CMPCF COMPLIANCE USING DECISION TECHNOLOGY

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ABSTRACT

INTRODUCTION

Compliance with the CMPCF is becoming mandatory. It is highly likely that Ofwat will place more emphasis on compliance when making determinations for PR'09. The impact of decision technology will be marked in respect of the process and output criteria. Adoption of decision technology during AMP4 gives the opportunity for companies to be viewed favourably at PR09.

This paper opens by looking at the implications of Ofwat's for data improvement (data) and decision support (process). It then considers the role of asset performance modelling.

It is given that top-down modelling approaches used for deriving asset management strategies over long time horizons must take into account the effects of deterioration and interventions. Top-down models have the advantage that all combinations of decision can be considered, such that the right strategy can be selected to achieve objectives. Top-down methodologies overcome problems of data scarcity by pooling data and being able to generalise within asset groups and areas. In this way, data is effectively 'borrowed' from adjacent areas, poor data is overcome and deterioration is understood. Bottom-up focussed methods take areas in isolation and rely on highly accurate data. Such methods are limited to budget setting (what did we spend last year?) and prioritisation to derive schemes. However, top-down models lose certainty at the more detailed level. This is where they must link to bottom-up methodologies and tools.

In embedding a 'business as usual' common framework type approach, activities to derive strategy must be linked to program rollout and appraisal activities. These activities must be linked in an eternal circle, or Asset Management Cycle, to drive better decisions and efficiency.

After envisioning this Asset Management Cycle, this must be serviced by a software architecture that covers the functions within the cycle in a joined up manner.

In summary, this paper covers:

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- data and process
- performance modelling in context
- the top-down/bottom-up modelling paradigm
- the asset management cycle, and
- servicing the asset management cycle

The paper closes by looking at the way embedded decision technology impacts on CMPCF compliance, focussing on Ofwat's 18 criteria.

DATA AND PROCESS

The traditional reaction to poor data and decision making is to start collecting more/better data and hope that it will somehow tell us what to do. This approach does not work. Without knowing how we would use it (process), how do we know what data is worth collecting/improving?

Decision Support and Data Improvement are complementary, parallel activities. Where data is poor or lacking, diligent decisions still have to be made.

This ethos aligns with Ofwat's assessment of companies' compliance with the CMPCF for PR'04. The 18 criteria that companies were measured against spanned 3 broad categories; Data, Process and Outputs. Each criteria was given a weighting which it total prioritised these broad categories in the following order of importance; Process (46.4% weighting), Outputs (31.4%) and Data (22.3%)[3]. This focus on Process and away from Data is not to say that the quality of data and quality of decision are not linked. However, it highlights that it is only when a decision-making framework is in place that this can focus the sensitive areas for data improvement. The adoption of decision technology allows companies to embrace the process and drive improvements in data which are key to business success.

PERFORMANCE MODELLING IN CONTEXT

Engineers may consider performance models to be the engine of any investment and operational planning system. However, other stakeholders clearly see the asset management process as the engine. This is evidenced by Ofwat in their CMPCF compliance scoring mechanism. Indeed, YW's LEADA system is successful in managing service to customers, and the overall risk that the company carries. It does not, however, focus on performance models.

The authors suggest that performance models are an important part of asset management. It is suggested that they should be considered in the following context:

[3] Based on the 'Original Adjusted Weightings', Mott MacDonald (2004)

Performance models bring the benefits of scientific analysis to asset management. The confidence that they bring to the asset manager - the decision maker – is, however, bounded:

1. there are commonly different (if only slightly) analytical approaches that can be taken to an analytical challenge. Hence, the requirement to carry out reviews and select the 'best' approach
    i. selection should be based on a clear framing of the problem that the analysis is trying to shed light on, and the decisions that are being based on the output
    ii. performance models must be flexible
2. often, the decision maker will not be carrying out the analysis themselves, and therefore requires reassurance on robustness
    i. effective quality control of the analysis must be ensured and demonstrable. This relies on well-designed analytical procedures
    ii. the best possible validation techniques should be employed (validation is not always possible to a great extent in forward looking analyses. Spatial validation is possible through the isolation of 'unseen' datasets). True, temporal validation is only possible with time
3. the engineering approach of absolute correctness can rarely work in isolation from intuition. Again, this is especially the case with forward looking analyses
    i. feedback loops (e.g. post-scheme assessments) can continually fuel the refinement of modelling techniques
    ii. asset management systems should be designed to capture experience-based intuition and local knowledge, to complement science. Again, asset management systems must have efficient design to properly align these complementary sources of information. This brings the strength of diversity to decision making (the top-down/bottom-up approach brings the benefits of centralisation and de-centralisation in capturing this information)

