TOOL C.2

VALUE ENGINEERING IN PRACTICE

1. INTRODUCTION

"Value engineering" refers to the value management activities that take place once the major value drivers for the project have been identified and agreed upon through Value Planning. Value Engineering is a reiterative activity through which value analysis is applied at progressively more detailed and technical aspects of the projects. It starts in the early phases of development of the spatial concepts of the design, aimed at identifying the design strategy that will be most effective in delivering the particular configuration of value that the client wants, in terms of desired benefits and cost limitations. It continues throughout the scheme and detailed design phase to optimise design options in view of overall value and cost principles set for the project.

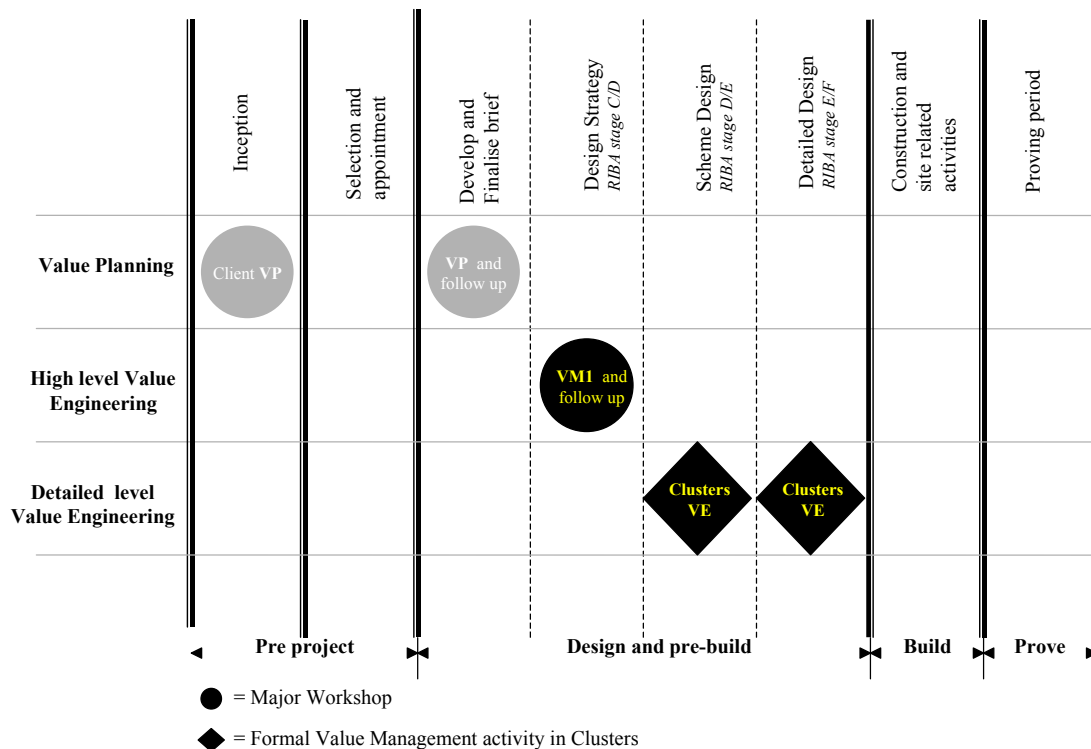Figure 1 summarises The major Value Engineering events and activities in the project.

Figure 1: Value Engineering events in the project (in dark)

2. HIGH LEVEL VALUE ENGINEERING WORKSHOP (VM1 AND FOLLOW UPS)

The first major Value Engineering workshop is aimed at consolidating a design strategy which specifies the basic spatial layout on the basis of the initial design options put forward by the Core Project Team.

The goal of the workshop is that of conveying all the necessary information to enable clusters to progress with the design of different parts of the facility. In convening the workshop, the prime contractor and Core Team involve other potential supply chain members drawing from their approved lists, as appropriate to options being considered. The basic criteria for inclusion is to involve suppliers/sub-contractors relevant to addressing key risks associated with the options.

