

## TOOL C.1

### FORMING SUPPLY CLUSTERS AND APPOINTING CLUSTER LEADERS

#### 1. WHAT IS A CLUSTER?

A Cluster is, in many respects, a “design and construct” mini-project that takes place within the larger framework of a project. It is a place where a limited number of designers, suppliers of materials or components engage in intensive collaboration to design and deliver a significant, recognisable element of the overall building, working to reduce costs, improve value and minimise waste. Clusters operate as semi-independent parts of the project under the overall co-ordination of the Contractor or Project Manager, replicating the logic of one-point responsibility down the supply chain. Relations between Clusters and the overall project may vary along an increasing level of delegation: Clusters may be granted functional responsibility over a set work-package, they may be attributed greater powers of discretion with regard to technical and commercial arrangements within an allocated cost target, or they may even be completely delegated the responsibility for part of the work, including the direct management of all contractual and commercial relations with the suppliers involved in the activities. Cluster Based Project Organisation. Figure 1 below summarises the basic model of a cluster-based project.

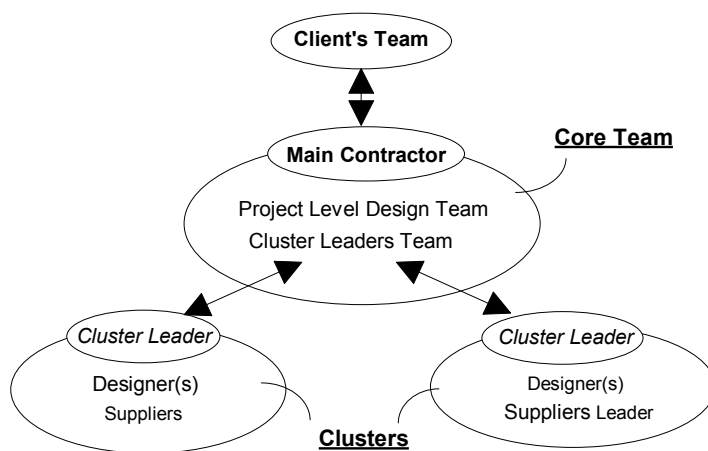


Figure 1

#### 2. WHY USE CLUSTERS IN A PROJECT?

The rationale for using Clusters as a way of breaking down a total project is that collaboration between members of the supply network is most likely to be effective when it takes place in work packages involving a limited number of players, working on a bounded area of the total project. Clusters will typically focus on areas such as: ground work; frame and envelope; building services and internal finishes. Clusters will have a high inter-dependency between players within the work Cluster to ensure the efficiency, effectiveness and availability of the constructed output from the Work Cluster, including all interfaces.

Clustering facilitates the involvement of specialist contractors and suppliers from the outset of the design process and promotes multidisciplinary work, enables paralleling of tasks and minimisation of interfaces, and promotes transparent communication.

### 3. CRITERIA FOR FORMING CLUSTERS

Four criteria guide the formation of clusters at project level: integrity of processes, interdependency of activities, leadership and incomplete clustering.

#### *Criterion 1: Base Clusters on “whole” building elements*

Clusters are based around “whole” building elements or systems, which retain functional unity. A Cluster should have a meaningful and measurable output, which can be subject to value management in its own right, e.g. the frame and envelope, the swimming pool, the internal finishes. A Cluster should not normally be put together around the work of a particular trade e.g. *residual metal work*, as sometimes happens with traditional work packages.

#### *Criterion 2: Base Clusters on interdependent activities*

A Cluster needs to cover a range of operations at the construction stage that are relatively interdependent one with the other, whilst being relatively independent of other aspects of the building. Considerations of what belongs together in terms of timing, operational convenience and cost minimisation need to be taken into account and reconciled here. Boundaries need to be drawn around activities in such a way that some benefits derive from carrying them out as part of the same work package. Benefits include reducing risk at the interfaces, improving sequencing, achieving economies of scale in the use of a particular kind of plant or labour, or achieving higher quality and reduction of waste through improving understanding between people engaged on tasks that are strongly linked. For example, by including the suspended ceilings in the mechanical and electric work package one can prevent rework (the same scaffolding can be used for all three), waste (ceilings are not damaged by subsequent activities) and time (there is no interference between the two activities).

Cluster members then have the scope to establish control over cost, programme and quality in completing the work of the Cluster. They will not have to wait for someone else to complete something crucial. Simultaneity and concurrency are therefore highly supported by this organisational arrangement.

