Department for Environment, Food and Rural Affairs (Defra)

List of Business Critical Models

July 2014

	Model Name and type	Description	Why model is Business Critical	Summary of QA
1	Appraisal models for flood and coastal erosion risk management investments. Type of model - Procurement and Commercial [Procurement & Commercial]	The generic model takes input data on flood levels, flood probabilities and floor levels of properties, and uses depth-damage relationships from research to generate probabilistic monetary estimates of flood damage for different flood management options, for specific proposed investment projects. Models are generally constructed and operated by private sector consultants to economic appraisal principles established by Environment Agency (EA) and Defra. Models are used to recommend substantial (up to £m) investments with long lives (up to 100 years in some cases).	Drive individual project funding decisions within Defra's largest capital investment programme (totalling up to £180-230m per annum). Most individual project decisions taken by EA; Defra have oversight of programme and approve larger investments (over £100m).	Developer testing, models delivered by several private sector partners so subject to competition, peer review by Environment Agency, peer review by Defra, including modellers and economists (in the case of the largest investments).
2	Environment Agency National Flood Risk Assessment (NaFRA) and Flood and Coastal Erosion Tool (FACET). Type of model - Planning. [Planning]	The model is a high-level national version of the generic investment appraisal model described above. It takes input data on flood probabilities, extents and depths across the country and uses these in conjunction with depth-damage relationships to generate aggregate flood damage estimates to various geographies. The model is developed and run by a private sector partner to Environment Agency specifications and with Defra oversight. NaFRA is validated and updated by local Environment Agency modelling teams. The NaFRA / FACET model is used to forecast national and regional flood risk and damage, to inform high-level investment and resource planning decisions (for example, operation and maintenance requirements via System Asset Management Plans).	Drives key funding decisions, including Defra national analysis as part of Spending Reviews. Also helps determine level of operational resources Environment Agency Regions and Areas put in to managing specific flood management systems, affecting communities on the ground.	Developer testing, models delivered by private sector so subject to competition, peer review by Environment Agency, peer review by Defra including modellers and economists.

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3	In house funding model operating jointly with Natural England to determine The Rural Development Programme for England (RDPE) budgets. Type of model - Policy Simulation [Policy Simulation]	The model converts business assumptions and policy targets into financial commitments. RDPE agreements are largely 5 or 10 year agreements. The model provides outputs of financial commitments going forwards over the longer term. Annual budgets are set and future Programme funding pressures feed into policies to develop new programme.	RDPE is a £3.7bn programme with £1.8bn of commitments locked into the next 7 year period. The model highlights pressures, can simulate different policy scenarios and give policy impacts of various funding decisions.	Internal peer review and internal audit. External peer review
4	Exchange Rate Impact Calculator. Type of model - Forecasting/ Financial and Evaluation. [Forecasting]	The model assesses the impacts of spend, forecast spend and exchange rates on the EU budget for rural development.	Model is used for critical decisions around a 3.2bn Euro EU allocation. The model outputs used for risk management in relation to Programme affordability, progress against EU spend targets and risk of surrendering EU funds.	Internal peer review and internal audit. External peer review.
5	CAP Delivery Programme Dynamic Financial Model (DFM)	The model is used to forecast the spend profile for CAP Delivery incorporating forecast and actual expenditure into functional areas and Programme Support. The CAP Delivery Programme is the implementation name for the Future Options Programme. The DFM takes the output from the Outline Business Case as a baseline budget profile and forecasts forward based on actual expenditure on a month by month basis and in light of latest Programme decisions and planning assumptions.	The model outputs indicate the funding requirement on a annual basis required by the Programme. Failure to identify funding pressures in a timely fashion may affect the reputation of the Programme within Defra and potentially externally.	Developer testing, internal peer review, external peer review.

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6	Waste Infrastructure Delivery Programme – PFI Modelling. (forecasting model). Type of model - Forecasting. [Forecasting]	The model forecasts waste infrastructure capacity and compares this to waste forecasts to assess whether sufficient capacity will be in place in England to meet the 2020 EU Landfill Directive Targets.	It is critical to assess whether the EU targets will be met as failing to meet the targets could lead to infraction proceedings and fines. The PFI programme involves substantial infrastructure investment decisions.	The model is peer reviewed internally and signed-off by Defra's Chief-Economist and the Model Senior Responsible Owner. The model has been externally peer reviewed and audited by senior economic consultants for further quality assurance.
7	HadGEM3-ES family of Global Climate Models. ALB - UK Met Office. Type of model - Science based. [Science-Based]	The model does not allocate funding resources. Global Climate-Earth System Models simulate processes occurring in the atmosphere and at the interface between atmosphere, water and terrestrial ecosystems. Global Climate Models are used to answer questions about how climate might change in the future; depending on how the system is initiated (i.e. with what carbon dioxide concentrations in the atmosphere and what emissions we anticipate over future years). They can also be used to assess the statistical likelihood of extreme events being attributed to climate change.	These models are funded as research, eventually producing evidence to support policy decisions on adaptation planning. The previous generation of climate models helped to develop the UK Climate Projections (UKCP09) on which the first Climate Change Risk Assessment (CCRA) is based. The National Adaptation Programme seeks to identify solutions to the key risks in the CCRA and is being taken forward in conjunction with a number of government and external stakeholder, all of whom will be using information on future climate generated by global climate models (and most provided in the form of the projections, UKCP09).	Developer testing, Internal peer review, External peer review, Use of version control, Quality Assurance guidelines, Governance, Transparency, Fitness for Purpose.

