Defence Scientific Advisory Council

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REPORT OF A WORKING PARTY ON

THE MOD RESPONSE TO THE MACPHERSON REVIEW

(Communicated by: Mrs Judith Rawle and Prof Peter Johnson)

(Status of Report: Final Report ver 1.0)

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Executive Summary

S-1. The MOD has produced an action plan in response to the recommendation of the Macpherson review of the quality assurance of analytical models used in government. A short DSAC study was commissioned to provide an independent peer review of the plan to provide assurance that the proposed measures are appropriate and comprehensive. The objectives of this study were to:

- Suggest any further measures needed
- Suggest areas where the proposed measures could be strengthened
- Provide assurance where the proposed measures were appropriate.

S-2. The study focused on a review of the plans and any associated systemic issues rather than providing an audit of individual areas or models.

S-3. From the evidence made available, the study concluded that the proposed measures in the action plan were appropriate.

S-4. A small number of specific further measures and strengthening of proposed measures are recommended as shown on the following page. The detailed findings and conclusions of the report should also be considered in the actions being taken forward by the MOD.

S-5. All recommendations are directed at the Cross Defence Macpherson Implementation Working Group under the leadership of the MOD Chief Economist.

Recommendations

R-1. The MOD should continue to implement the action plan.

R-2. The MOD should ensure that all models (operational, financial, and overarching option selection) that contribute to business critical decisions are covered by the actions.

R-3. The MOD should consider developing more guidance on how to determine the level of QA that will be appropriate to apply to different models. This could be based on the collection of metrics on the use of models. We would expect the justification for conducting a particular level of QA to be documented.

R-4. The MOD should share guidance with organisations that conduct modelling on behalf of the MOD.

R-5. The MOD should ensure that responsibility for the assurance of all modelling and analysis that supports a decision is clearly allocated and understood.

R-6. The MOD should maintain the excellent culture and professionalism that exists while developing a culture of identifying and openly reporting errors at the component and holistic levels as part of the assurance process.

R-7. The MOD should ensure there is full recognition of the ability and competence of the staff involved to foster staff morale, professionalism and staff retention. Providing education and understanding is vital: providing more procedures and checklists can circumvent understanding unless the appropriate QA education and learning culture is also in place.

R-8. The MOD should ensure there are ways in which new practices can evolve. Mechanisms for collecting, sharing and applying and tailoring practices are needed for the evolution of good practices and the mitigation of bad practices. This applies to both within the MOD and between the MOD and its suppliers.

R-9. The MOD should develop and maintain an internal documented list (or lists) of all significant models and modelling being carried out across the MOD to enable each organisation to gain an understanding of the models in their area and how business critical they are. These lists will also allow the MOD to construct the Business Critical Model (BCM) list.

Contents

Introduction

The Macpherson Review

1. Following the problems in the award process for the InterCity West Coast franchise by the Department of Transport, Sir Bob Kerslake and Sir Jeremy Heywood commissioned a review of the quality assurance (QA) of analytical models that inform policy across government. The review was led by Sir Nick Macpherson, Permanent Secretary at the Treasury and published a report in March 2013.
2. The report set out a list of recommendations to ensure modelling across government is subject to the appropriate QA procedures. In particular, the report recommended that all departments and their arms-length bodies should have in place a plan for how they will create the right environment for QA and ensure that they have effective processes, including guidance and model documentation.

The Ministry of Defence Response

3. The Ministry of Defence (MOD) was engaged throughout the review and, following the publication of the review, it conducted a light-touch self-assessment with the main areas of the MOD that carry out business critical analytical modelling. This has been used to develop a MOD Action Plan setting out the purpose and nature of modelling in the MOD, the current QA processes and environment, and the strategy for ensuring that MOD is employing best practice in QA.
4. The outcomes the MOD is working towards are to:
    - Have appropriate QA processes in place for analytical models
    - Respond appropriately to all of the Macpherson Review's recommendations in a timely manner.
5. The MOD has also contributed to the wider government development of analytical modelling QA.

