects Complexity 4&5	All projects complexity 2&3	All projects with value over £50m	All projects with value between £10m - £50m	All project with value between £1m - £10m	All projects below value of £1m
Number of Projects N		26.0	8.0	13.0	15.0	4.0	9.0	6.0	7.0	9.0	4.0	13.0	13.0	3.0	3.0	12.0	8.0
Number of Projects with Cost Overrun		13.0	4.0	7.0	6.0	4.0	3.0	3.0	3.0	5.0	2.0	6.0	7.0	1.0	2.0	7.0	4.0
Number of Projects with Cost Overrun in %		50.0	50.0	53.8	40.0	100.0	33.3	50.0	42.9	55.6	50.0	46.2	53.8	33.3	66.7	58.3	50.0
Cost overall - all projects (%)	Mean	10.2	11.5	12.8	4.2	47.6	-1.7	-1.0	9.6	12.9	-4.9	13.0	7.5	5.5	15.6	2.4	21.8
	Min	-43.9	-7.4	-13.0	-43.9	18.1	-43.9	-7.4	-43.9	-25.5	-32.2	-43.9	-32.2	-4.0	-7.4	-43.9	-17.9
	Max	117.0	59.6	59.6	72.2	117.0	72.2	59.6	117.0	72.2	22.0	117.0	72.2	21.2	36.2	59.6	117.0
	Median	4.3	4.9	10.6	-0.8	27.6	-14.0	8.7	-13.0	9.7	-4.6	-0.8	8.7	-0.8	18.1	2.0	4.8
	Mode	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cost escalation (%) projects with overrun only	Mean	34.7	27.1	28.9	33.3	47.6	33.6	38.0	51.0	30.7	15.3	44.5	26.3	21.2	27.1	25.8	55.2
	Min	8.6	10.6	10.6	10.6	18.1	9.6	18.1	17.0	9.6	8.6	17.0	8.6	21.2	18.1	8.6	9.6
	Max	117.0	59.6	59.6	72.2	117.0	72.2	59.6	117.0	72.2	22.0	117.0	72.2	21.2	36.2	59.6	117.0
	Median	21.2	19.1	21.2	20.1	27.6	19.0	36.2	19.0	21.2	15.3	27.6	21.2	21.2	27.1	18.0	47.1
	Mode	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Contingency in £ (FBC) projects with overrun only	mean	1,019.3	2,346.2	1,807.4	1,602.1	781.9	106.9	1,096.6	97.4	1,864.5	173.2	597.0	1,381.3	8,747.9	1,439.5	241.4	43.9
Contingency in % of FBC cost estimates (overrun only)	mean	9.4	10.2	10.5	10.2	7.2	14.2	6.5	8.2	8.9	14.5	7.8	11.2	12.2	7.0	5.5	21.3
% of contingency (of FBC cost) of projects without cost overrun	mean	13.7	13.6	13.6	13.7	N/A	10.8	13.6	12.6	5.9	24.3	13.6	17.5	13.4	25.9	17.2	10.1
all projects Average Contingency in %	mean	13.0	13.2	13.0	13.3	N/A	10.6	13.2	10.9	10.8	21.1	13.1	12.0	13.2	12.2	10.2	8.6

Description		All Projects	New build Laboratories	all New build projects	All Laboratory facilities	All Animal Facilities	All refurbishment projects	All projects with Complexity 5	All projects with Complexity 4	All projects with complexity 3	All projects with complexity 2	All projects Complexity 4&5	All projects complexity 2&3	All projects with value over £50m	All projects with value between £10m - £50m	All project with value between £1m - £10m	All projects below value of £1m
Number of Projects with Time Overrun		18.0	5.0	10.0	10.0	3.0	5.0	4.0	3.0	7.0	3.0	8.0	10.0	2.0	3.0	7.0	6.0
Number of Projects with Time Overrun in %		69.2	62.5	76.9	66.7	75.0	55.6	66.7	42.9	77.8	75.0	61.5	76.9	66.7	100.0	58.3	75.0
Time variance overall in %	Mean	39.7	20.4	29.3	28.2	53.8	35.0	14.9	37.2	61.0	35.3	26.3	53.1	16.3	7.5	29.6	75.7
	Min	-10.2	-10.2	-10.2	-10.2	0.0	0.0	0.0	0.0	-10.2	0.0	0.0	-10.2	-10.2	7.0	-3.8	0.0
	Max	200.0	78.1	170.0	116.7	200.0	116.7	35.0	200.0	170.0	100.0	200.0	170.0	35.0	8.3	170.0	200.0
	Median	8.7	15.7	8.3	9.1	7.7	3.7	8.3	0.0	78.1	20.6	7.1	37.5	24.2	7.1	6.6	92.6
	Mode	0.0	N/A	N/A	0.0	N/A	0.0	N/A	0.0	N/A	N/A	0.0	N/A	N/A	N/A	0.0	0.0
Time overrun in % (overrun projects only)	Mean	58.1	35.4	39.4	43.7	71.8	62.9	16.3	86.8	80.4	47.1	42.8	70.4	29.6	7.5	51.3	100.9
	Min	3.7	7.1	4.2	3.7	7.0	3.7	7.0	27.8	4.2	3.7	7.0	3.7	24.2	7.0	4.2	3.7
	Max	200.0	78.0	170.0	116.7	200.0	116.7	35.0	200.0	170.0	100.0	200.0	170.0	35.0	8.3	170.0	200.0
	Median	33.8	32.7	26.0	33.8	8.3	91.7	8.3	32.7	91.7	37.5	26.0	84.9	29.6	7.1	32.7	96.8
	Mode	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A