Combining these first two criteria suggests that Clusters will normally be set up to separate, for example, shell construction from finishes and other interior-related activities. Clusters should also be defined so that suppliers and/or vendors become responsible for specific “bundles” of value considerations from the client perspective (e.g. a durable and reliable water system - including purification, heating, filtering) instead of from a professional or technical perspective (e.g. well made plumbing).

### Criterion 3: Ensure effective leadership

There needs to be the potential for effective leadership and co-ordination amongst the players involved in a Cluster. Usually this means identifying a lead supplier, sub-contractor or designer who has the credibility and capability to co-ordinate the work of the others. This is the Cluster Leader.

### Criterion 4: Incomplete clustering

Some activity will however not fit easily into building-element focused Clusters, e.g. maintenance and operation of site plant, or trades, such as bricklaying, needed by several different element-based clusters. These can be placed together within a separate “Services Cluster”, which provides services to the element-based Clusters.

For example, using these principles the two Pilot project in the “Building Down Barriers” initiative operated with the slightly different Clustering arrangements summarised in Table 1 below:

**Table 1**

<b>CLUSTERING ARRANGEMENT IN THE TWO BDB PILOT PROJECTS</b>	
<i>WATTISHAM PILOT</i>	<i>ALDRSHOT PILOT</i>
1. Groundwork	1. Civils and Groundwork
2. Frame and Envelope	2. Dry Envelope*
3. Swimming Pool (including water treatment)	3. Internal Building and Construction, including Finishes
4. Internal Finishes	4. Water Treatment
5. Mechanical and Electrical Services.	5. Sports Equipment
	6. Mechanical and Electrical Services

\* Leadership of this Cluster was shared between Roofing/cladding specialist & steel frame specialist

## **4. THE ROLE OF THE CLUSTER LEADER**

Each Cluster needs to have a lead organisation, which will usually be represented by one person who will be the designated Cluster Leader. The overall responsibility of the Cluster Leader is to provide Leadership in all aspects of the Cluster’s work, so that the Cluster achieves its key objective, to deliver its products for the Concept and Construction Stages, “right first time.”

In order to do this, the Cluster Leader has the following more specific responsibilities:

- to provide leadership and co-ordination in design and construction tasks allocated to the Cluster
- to manage the interfaces between the Cluster’s design development and construction work and the overall project design and construction process.
- to assess and refine the total cost of the design being developed for the Cluster, identifying how value can be improved, and then agreeing a price

with the Prime Contractor that the Cluster as a whole can deliver to reliably.

The Cluster Leader (CL) is in effect a “mini-Prime Contract Manager”.

## **5. MECHANISMS FOR CO-ORDINATING CLUSTERS**

Clusters are co-ordinated by a Cluster Leader Team that meets regularly throughout the duration of the project. The Cluster Leader Team comprises:

- Representatives of the Contractor
- Cluster Leader from each Cluster
- Other design specialists with project-wide responsibilities.

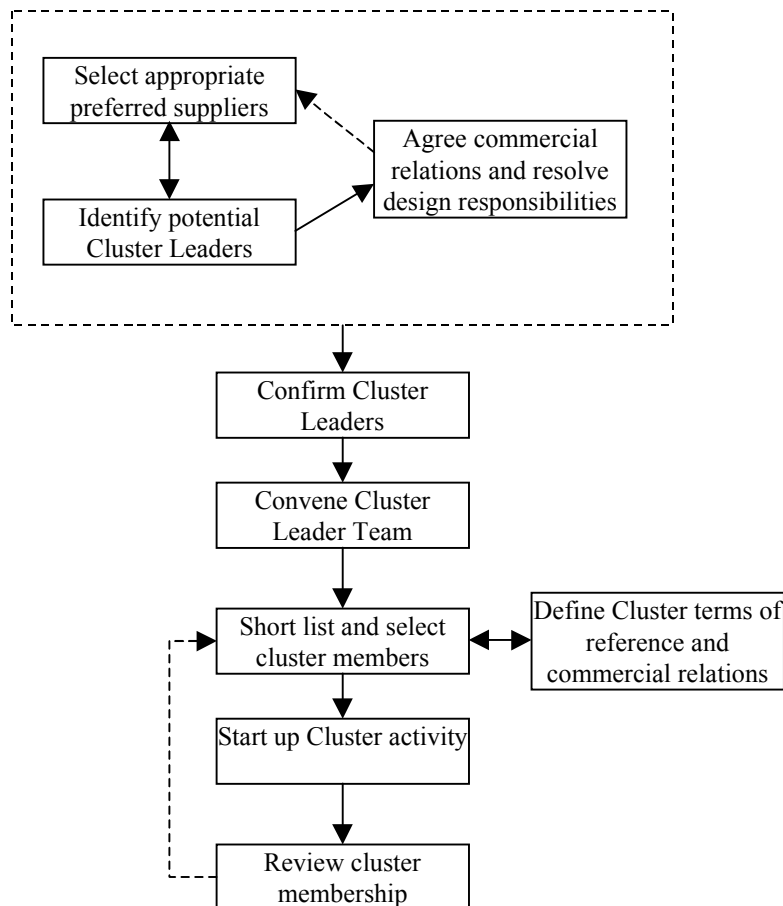
This team is put in place as early as possible during the early phases of the design, then finalises the division of the project into a number of Clusters. Once the Clusters have been set up, the Cluster Leader meetings co-ordinate design development work across the different Clusters, resolving interface issues that concern two or more Clusters. The team has a similar role during construction, co-ordinating the plans and actions occurring within each Cluster and resolving issues that cannot be dealt with within a Cluster.