The DSAC Study

6. The MOD commissioned this DSAC study to provide an independent view of its response to provide assurance that the proposed measures are appropriate and comprehensive. The objectives of the study were to:
    - Suggest any further measures needed
    - Suggest areas where the proposed measures could be strengthened
    - Provide assurance where the proposed measures were appropriate.
7. The study focused on a review of the plans and any associated systemic issues rather than providing an audit of individual areas or models. It was conducted in very short timescales and the nature of the findings and conclusions reflect this quick and short review. The terms of reference, members of the study team, and contributors are documented in Appendix A.

Findings and Conclusions

8. This section contains an overall view of our findings from the review of material provided and the interviews conducted and the conclusions we drew.

Culture

9. The professional attitude of all those interviewed was found to be exceptionally good and reassuring. This is to be highly commended and maintained. It was clear that each person took responsibility for the quality of their work taking very high levels of care and attention. This professional attitude was found within local groups as well as in individuals. The proposed changes need to ensure that individual and local professionalism is not damaged. The proposed changes need to ensure there is not disproportionately more emphasis on checking the data sets, and/or the assumptions behind them, while assuming that others are considering and assuring quality in other areas of modelling.

10. The Macpherson review requires that a holistic view of models and their use is maintained at every level to ensure quality and assurance. In many areas there appears to be a good emphasis on taking a holistic view of the modelling. This is to be commended. The whole is more than the sum of the component parts: therefore it is essential to ensure that there is assurance at the component level and of the whole. The study team found some instances where assurance was only at the component level and measures to provide holistic assurance were required.

11. There is very good professionalism in all aspects of modelling. There is a strong culture of making sure that everything is correct. This is to be commended. In any organisation that punishes mistakes there is a danger that this approach encourages attempts to prove things are right rather than acknowledging where they are wrong. If people do not look for errors or if, when errors are found, they are corrected but not reported, there is less chance that learning occurs across the organisation. Creating a culture that supports and encourages the identification and open reporting of errors when they are found is important.

12. There is not a single culture in the MOD but many different cultures. Those cultural differences influence the way that quality assurance in modelling is interpreted and provided. The MOD as a whole needs to ensure that the Macpherson review recommendations are not distorted by those cultural differences.

Coverage of Models

13. The MOD initially identified four organisations in which business critical modelling and analysis is conducted: Dstl, DE&S, DIO and Defence Statistics. These organisations provided information on a number of Business Critical Models (BCM) to the Macpherson Review. As part of the Action Plan, the MOD has identified additional organisations that use quantitative models or that are beginning to consider using them.

14. The study team considered the types of model being covered by the QA processes and found that many of the models that were core to the organisation were covered, but that there were cases where not all of the associated models were being identified. For example, the cost model associated with a business case could be covered but not the model of operational benefit (or effectiveness). The team believes that more could be done to cover the models of operations (typically operational benefit or operational effectiveness) and option selection models.

15. The study team found that in a number of areas there was some uncertainty about the selection criteria for models to be declared as business critical[1]. In some cases the decision to declare a model business critical or not leads to an implied two-tier level of QA to be applied.

16. Individual organisations are deciding which models should be declared as Business Critical Models as defined in the Macpherson report with no evident common definition or check of coherence: this may lead to less critical models from smaller organisations being included above more critical models from larger organisations. This is a deliberate policy to achieve buy in, and an acceptance of ownership, by the organisations.

17. The BCM list, with specific QA requirements attached to models on it, needs to be an output from the QA processes, not an input. The decision about how business critical a model will be may not always be easy to make and may change over time. The MOD should allow for there being a spectrum of models requiring different degrees or levels of assurance activity. Good practice assurance should be applied across all analytical modelling.

18. There was evidence of a good variety of methods of communication of the Macpherson review[2] and its recommendations. Planned updates to key documents such as the approvals guidance[3] for business cases will also raise awareness of the need for appropriate levels of QA to be applied.

19. The MOD as a whole should know what models are being used to support decisions. This knowledge does not have to be in a single list but the hierarchy of models used for any decision should be open and transparent within the organisation. A view of how critical the decisions supported by a model are is useful to enable decisions to be taken on the level of assurance to be applied. A slice from the top of this internal list can then be used to inform the MOD's BCM list.