Level:	High Level Value Engineering
Timing:	After Core Project Team prepares Design options - spatial outputs and design possibilities (major options)
Objectives:	Review concept design layout options and assess which best meets the requirements of the client and end users
	Agree on the preferred design option
	Brainstorm and identify opportunities for option development and improvement
	Pursue the best balance between user requirements and Cost
	Further develop team working ownership
Team:	Same as the Preceding value planning workshop, plus selected members of the supply chain invited on the basis of their capability to contribute with key information on technical choices which can bear a significant impact on the functionality of the building
Induction	The "VM Briefing Pack" will include: o Background information on the project for the new comers and report of Value planning (Project Brief) o The objectives of the workshop o Details on the event (dates and schedule) o A list of participants o The agenda for the meeting o A short description of what the participants will do when attending the workshop o A synthetic flier on Value Engineering and its basic tools o Report of previous Value Management activities
Input	Depending on the state of development of the design options these may be circulated to the participants prior to the meeting in order to give them enough time to do some "homework" and coming to the workshop with more informed views. In order to pursue the best balance between user requirements and Cost the design options to be value engineered during the workshop should be roughly costed prior to the event in order to expose significant cost difference between the schemes
Output	*Report from the Workshop* Agreed design and basic options Action plans for opportunities

dti

	Updated cost plan
	Updated project plan

At the end of the workshop the prime contractor in collaboration with cluster leaders will identify areas in the workshop report that will be allocated to each cluster.

Critical Issues

The experience gathered within the Building Down Barriers suggests that *in this phase* some of the critical success factors such *as limited number of participants and no "passengers, full time attendance, proper setting and no hidden agendas are especially important*. In addition, at this stage of the process special attention should be paid to the following aspects:

Retain the ownership of the decision making process within the Workshop.

Because the development of the design options takes place in consultation between the Prime Contractor's team and the Client, it is easy at this stage to pre-empt the outcome of the value management workshop and to decide which option to carry forward before the meeting. In this way, however, the ownership of the decision making shifts from the community of end users and cluster members to the traditional figures of Prime contractor and client. The potential contribution of the supply and end user community is hence drastically reduced, and the workshop becomes a redundant exercise.

At the same time, however, it is also obvious that it is impossible to value manage too many options during the meeting, for this would take too much time. A promising middle path explored by the Building Down Barriers is that of giving the Client representative only a "power of veto" before the meeting, i.e., asking the client representative to eliminate emerging options that for some reason do not match with some criteria or requirements, leaving to the value workshop the final decision of which among the (few) survival options bears the best value for money.

Develop the design to a reasonable level of details

In order for the end users and cluster leaders to be able to provide a significant contribution, the design needs to be developed to a point at which all functional requirements can be explored. For example, alternative floor plans need to be detailed enough for the different stakeholders to explore the functional implications of spatial arrangements (Is there enough space for my activity? are important criteria respected?)

© The Tavistock Institute, August 2000

dti

An example of High level Value Engineering in the BDB project: saving money by repositioning the building

During the High level Value Engineering workshop it became clear that it was possible to achieve some significant savings by optimising the location of the building. Because of the nature of the site, small variations in the positioning of the building meant that either some of the material dug for the foundation would have to be disposed of, or that new material would have to be brought on site to obtain the necessary rise. The architect and the Ground work Cluster leader identified the issue, and in the follow up worked out a position for the building so that no transport of material was necessary. The solution was presented to others at the wrap up meeting and was accepted by the client.

Starting the development of the design options right after the Value Planning workshop may help the design team to capture with little effort many of the detailed suggestions emerging from the discussion with the end user representatives.

Establish appropriate forms of involvement of the supply chain

Members of the supply chain may experience some difficulty to contribute at this stage. This may be due to two related reasons:

− The discussion is still at a very general and functional level, so that the possibility to provide a technical input is limited.
− Suppliers lack the necessary experience or training to play an active role at this stage.

