

A Methodology to Guide Best Value Knowledge Production via Resource Allocation Models

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This paper reports on the application of a methodology to assist a group of stakeholders in their prioritisation and resource allocation decisions. This is achieved by jointly codifying, exploring and improving a group's current knowledge via the provision of systematic and transparent analytical assistance. The approach produces new high-value knowledge by assessing the net benefits gained from alternative resource allocation configurations

A three-month action research project was set up with a London council in 2006, to explore ways in which the council could get best value from their resource allocation decisions in relation to issues of teenage pregnancy (TP). In the UK, problems of TP can be characterised as 'messy' problems constituted by a large number of interconnected dynamic issues, and driven by multiple conflicting objectives.

The project was carried out for a multi-organisational group working under the council's TP strategy group. It comprised the TP strategy co-ordinator, a head gynaecologist, a priest, a young mother and representatives from education, council, and 'support to parents' group. Resources were previously allocated on a piecemeal basis during traditional meetings when some of these stakeholders were available. This less methodical approach resulted in options with the biggest benefit often being funded at the expense of better value for money ones.

At the core of the methodology is the development of a decision model in 'real-time' jointly with the group. Individuals' knowledge was codified with the help of the networked group support system *Group ExplorerTM* (GE) which runs with the *Decision ExplorerTM* (DE) mapping software. GE allows for anonymous input of individuals' knowledge and preferences, whereas DE codifies and structures this knowledge using the cognitive mapping technique (Eden 1988). The emergent model is then used as a 'transitional object' to facilitate dialogue and negotiation among participants, as well as commitment to coordinated action.

The model was further developed to assess the potential value which could be acquired by a particular resource allocation plan. Following the principles of 'decision conferencing' (Phillips and Costa 2006) it was necessary to elicit and structure evaluation criteria by which 'best' could be defined. The surfaced criteria were prioritised using the 'swing weighting' technique and an efficient frontier of best value portfolios was plotted across a range of budgets using the *EQUITYTM* software. Sensitivity analysis highlighted the effects of changes in the model parameters on the optimal resource allocation plan. By looking at options that were marginal at a budget of interest, the model was able to identify how different an estimation would need to be to make a difference to the proposed resource allocation plan. This often showed, for example, that the weighting of a criterion would need to change by 50% to change the decision and the group were confident that their values lay within that range.

A second iteration of the model ensued with refining of the decision variables but limitations in time and functionality of the software did not allow full exploration of the potential of sensitivity analyses.

The methodology was evaluated by using the Competing Values Approach (McCarrt and Rohrbaugh, 1995) to group process effectiveness. The model-driven

meetings were found to be more effective than the group's average meeting on all four CVA criteria: consensual (participatory process and supportability of decision); political (adaptable process and legitimacy of decision); rational (goal-centred process and efficiency of decision); and empirical (data-based process and accountability of decision). The lowest CVA scores corresponded to the empirical criteria, and it is proposed that this might be improved by further sensitivity analysis highlighting where inaccuracy, uncertainty and disagreement can remain without affecting the recommended portfolio.

The portfolio of actions to which the model recommends allocating resources is not fixed, and sensitivity analyses are conducted to explore the impact of including actions marginal to the portfolio. Increasing accuracy, certainty and agreement about their potential inclusion is where the most value is likely to be gained from new knowledge of the situation, for example, by further dialogue, modelling, simulation, experimentation or survey.

Each action contributes benefits (B) to the portfolio, and sensitivity analysis can tell us how much benefit (B') would be required of an action outside of the portfolio to be included in it. Eliciting a probability (p) distribution for the action's impacts allows us to conduct a confidence test to estimate $p(B > B')$. We then have a p that the action should be included or not. With an elicited practical maximum to the distribution calculus can then be used to find an expected benefit level (B'') in the interval above B'. If the decision is between, for example, two actions of equal cost, one marginally within the portfolio and one outside, then a useful Expected Value of Perfect Information is: $(p \cdot B'' + (1-p)B') - B'$ (unit cost of benefit calculated from EQUITY model). This could act as a guide to limit the maximum amount which should be spent on producing new knowledge about this.

Due to a low p of swapping in or out of the portfolio, knowledge about actions far from the margins is relatively worthless. Our existing knowledge about them would have to be extremely inaccurate to change our decisions, and the existing knowledge we have about them is likely adequate for our decision situation. It would be highly inefficient to allocate resources to refining our knowledge about them.

This valuation of knowledge via sensitivity analysis is as yet untested but offers an iterative guide akin to a fast and frugal (Gigerenzer and Goldstein, 1996) 'group bounded rationality': a lens to dynamically focus decisions in messy problem situations.

References

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