There will always be analytical alternatives and new developments. There will always be debate over which approach is 'best'. Careful system design can house alternatives. Analysis can be designed to give assurance. Careful system design can also harness alternative sources of information, such that the reliance on science is not absolute (the answers it can give should not be treated this way anyway), and the risk of perhaps not having the 'best' model is mitigated.

A well designed Decision Technology platform can be used to evaluate alternatives, and evaluate the impacts of uncertainty.

THE TOP-DOWN/BOTTOM-UP MODELLING PARADIGM

“It is only when we cease to try to predict and analyse the behaviour of individuals and instead look at hundreds, thousands or even millions that we can understand behaviour.” (Ball, 2004)

Top–down models have the advantage of being able to generalise and overcome the problems of incomplete and/or inaccurate data. In top-down approaches, a company’s whole dataset spanning several years is typically tapped into. Data is effectively borrowed from adjacent geographical areas, overcoming problems of data scarcity in deriving generalised models. These generalised models (for predicting a range of performance, serviceability and cost driver quantities) are applied and calibrated to discrete regions.

Top-down approaches allow the entire system to be considered, with all combinations of operational and capital decision considered in achieving serviceability objectives. Best informed decisions cannot be made considering decisions in isolation, in a bottom-up approach. The approach makes best use of a limited temporal extent and quality of data. Behaviour is understood within asset groups and areas, aggregated to any level.

However, top-down approaches lack certainty at an asset by asset level. The generalisations of WiLCO’s top-down models collapse as models go down to a finer and finer level of detail. This is where **bottom-up** approaches come into the asset management process. Within a GIS environment, top-down recommendations are challenged and tempered by ground level data (asset failure, DG data, complaints, water quality), including hydraulic simulation data (criticality, peak flow). Schemes are then produced and fed back into the company hierarchy in managing these against ongoing strategy.

There must be consistency in the approach to strategy at high level, and scheme building at a low level. For instance, if the strategic objective addresses mains repair rate, DG3 interruptions above 6 hours, and discoloration complaints, then the same low level data must be used in the final (bottom-up) scheme derivation. Otherwise a skew will have to be managed when feeding back into strategy.

Note: Typical data which is used in building top-down performance models is; works management data, customer contact data, regulatory reporting data (e.g. DG3), leakage data and comprehensive cost data. Performance models are built to predict, for example, customer interruptions, mains repairs, minor repairs, leakage, complaints and so on. The outputs of these are cost drivers (the quantities that drive cost, for example volume of water, number of repairs of different descriptions) and serviceability measures (e.g. unplanned customer interruptions, leakage level, mains repair rate). This is in addition to asset data which form the asset files in a WiLCO Model, and also contribute in repopulation exercises and performance model derivation.

THE ASSET MANAGEMENT CYCLE

When a strategy has been derived using top-down modelling combined with optimisation (see Jennings, 2005), the Asset Management Cycle (Figure 1)

has begun. Program Rollout begins, and decisions must be cascaded and managed as described conceptually in “Top-Down/Bottom-Up Modelling” above.

Taking the application of the WiLCO software to clean or sewerage infrastructure[4] as an example (Skipworth and Engelhardt, 2005), a cascade of models is built, used to make decisions in ever increasing detail. The results handed down from the model above are used as constraints in re-optimisation. Tools centred around a GIS environment are used as the focus for the meeting of top-down and bottom-up modelling and information. This produces the best informed and managed asset management decisions.

The Asset Management Cycle shown in Figure 1 embeds the proactive culture required to release maximum shareholder value. The Strategic Planning stage centres on the delivery of asset management plans. The Program Rollout stage represents delivery to budget and serviceability targets.