20. There is a good level of communication of the Macpherson Review and the proposed actions. Plans to provide further information and guidance through electronic media such as the "wiki pages" being developed by Dstl and the shared working environments being proposed by CAAS are welcome improvements.

[1] And hence be included on the Business Critical Model (BCM) List.

[2] Examples include memos and blog entries

[3] Approvals Guidance, providing details of the Approvals and Scrutiny process, published as part of the Acquisition Operating Framework

Appropriate Staff and Training

21. Staff at all levels show considerable professionalism. Their workloads are high, their work is complex and across the organisation the work is diverse involving many different professionals. Providing all staff with education and understanding of quality assurance of models is vital.

22. The diversity of professionals involved and the complexity and pressure of the work make it harder to ensure all those involved in modelling are appropriately educated and have relevant understanding of the recommendations of the Macpherson review. All people we met were eager to learn and to maintain their professionalism. The study team found evidence of more procedures and checklists being requested. Although these can be helpful for experienced people, there is a danger that providing these on their own will circumvent learning, education and understanding. It is important that staff should have the understanding, know the meaning, and have the ability and skills in order to assure a culture of responsibility and ownership

23. Some concern was expressed to us about the ability to operate when it is difficult to recruit and retain staff. We felt that recognition of the excellent culture and professionalism of the staff and the provision of education, learning and career progression would support both recruitment and retention.

24. It is important that individuals have a holistic understanding of how the Macpherson recommendations apply in their organisation, programme, project or study as well as an understanding of how they apply to the specific work they are conducting. People involved at each level and aspect of developing, applying and using models, must have this holistic understanding while knowing how to provide quality assurance applicable to the level and nature of their work.

25. The nature of the work, as we have said, is complex and diverse across the MOD. To enable a continual assurance there needs to be 'expansive learning". Expansive learning is where the individual and the organisation take responsibility for continually developing their learning and understanding. This involves learning about the work, learning about the changes in the work and learning about the ways to learn about the work. It involves a process by which individuals and the organisation capture and disseminate knowledge to ensure that professional learning occurs.

26. There needs to be full recognition of the ability and competence of the staff involved. This is important for staff morale, professionalism and staff retention. How that recognition is achieved and rewarded needs careful consideration.

Processes and Guidance

27. Mature processes and guidance for quality assurance of modelling exists in the longer established modelling and analysis areas such as Dstl (for operational analysis) and CAAS (for cost modelling). D Scrutiny also provides guidance on modelling and analysis for use in business cases.

28. The other areas in the MOD that the study team talked to were making good use of this existing material, by using it, or in developing their own guidance. Some areas are

going through the early stages of considering how to provide assurance on activities that have not previously used quantitative modelling.

29. Where there is an understanding that there are a number of levels of QA that could be applied to the analysis, there is some uncertainty over how the level of QA to be applied to an individual model or suite of models should be determined.

30. Evidence was provided that the updated approvals guidance[4] will provide requirements for QA of modelling and analysis. There are various guidance documents that cover modelling including JSP 507[5], guidance on cost modelling by CAAS, and the Aqua book that will provide additional guidance.

31. At the conceptual level, the existing processes and guidance with additions from the Action Plan will provide a good basis for the development and use of models. We have not looked at the lower level processes and guidance in any detail as they will be specific to the individual organisations. We did, however, note that all organisations were developing their own processes and guidance or planning to use existing ones from other areas. One requirement that is common across the MOD as a whole is for more guidance on how to determine what level of QA is appropriate to apply to models.

Sharing Good Practice

32. There is good practice to be found in every part of the MOD that we visited in connection with this peer review and there were a variety of mechanisms for collecting and sharing that good practice. As the MOD is such a large and varied organisation, sharing good practice across the Department can be difficult and slow. Moreover, despite how well something works in one area it is likely to need tailoring to be applied elsewhere to good effect. Consequently, mechanisms for collecting, sharing and applying and tailoring good practice are needed. One area of promise we found was in Dstl where the Physical Sciences Department has developed a modelling wiki that is accessible to all and provides a living, dynamic mechanism for collecting, identifying, sharing, applying and tailoring good practice[6].