The experience derived from the Building Down Barriers suggests that nonetheless the involvement of the key supply chain members at this stage is fundamental in order to ensure that the end users satisfaction criteria are well understood and satisfied in the project. In order to overcome the difficulties mentioned above one may consider:

− Inviting suppliers only at particular parts of the workshop only (for example in the Building Down Barriers some selected suppliers were invited to present the benefits of their solutions in order to explore strengths and weaknesses from an end-user perspective such as maintenance, security, etc.).

− Training suppliers in advance helping them to become proactive in interpreting the desires of the end users in terms of "can do/ cannot do"

− Selecting suppliers on the base of specific experience instead of availability

− Accept that suppliers may play an "active listener" role. Encourage them to ask questions, so that compromises between solutions and functionality can be explored directly between cluster members and end users.

3. CLUSTER LEVEL VALUE ENGINEERING ACTIVITIES

Value Engineering activities at Cluster level are carried out as a way of progressing design of different parts of the facility. Clusters will pursue the design of the areas allocated them after the agreement on concept design layout, and will value engineer them.

Level:	Engineering/Detailed Level
Timing:	From sign off of Design Strategy to completion of Scheme Design and establishment of "firm price"
Objectives:	Optimise cluster contribution Identify savings in time, improvements in performance, ways to enhance quality Produce simpler solutions using cluster members' expertise and experience Optimise procurement Develop Process improvements Optimise best balance between user requirements and Through Life Cost
Further objectives: **expected as a result of the value activities at the cluster level**	Team building Optimise interfaces Improve communications within clusters Integrate cluster with necessary skills and expertise Produce co-ordinated design Enhance buildability
Team:	Facilitator Prime contractor Cluster Team Leaders Design Team Leader Cluster members (selected suppliers)
Output:	Value register and action plan for opportunities Revised cluster level cost plan Updated cost and project plan (Risk register and allocation of ownership of risks: see risk tool)

The Process

Value Management activities at the cluster level can be carried out through a range of initiatives from formal workshops with follow up meetings to less formalised Value Engineering Meetings. As a rule, all cluster members should participate in a structured event at which the principles, practices and tools of Value Engineering are introduced and road tested.

Appropriate action needs to be taken so that each of the subsequent meetings retain the minimal structure of any VM event, i.e., they include a brainstorming and an analytical and comparative phase, they specify and forward actions, and they retain any information produced through some form of recording system.

It is fundamental to guarantee ongoing integration of the work pursued within the clusters. It is fundamental therefore that a specific forum is identified within the project in which the progress of the work within the clusters is reviewed and discussed on a regular basis, usually on a fortnightly basis. At the same time, specifically, it is essential that the work of the cluster is properly co-ordinated so that the systemic integrity of the design is preserved. This can be achieved as follows:

Cluster leaders or champions (who will be assigned at the end of the main Workshop to explore opportunities) will have to decide if, and to what extent, opportunities and ideas identified at the cluster level will impact upon the work of the other Clusters. If this impact occurs, the Champions will report to the Project Core Team (which includes all other cluster leaders). Cluster leaders will then report to their Clusters on the development of the other strands of work, and discuss the potential impact on their own activity. If issues of compatibility or potential conflict arise, the Project Core Team will consider appointing a temporary, Cross-Cluster Team to focus upon and solve the specific issue.

The same process should be applied to the emerging TLC data. Within the Building Down Barriers a Cost model was developed which seeks to provide, as far as possible, a method of comparison and evaluation of the financial performance of the project in optimising the whole-life cost of the building. TLC data should be fed into the central cost model on a regular basis to enable continuous feed back to be provided to the cluster on progress made toward achieving the set global target cost. Using the cost model as a support, the Prime Contractor identifies the cost gaps at Project and Cluster level and provides the necessary feedback to Clusters for action.