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8	Thames Tideway Tunnel financial model – developed by UBS on behalf of Thames Water Utilities Limited (TWUL). Type of model - Procurement and commercial. [Procurement & Commercial]	The model has been developed by UBS for TWUL with input from HM Treasury, Ernst & Young (on behalf of Defra), and Ofwat. It is available to all those organizations and will be used for the development of the delivery structure of the Tunnel and its procurement, and models the project up to completion of the tunnel. It is commercially confidential and so is not available to the public. At the time of writing, it is still under development.	The model is critical to inform decision making on the delivery structure of a very high capital investment decision. It carries significant reputational risks for TWUL but also the other parties with access to the model.	The model has been validated against a previous model. It has been widely peer reviewed by a wide range of parties, from both government and private sector. The contractors followed industry guidelines, and there is an extensive governance structure supporting the model development. It has undergone developer testing, and has a documented version history. It is currently being externally audited, and on completion, the auditors will provide a final sign off letter confirming the model is fit for purpose.
9	Exodis-FMD ALB - Animal Health and Veterinary Laboratories Agency (AHVLA). Type of model - Science based/forecasting. [Science-Based]	To forecast the potential range of outcomes and resources used in an outbreak of FMD, as well as monitoring disease control. Used between outbreaks for developing contingency plans and investigating control options including vaccination.	Part of AHVLA's preparation against the highest priority disease threat, a Foot and Mouth disease outbreak. Foot and Mouth response has the greatest potential impact on AHVLA reputation.	Developed by an external company, Internal peer review, External peer review, Full documentation and training courses available. Comparison with equivalent models, Repeated high profile use.

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10	Pollution Climate Model (PCM) (outsourced to external consultancy (Ricardo-AEA), GIS-based air quality dispersion model). Type of model - Science based. [Science-Based]	Model provides estimated concentrations 3for key air pollutants at background locations (1x1km 4maps) and at roadside locations (approx. 10,000 major road links) throughout the UK to calculate population exposure, area and road length exceeding European Limit and Target Values. The model also allows for projections of future concentration fields. Outputs are visual map images, GIS data layers and compliance summary information that inputs to the '461 Questionnaire' submitted to European Commission annually to comply with the requirements of the Air Quality Directive.	Model outputs form a significant part of UK's assessment of compliance with Directives. UK's monitoring network alone is not compliant with Directives therefore without model this could engender serious financial penalties. Without the use of the model the UK would be liable to infringement proceedings leading to possible infraction.	Developer testing, Internal peer review; External peer review; Peer reviewed publications; Defra model intercomparison; Use of version control; Quality Assurance Guidelines; ISO 9001 accreditation; Governance; Outputs publicly available.
11	Air Quality Unified Model (AQUM) [Forecasting]	AQUM is used to provide forecasts of air quality for public information purposes. AQUM has been developed to fulfil two purposes: (i) the operational delivery of daily air quality forecasts and (ii) to enable atmospheric modelling studies to address scientific and air quality policy-related questions.	The forecasting results are high profile, affect our relationship with stakeholders including the public and have high external impact	Results published in peer reviewed papers. Performance was assessed in the recent Defra Modelling Intercomparison Exercise. The final report comparing models run in forecast mode is in preparation to be published (Summer 2014). The AQUM was found to perform best of the 4 models that submitted data.
12	National Atmospheric Emissions Inventory (NAEI) [Science-Based]	Model provides national estimates of key air quality pollutants by sector on an annual basis to meet EU and UNECE reporting requirements. A consistent time series is calculated back to at least 1990 and current year data are disaggregated to 1x1km grid squares. Outputs include database, visual map images and GIS data layers	Model outputs form a significant part of UK's assessment of compliance with Directives. Without the use of the model the UK would be liable to infringement proceedings leading to possible infraction.	Developer testing; Internal peer review; External peer review; Use of version control; Quality assurance guidelines; ISO 900 accreditation; Governance; Outputs publicly available