33. There was evidence of the MOD being engaged in pan- and cross-government sharing of good practice including contributions to the new Analytical Quality Assurance (AQuA) book and participation in the cross-governmental working group set up to discuss, and share best practice in, the quality assurance of modelling across the government.

34. The MOD has a significant engagement with external suppliers. The MOD must consider if and how the good practices for the quality assurance of modelling in MOD business critical decisions are also shared with its external suppliers. In addition some good

[4] Approvals Guidance, providing details of the Approvals and Scrutiny process, published as part of the Acquisition Operating Framework

[5] Joint Service Publication (JSP) 507: MOD Guide to Investment Appraisal and Evaluation

[6] We have assumed that this wiki will be moderated to ensure the quality and usefulness of the material it contains.

practices that the MOD would benefit from may exist or be developed in its suppliers. Hence there is a need to consider how good practice is shared between the MOD and its suppliers in both directions.

35. As has been mentioned above, it is important to understand how good practice is not only collected and shared but also applied. Hence there need to be mechanisms for continual learning and wherever good practice emerges applying it everywhere that is appropriate. These will need to include mechanisms for tailoring good practice to fit local contexts and constraints, and for supporting its adoption.

36. The converse of sharing good practice is mitigating and inhibiting bad practice when it emerges. Consequently, practice needs to be shared in order to detect bad or worse practices elsewhere. Through building large communities for the sharing of practices the community can work to both detect and mitigate bad practices. Care must be taken to ensure that new practices can still evolve otherwise stagnation can occur and simply through standing still the current good practice can become bad practice in comparison to a better practice. Hence sharing and continual evolution of practices leads to the evolution of good practices and the mitigation of bad practices whilst also overcoming complacency and stagnation in a changing and complex world.

Roles and Responsibilities

37. The Modelling Champions spoken to were actively engaged in the activities associated with the Action Plan. There was also evidence that Senior Responsible Owners are being appointed for each business critical model[7]. The roles and responsibilities of Modelling Champions and Model Senior Responsible Owners seem to be well documented and understood.

38. It was not always clear which organisation was providing overall modelling quality assurance when multiple organisations were working together. This is particularly an issue where a number of different models are contributing to a decision. The new approvals guidance is expected to make the roles and responsibilities clearer in this situation.

39. In some instances the study team did not feel that the roles and responsibilities of the original model developer and subsequent model users were clear. In some cases the model user was also the model developer but in other cases the developer had left the model with the user to maintain and continue using. There is a risk that this may leave the user with insufficient knowledge of the model to act as the model owner. The overall responsibility for assurance of the analysis across the suite of models used to support a decision or area also needs to be clear.

40. Roles and responsibilities are relatively well defined where the activity being supported is run as a programme or project. The level of assurance is also reviewed by the Scrutiny community where a formal business case is being generated and approved. It is less clear where responsibility lies when the model is supporting decision making in

[7] As required by the Macpherson recommendations.

policy and strategy areas. It was also noted that these areas are not covered by the independent review of the scrutiny community.

Model Assurance Documentation

41. The plans for providing logs of the assurance activities applied to models vary across the MOD. Signed formal statements of adherence to standards of assurance that pass up the management line in some cases, and informative, but less formal, descriptions of the models and assurance activities and attributes that would provide confidence in them. The study team believe that these differences are appropriate given the variety of type and use of model involved.

42. The review team did not look at the information that is being provided to decision makers about the quality of the modelling results and their limitations. The changes to the Approvals Guidance are expected to provide guidance on this.

Recommendations

43. Our findings and conclusions presented in the previous section lead us to make the following recommendations. The MOD, under the leadership of the MOD Chief Economist, should:

44. **Recommendation 1**: continue to implement the action plan.

45. **Recommendation 2**: ensure that all models (operational, financial, and overarching option selection) that contribute to business critical decisions are covered by the actions.

46. **Recommendation 3**: consider developing more guidance on how to determine the level of QA that will be appropriate to apply to different models. This could be based on the collection of metrics on the use of models. We would expect the justification for conducting a particular level of QA to be documented.