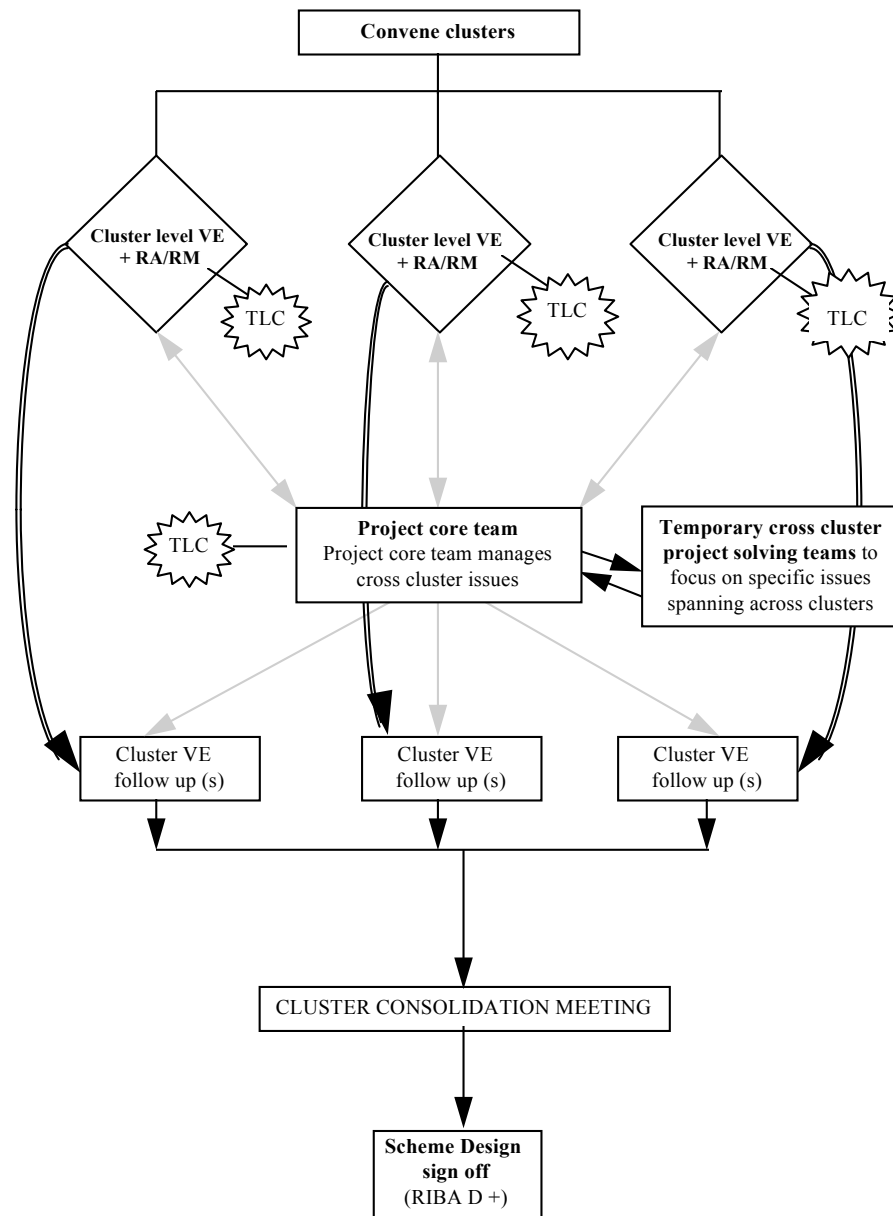The overall generic process is summarised in the figure 2 below:

Figure 2

Supporting tools

The VM process at cluster level *can be supported by the use of A value Register and of the Interface Register* (see Tool C.3)

VALUE REGISTER (VR)

The value register is used with the dual purpose of identifying major design solutions to be value engineered and listing potential solutions to be further explored at the cluster level. The form may also record advantages and disadvantages of the proposed idea and exploration of the impact of the options on other areas of the building.

The value register can be used as a reference document at the periodic cluster leader meetings at which it should be regularly updated and reviewed.

An example of Value Register is provided in figure 3.

Project		Cluster			Date	

N.	Description of items to be investigated	Target Cost	Potential saving	Action by	Decision	Comments

Figure 3: example of Value Register

VALUE RATING SHEETS AND THROUGH-LIFE COST FORMS

Different forms can be used to support and/or record the outcomes of the VE activities at Cluster level.