In this way, Strategic Planning becomes a live process, feeding into Program Rollout and Appraisal in an eternal circle which drives capital maintenance efficiency. This process and the common language created by Whole Life Costing provides proper communication between strategists and planners, and between finance and engineering professionals. In the past, the only communication may have been the size of the budget.

[4] WiLCO has now been developed for application to non-infrastructure assets

Figure 1 - The Asset Management Cycle

SERVICING AND EMBEDDING THE ASSET MANAGEMENT CYCLE

WiLCO is forward looking modelling technology for deriving and managing least cost strategies, for a desired serviceability outcome. Decisions (capital and operational) are focussed to all levels of detail.

WiLCO utilises the concepts of top-down meets bottom-up modelling, optimisation, and whole-life-costing. It takes full account of the effects of deterioration and interventions on costs, performance and serviceability. It is a knowledge in-sourcing system. It makes full use of available data and knowledge on the "data⇒knowledge⇒decision support" track. It exposes the value of data and data improvements.

The new service-oriented WiLCO Architecture turns the Asset Management Cycle into reality. It breaks the asset management process down functionally, and gives location independence when fitting to a company's business process.

The WiLCO Architecture offers a three-tier business solution where the calculation is separated from the data and the presentation layers. The

extensibility and flexibility enables the integration of value added applications to support associated business processes. With reference to Figure 2:

Data and Process Audit Add-on (top left)

- these software services establish the data audit trail and process transparency. They are used to facilitate and standardise the model building process.

Program Management Add-ons (bottom right)

- these tools are used to manage program rollout and scheme assessment in line with strategic planning.

Optimisation Add-on (top middle)

- this software service identifies the optimal interventionary strategy to meet quality of service objectives at least cost

Performance Models Add-on (top right)

- a series of performance models characterising serviceability and its deterioration can be added to or deleted from WiLCO models

Notably, the Core Components offer the flexibility to reflect any risk or economic (cost-benefit, cost-effectiveness) formulation. WiLCO is a generic technology that can be deployed in all utility sectors - water; gas; electricity; rail and road.