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13	Flood Re models (financial evaluation)	Two models are currently being used in relation to the Flood Re Proposal to test the impact of various alternative structures of a pooled insurance vehicle which would insure properties at higher risk of flood and which the UK private insurance market might not be prepared to insure except possibly at high cost to the individual property owners. The Pool Combined Model was agreed with ABI during 2012 and uses insurance industry data. This will ultimately be replaced (in 2014) by the New Defra Model which is populated with HMG data and estimates. It also assesses the operation and impact of a regulatory alternative not supported by ABI.	These analytical tools input into decisions on flood insurance, a key Departmental priority.	Pool Combined Model - Developer testing; Internal peer review; external peer review (GAD) and Professor Diacon at the University of Nottingham; use of version control; governance. Full publication of model unlikely as it contains sensitive industry data. New Model - Developer testing; Internal peer review; use of version control. External peer review and more formal governance structure planned once model and new supporting dataset are complete over summer 2014. Transparency has not happened as the model is too sensitive, but some results have been published as part of Impact Assessments during 2013.

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14	Tree/plant disease spread model Type of modelling - Forecasting/simulation	A suite of models was developed by Cambridge University, Rothamsted Research and the Central Science Laboratory in a Defra funded R&D project (PH0406). The models are based on well-established and internationally recognised models of atmospheric dispersion and particle trajectory. The models are used to: (i) assess the risk associated with outbreaks of novel pests and diseases (ii) optimise strategies for detecting and mapping invading pathogens and (iii) optimise strategies to eradicate or contain invading pathogens. The models are jointly owned by the three research contractors.	The model outputs are key for predicting spread of plant disease but also important for management of disease outbreaks. Safeguarding plant health is one of Defra's strategic priorities and therefore making best use of resources to effectively and rapidly manage disease outbreaks is key.	Some developer testing. Extensive communications of model outputs with stakeholders and experts. Peer review of models expected upon delivery of final report.
15	Aglink	A partial equilibrium model of global agricultural markets developed by the OECD and the UN Food & Agricultural Organisation. It is widely used by agricultural analysts	Aglink is used in house to produce advice on a range of high profile policy issues includes end of sugar quotas, biofuel policies and the pesticide bans	The model is extensively QA'ed by the organisations that run the model. Defra is represented on the working group that oversees the model
16	Water Bill Projection Model (forecasting)	This model is being developed in conjunction with OfWAT and Environment Agency to inform a long-term view of the potential progression of household water bills in response to water industry investment levels, environmental requirements and market reform.	Utility bills are highly sensitive and the water market will be subject to key changes in the coming years, the impacts of which Ministers need to understand. Defra has indicated to PAC that it will develop this model following NAO recommendations in 2013.	Model currently in development but a full suite of QA measures are planned, including developer testing, internal and external peer review, use of version control and governance. A governance structure for developing the model already exists.

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17	Allocations methodology for Local Enterprise Partnership and LEADER (allocation)	EU Funding is allocated to Local Enterprise Partnerships for 2015-2020 primarily pro-rata to rural population, using the 2011 Census and the 2011 Rural-Urban Classification. However, portions of the funding are adjusted to take account of variations in rural population density (compared with the England average density), variations in productivity (Gross Value Added per head, compared with the England average), and specifically to target rural populations in sparsely populated areas (as defined in the Rural-Urban Classification).	It is allocating EU funding. A total of £177m is notionally allocated to Local Enterprise Partnerships, who will then develop projects to apply for the funding up to the level of their allocation. It is currently proposed that a further £138m will be allocated to LEADER groups using primarily the same methodology.	The model was developed in consultation with policy, statistical and rural delivery colleagues; it has been presented to the Local Enterprise Partnership Round Table, and the results scrutinised by local practitioners, and potentially ultimately by the European Commission. The allocations will be published as part of the Rural Development Programme for England. Base data come from the 2011 Census and the Rural-Urban Classification and have been checked against published sources for consistency. All columns in the spreadsheet are clearly labelled, and the calculations are done step by step to make it easier to check. Results have been scrutinised to ensure that they are consistent with expectations given the base data. The spreadsheet calculations were checked by a statistical colleague not directly involved in the model development.

The review team based this initially upon the departmental return made with last year's Macpherson report. We closely engaged with model owners and operators to tighten the definition of business critical, and these are those that scored high on at least three of the five following risks: reputational, financial/economic, legal, operational/user impact and future effect. We requested a completed declaration that the senior responsible owner is aware of the assurance, the key assumptions and the limitations around their model, and spoke with several model owners and modellers to challenge these.