Value rating sheets are mainly used to record the result of the functional and technical analysis and compare the options put forward by cluster members. During the VE exercise, each major option is evaluated according to functionality and a number of other technical criteria (e.g., durability, safety, buildability, impact on other parts of the building). Although cost should not be a central concern at this stage - in that functional requirements should always have precedence over simple economic considerations - (indicative) cost should constitute one of the categories.

Pros and cons of each of the options analysed are recorded in various parts of the form. The form should also indicate the result of further explorations and other relevant information. Once the process is completed and one option selected, the form constitutes a document to be used for audit purposes.

To support the process of evaluation, the *Functional and Technical Comparison Decision Matrix* can be used. The matrix allows clusters to compare options by weighting the importance of different criteria, scoring the options and ranking them on the basis of the results. The form is used to compare options along measurable but difficult-to-cost dimensions.

dti

Finally, *Through-Life Cost (TLC)* sheets can also be used to gather data in support of the process. The TLC form usually provides a TLC profile for the item under discussion which specifies capital cost, maintenance and replacement costs and running costs. The data can be provided in actual terms and then reconciled in NPV terms and can therefore be used in the decision process, while the cost information can be inputted in the general cost model and TLC profile.

Key success factors

Train People: The Clustering process should start with an "induction" workshop at which the principles, rules, and use of the different tools are shared with the cluster leaders and members.

Break down expertise supported barriers: It is fundamental that; logic behind and spirit of approach, reasons for use of each tool and expectations of contributions from each participant, are explained to all members at the outset.

Prioritise: Identify priorities and set Key Value drivers at the very outset of the process. This will reduce time consumption and number of meetings.

Timing: The "it is never too early" view should be adopted. Every effort should be made to avoid decisions taken at one point of the VE process becoming constraints for future deliberations.

Insure continuity of representation: It is important that clusters are always represented by the same person at the inter-cluster level. At the same time, it is worth considering having a representative at strategic level sitting at the cluster meetings to

---

Value Engineering at Cluster level in the BDB

The foundation for the swimming pool of one of the PRTC's had been designed using a "extended slab" approach. The basic idea was to extend the base slab beyond the pool walls as an anti-buoyancy measure. Although the "toe-in solution" proposed by the design consultant was technically acceptable and broadly used, it posed some difficulties with regards to buildability, as the formation of the toe was technically difficult to construct. At the same time, the solution would mean that extra costs would be incurred because of the back filling and the extra earthwork support required.

During the VE at clustering level, an alternative and innovative solution was put forward by the ground work Cluster. It was proposed that interlocking trench sheeting would be used to support the excavation sides but would be increased in size so that they could also be used as friction piles which would "anchor" the pool in place. The sheeting would be placed around the inside face of the pool. However, this required a very precise positioning and fitting of the sheeting. The idea was value engineered in consultation with relevant cluster members (Groundworks Cluster Leader and Piling contractor.). Buildability issues were examined and some site tests was carried out. It was found that this solution would produce some extra benefits: the sheeting would provide support for the outside ground work, improving safety on site during foundation work; at the same time, the sheeting could be used as a formwork to pour concrete against it. The solution was found to deliver superior value for money in comparison with the original, and it was therefore accepted and implemented.

dti

ensure that a system view is retained.

Emphasise cross cluster co-ordination mechanisms: The Interface Register and the Cluster Leaders meeting proved to be fundamental inter-cluster co-ordination mechanisms.

Encourage informal communication between clusters: Interface issues, once identified, should be delegated to the clusters for future exploration and sorting out. Clusters should be encouraged to communicate directly so that meetings are used for review and endorsement as opposed to analysis and decision-making.

Start clustering on the basis of a definite spatial layout and cost strategy: To increase the potential contribution of the supply network, especially when suppliers are new to the process, it is important to ensure that the design team develops a definite spatial layout before starting clustering activities. In similar fashion, a clear cost strategy for TLC composition should be agreed before activating the clusters.