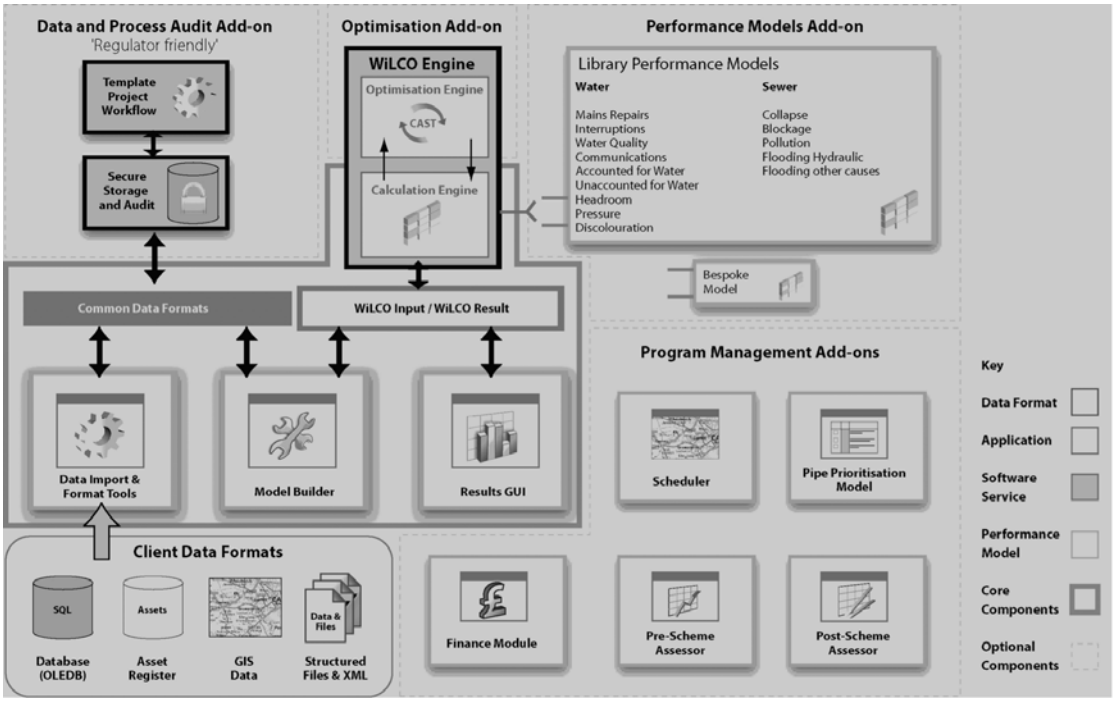

Figure 2 – WiLCO Architecture

THE IMPACT OF AN EMBEDDED DECISION SUPPORT SYSTEM

The effect of embedding a decision support platform such as WiLCO is to drive out ongoing capital maintenance efficiencies. Beyond this, based on Ofwat's 18 criteria (Table 1) it is clear that properly embedding a system will have a large effect on how a company is judged at PR'09. Table 1 gives estimates of how embedding WiLCO (or a similar system) might effect these scores.

WiLCO does not affect the "Acquisitions" and "Confidence Grades" criteria. Therefore, these are not included in Table 1:

- Acquisitions: WiLCO improves the processing of data, rather than being aimed at data acquisition.
- Confidence Grades: WiLCO has no impact on the Confidence Grades ascribed to data in the June Returns.

Figure 3 shows the estimated effects (from Table 1) on the CMPCF compliance score at PR'09 for embedding a WiLCO type solution. These effects are conservative, and no effect has been assumed for "Acquisitions" and "Confidence Grades" – the PR'04 industry average has been taken. The "Leading" and "Above Intermediate" thresholds shown in Figure 3 are for PR'04. Clearly, these are likely to move up for PR'09 with the implementation by the industry of joined up solutions such as WiLCO. Therefore, companies who stand still will effectively go backwards.

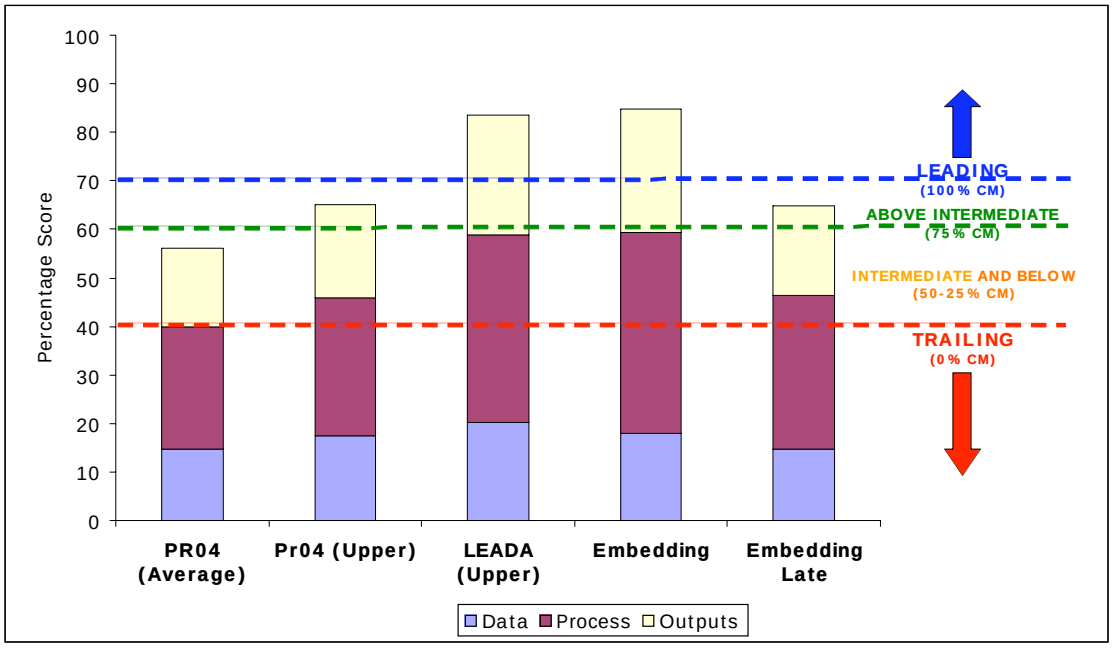

Figure 3 Effect on CMPCF Score for Embedding of a WiLCO type Solution