47. **Recommendation 4**: share guidance with organisations that conduct modelling on behalf of the MOD.

48. **Recommendation 5**: ensure that responsibility for the assurance of all modelling and analysis that supports a decision is clearly allocated and understood.

49. **Recommendation 6**: maintain the excellent culture and professionalism that exists while developing a culture of identifying and openly reporting errors at the component and holistic levels as part of the assurance process.

50. **Recommendation 7:** ensure there is full recognition of the ability and competence of the staff involved to foster staff morale, professionalism and staff retention. Providing education and understanding is vital: providing more procedures and checklists can circumvent understanding unless the appropriate QA education and learning culture is also in place.

51. **Recommendation 8:** ensure there are ways in which new practices can evolve. Mechanisms for collecting, sharing and applying and tailoring practices are needed for the evolution of good practices and the mitigation of bad practices. This applies both within the MOD and between the MOD and its suppliers

52. **Recommendation 9:** the MOD should develop and maintain an internal documented list (or lists) of all significant models and modelling being carried out across the MOD to enable each organisation to gain an understanding of the models in their area and how business critical they are. These lists will also allow the MOD to construct the Business Critical Model BCM list.

APPENDIX A: Terms of Reference, Working Party and Contributors

A-1. Following the publication of the Macpherson Review of the quality assurance of analytical models that inform policy across government, the MOD conducted what it considered a "light-touch" self-assessment and used this to develop an Action Plan to address the Review's recommendations. The MOD requested a review team from the Defence Scientific Advisory Council (DSAC) to review this plan to provide assurance that the measures being proposed were appropriate and comprehensive.

A-2. **The objectives** of the study were to:

- Suggest any further measures needed
- Suggest areas where the proposed measures could be strengthened
- Provide assurance where the proposed measures were appropriate.

A-3. **The sponsor** for this review was the MOD Chief Economist.

A-4. **The scope** of the review was agreed as:

- Probing to examine whether the range of identified business critical models is adequate
- considering whether the proposed measures and their delivery plan is adequate in scope and depth
- limited to focus mostly on the areas producing and using models considered to be "business critical"
- limited to fit the planned days available.

A-5. **The approach** consisted of the following activities:

- An initial kick-off meeting with the sponsor
- Desk review of the material provided on the Macpherson Review and the actions planned and taken by the MOD and generation of a set of areas to be covered in interviews
- Interviews with appropriate individuals and groups to gather evidence for the review
- Consolidation of the findings and generation of conclusions and recommendations
- Presentation to, and discussion with, the Sponsor and production of this formal report.

A-6. **The DSAC working party** comprised:

- Prof Peter Johnson
- Mrs Judith Rawle

A-7. The study was carried out between February and April 2014.

A-8. The following individuals and groups provided an input to this review:

- MOD Chief Economist
- The Cross Defence Macpherson Implementation Working Group
- Dstl
    - Chief Technical Officer (Dstl Modelling Champion)
    - Chief Scientist Policy and Capability Studies
    - Technical QA Lead – Chief Scientist Naval Systems
    - Physical Sciences Department – Chief Scientist and Lead Implementer
- DE&S
    - Head Cost Assurance and Analysis Service (CAAS)
    - Deputy Head, Cost Engineering and Forecasting, CAAS (DE&S Modelling Champion)
    - CAAS Customer Relationship Managers and Gateways
    - Weapons Operating Centre Finance Team Lead
    - ISS Finance Head
    - Air Support Approvals Assurance Team Lead
    - A400M Project Team
    - KPMG Technical support to CAAS
- Defence Statistics
    - Statistician Head of Branch, Defence Statistics (Navy) (Defence Statistics Modelling Champion)
    - Defence Statistics (Army)
- DIO
    - Deputy Head of DIO TLB Finance (DIO Modelling Champion)
    - Senior Finance Officer for investment appraisals in GEC
    - Financial Technical Scrutiny
- Head Office
    - Head of Scrutiny (Land, Estates and Policy)
    - Futures and Analytical Methods, Defence Intelligence
    - Management Accountancy Services (Army)
- Navy Command HQ
    - Operational Capability Management SO2

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