Record actions: All tools used should be developed and used on the principle that all actions need to be recorded in clear and understandable terms.

Improve cluster member selection process: Clusters, even when well managed, can only express the technical potential of the participants. In order to obtain good results it is important to select the right participants.

Adopt a balanced approach to formalised decision making process: A balanced approach should be adopted during the decision making process. Taking an extreme formalised and questioning attitude may signal distrust to suppliers and demotivate. On the other hand, accepting suppliers' views indiscriminately with no discussion (on the principle that they are the experts), may lead to accepting sub-optimal solutions deriving from industry customs and established practices. It is fundamental to remember that formalised rating tools are only decision support devices and that they should be used to support the process, not to hamper it.

Continuous Improvement: This should be addressed at Cluster Level from the beginning.

4. CLUSTER CONSOLIDATION MEETING

The aim of the meeting is to consolidate work carried out by the Cluster to finalise a "Scheme Design" and an advanced cost plan into the basis for the awarding of the construction phase.

Level:	Inter cluster
Timing:	Towards the end of the "concept design phase
Objectives:	To consolidate the work carried out by the clusters To consolidate "Scheme design"
Team (same as VM at cluster level):	Facilitator Prime contractor Cluster Team Leaders Design Team Leader Cluster members (selected suppliers) Client representative (s): Project Sponsor, Facility Manager, Advisors, representative of end users
Input and induction	Output from all clusters
Output	Final report including: Integration of cluster ideas Resolution of outstanding issues Recommendations Lessons learned

Key success factors

Focus presentation on areas which have maximum impact on functionality and on end user satisfaction.
Ensure that all client stakeholders are present.
Focus on design
Avoid discussing more detailed and technical issues: these will be tackled in the detailed design phase

5. DETAILED DESIGN VALUE ENGINEERING ACTIVITIES

Although the impact of Value Management is higher in the early stages of the design, further saving can be generated and the value for money ratio improved by carrying out Value Engineering activities also during the Detailed Design phase.

Cluster level MICRO Value Engineering activities

A number of "Value Analysis Cluster Meetings" should follow Design Review and Process planning Workshop at the beginning of the detailed design phase. These meeting are aimed at addressing the issues identified in the workshop and should involve both cluster leaders and cluster members. They can therefore only take place after most of the key cluster members are appointed.

The "Value Analysis Cluster Meetings" should have the following characteristics:

Level	Micro-level Value Engineering
Timing:	Beginning of the Detailed Design phase
Objectives:	Brainstorm for solutions and ideas Improve functionality and buildability Reduce cost Solve the identified issue Achieve saving target
Participants:	Cluster Leaders (to lead the meeting) Cluster members
Input	Action plans and targets from "Project Launch Workshop"
Output	Recommendations

The "Value Analysis Cluster Meetings" do not necessarily take the form of a full-fledged workshop. In many cases a short session will be sufficient. However, for the success of these meeting and of the all VE activity during Detailed Design the following conditions apply:

- □ "Value Analysis Cluster Meetings" need to be properly planned and facilitated
- □ Where possible, Cluster Leaders should facilitate these meetings in order to enhance ownership of problems and solutions
- □ The focus must be directed to micro manufacturing processes and issues
- □ The standard VE process should be followed during the meetings, namely:

↓Review functionality
↓Apply cost to functionality
↓Brainstorm for options
↓Evaluate solutions
→Make recommendations

dti

Although many of the cluster leaders have been exposed to Value Activities during previous phases of the project, this does not insure that they all have the necessary capabilities to run a properly structured VE meeting. The PC should therefore provide the necessary skills by running a training session on "How to conduct a Value Analysis Cluster Meetings". The training activity could take the form of a "hands-on" rehearsal of the process carried out at the end of the "Project Launch Workshop" on one of the issues identified. The training session MUST be carried out by an expert VM facilitator with training skills. To enhance the learning process the PC should consider the opportunity of asking Cluster Leaders to contribute to the costs incurred.