GOOD ENOUGH FOR GOVERNMENT WORK

Introducing a Network Approach to Quality Assurance of Operational Research in support of Public Policy Design and Implementation

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Modelling Integrity Topics

• Motive
  • Why do Quality Control and Assurance?

• Means
  • Embedding quality
  • How to do this?
    • Working tools
  • Who does what and when
    • 5 Steps

• Opportunity
  • Shaping Process and Collaboration

• Q and A
• Discussion
“Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful.”

George E. P. Box

Modelling Integrity gives confidence in how wrong a model is and that it is still useful for the question at hand.
Motive - West Coast Mainline

15 August 2012 – Franchise award to FirstGroup - challenged by Virgin through High Court

3 October 2012 - Award scrapped - Virgin continue running the route during rerun

‘The **errors** exposed by our investigation are deeply concerning. They show a lack of good process and a **lack of proper quality assurance**… 'completely unacceptable mistakes’

‘I am determined to identify exactly what went wrong and why, and to put these things right so that we **never** find ourselves in this position **again**.’

Philip Rutnam

*Permanent Secretary at the Department for Transport*

https://www.theguardian.com/uk/2012/oct/03/west-coast-mainline-process-derailed
Motive - Why MI?

- **Modelling Integrity** is essential to produce requisite, reliable, rigorous evidence as a basis for decision and policy design
- **Macpherson** Review of modelling
  - Set **requirements** across Government
- **The AQUA book**
  - High level ways to implement these
- Analysis Leadership Team endorsed **Network** Approach in BEIS
  - Maintain **reputation** as quality Analysts
  - By following the process better models tend to be built

Means - 3 working tools

- **QA Log** is the lynchpin - 5 criteria: 30 questions => Score Target 85 or 90
  - **Sum** of model scores gives state of modelling in **BEIS**
- **Model Report** introduces the model, collecting key information in one place
- **Assumptions Log** – often essential to understand risks and uncertainties

[Links]
- [intranet.beis.gov.uk/task/modellingintegrity](https://intranet.beis.gov.uk/task/modellingintegrity)
Means - Who

- Previously:
  - DECC Modelling Integrity Team and Circle of QA Champions
  - BIS project support

- Now:
  - BEIS Team of One
  - Scope and tempo of work need flexible collaboration to deliver
    - Network of Mutual Support as part of the Analyst day job
      - Annual objectives for Analysts
        - Analyst in one area does
          - Quality Control on model in own area
          - Quality Assurance for another area
  - Assurance comes from independent view
    - No marking of own homework
  - QA Champions reinforce the network
Opportunity – through Network

• Manage **Capability** rather than a team:
  • **Doctrine** – Theory and Authority
  • **Equipment** – the means – QA Log – plus the Tracking Sheet
  • **Sustainability** - Mapping tracking and **communication**
    • Develop **Connections** – match making
    • **Depth** of Quality Assurance needed and **Time** to implement
  • **Personnel** - Analysts
  • **Organisation** – Machinery of Government
  • **Training** – Use of QA Log

• Problem Structuring Methods assist with **Scoping models**
  • **Understand** the policy problem
    • Determine key **variables**
    • Agree what the model needs to do to be **useful**
Capability – Structuring the problem

**RESOURCES**
- Doctrine
- Equipment
- Sustainability
- Personnel
- Organisation
- Training

**ACTIVITIES**
- New areas needing models
- Stock of Models in BEIS
- Update list of models
- Publish Web Pages on BEIS
- Set up MI Network Volunteers Mail box
- Run Events on QA
- Draft MI Objectives for Analysts
- Present to ALT on Network approach

**OUTPUTS**
- OT1 QA Guidance available on Intranet
- OT3 BEIS Branded QA guidance - QA Log Model Report Assumptions log
- OT4 Number of events and feedback
- OT5 No of Models with QA Log
- OT6 No of new models with QA Log
- OT7 No of existing models that migrate to QA Log on review
- OT8 Extent of MI Network up and running
- OT9 Extent of ALT Support to MI Network and policy implementation
- OT10 MI Champions Metric - No of analysts supporting QA outside own model

**OUTCOMES**
- OT1 QA Log
- OT2 % of BEIS Analysts who know QA policy and approach
- OT7 No of Models with QA Log
- OT9 Extent of MI Network up and running
- OT10 MI Champions Metric - No of analysts supporting QA outside own model

**OUTCOMES**
- OT5 No of Models with full QA Log
- QA Logs Scores Total
- Sum of QA Scores for BEIS models over number of models
- Number of Models used to inform policy and operations that are known to be in a sufficient assurance state

- Number of models with full QA Log
- Proportion of models meeting QA target

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**Doctrine**
- Equipment
- Sustainability
- Personnel
- Organisation
- Training
5 Steps to QA

1) Start scope, specification and model map sections of **model report template**. Discuss model development plan with Modelling Integrity and QA Analyst.

2) Develop model using best practice (e.g. Excel template and guidance) so that it is easy to change and QA.

3) Start **QA log**, and write **QA plan** at an early stage.

4) Fill in **assumptions log** whilst building the model.

5) QA Analyst reviews the proposed **QA log** and **model score**.

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**Document and Communicate**

- **Review**
- **Design & Build**
- **Populate** (with data / assumptions)
- **Test**
- **Use**
Means - Opportunity

- **Involvement** through process of modelling
  - Preserving **independence**
    - Quality **Control** is by the model builder
    - Quality **Assurance** (QA) is by someone else
- Beware **confusion** of augmentation of build team with QA
- Harrison’s figure*
  - 7 phases
    - Real World
    - Interconnections
    - Mathematical Translations
  - Quality Assurers work on the boundary of the real world
    - **Gatekeepers**

*Figure 6 page 37 Paul Harrison Operational Research 1983 Mitchell Beazley London
1. Understand the problem: Formulation Phase

2. Determine assumptions: Model Building Phase

3. Formulate the problem in mathematical framework

4. Solve model of problem Solution Phase

5. Interpretation of solution

6. Validation of model

7. Implementation Phase

QA

Mathematical translations

Interconnections

Real World
What now constitutes requisite, rigorous and reliable modelling?

- George Box:
  - "Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful."
  
  - “In the inferential stage, the analyst acts as a sponsor for the model. Conditional on the assumption of its truth he selects the best statistical procedures for analysis of the data. Having completed the analysis, however, he must switch his role from sponsor to critic.”
  
  - Since all models are wrong the scientist cannot obtain a "correct" one by excessive elaboration.”
  
  - “Since all models are wrong the scientist must be alert to what is importantly wrong.

  It is inappropriate to be concerned about mice when there are tigers abroad.
Question and Answers – Discussion

“THIS DISCUSSION NEEDS YOU”
Back to basics – What is a model?

• All models:

  - Models are simplified versions of the real world. They can help by:
  - Forecasting a particular number (eg pension spend);
  - Better understanding of the market / policy drivers / intervention points;
  - Identifying unintended or perverse consequences.
  - What is a “model” – Any Code? Is the model always a spreadsheet?

A model is not an end in itself. A model is simply a tool to help intelligent people make better decisions.