In order to support the co-ordination process the Cluster leader Team used the “Interface Register” discussed in details in tool C.2 “Sequencing design”. The “Interface Register” is a log in which interface issues, their potential cross-Cluster impact, and actions to be taken to prevent or reduce these issues are recorded. The Interface Register is established at the outset of the Clustering process on the basis of an analysis of critical interface effects. During Cluster Leader Meetings, the Interface Register is regularly reviewed and updated.

## **6. SETTING UP CLUSTERS IN THE PROJECT**

The Clusters are set up by the Prime Contractor early in a project, usually around the time when the critical technical solutions to be adopted are agreed upon after careful comparative evaluation (development of the design strategy, RIBA Stage C/D and early scheme design). Cluster Leaders are provisionally designated by the Prime Contractor during the development of the Project brief and the drafting of the design strategy. Cluster Leaders are confirmed once the Design Strategy has been signed off. Cluster members are selected soon after in consultation between the Prime contractor and cluster leaders.

Figure 2 summarises the sub-process needed to actually get a Cluster off the ground and working:



**Figure 2**

The following are issues and options to be borne in mind when tackling each of these stages.

### ***6.1. Identify preferred suppliers and appoint Cluster Leaders***

The designers, specialist contractors or suppliers selected by the Prime Contractor to lead Clusters are drawn from the Prime Contractor's list of strategic partners or preferred suppliers. The preferred supplier (or subcontractor) relationship with the Prime Contractor is explained in the Base Discipline on Managing the Supply chain and in Tool A.5 “Selecting supply partners”. It incorporates a continuous improvement process that can only be effective if it goes beyond individual projects. The existence of long-term relationships facilitates the preferred suppliers being available during the early stage of the design process on an individual project to inform the exploration of the design options, including value engineering and through-life costing appraisals.

Cluster Leaders for a particular project can be selected by considering the following four criteria. The criteria provide useful guidance, but ultimately the PC may find themselves in the position of having to choose a CL based on an assessment of their suitability across the four criteria, with some met better than others.

*Who is best placed to carry the main risks in delivering the Cluster's product?*

If one party is likely to be naturally responsible for most of the key risks, e.g. the performance of a roof or the delivery of a complex piece of construction to program, then there is a strong argument that they should be the Cluster Leader (CL).

*Who is likely to have the most intensive interactions with other Cluster members (a) during Design (b) during Construction?*

Since the job of the CL is to integrate and co-ordinate the work of the Cluster during both design and construction, if a player will need to interact heavily with other members then there is a strong rationale for them to be the CL.

*Who is likely to have the most intensive interactions with other Clusters (a) during Design (b) during Construction?*

Since the job of the CL is to be the linking pin with the Core Project Team and the work of other Clusters, if a player will need to interact heavily with other Clusters, there is a strong rationale for them to be the CL.

*Who has the experience, capability and credibility to manage the work of others?*

It is important that the party given the role of CL has previous experience of being some form of construction manager, so that they can establish their credibility and authority with other Cluster Members.

## **6.2. Defining design responsibilities and commercial relations between the Prime Contractor (PC), Cluster Leader (CL) and Cluster Members (CM)**

At the very outset of the Clustering process the Prime contractor and the cluster leaders need to clarify and agree design responsibilities and commercial relations with Cluster members.

### **DESIGN RESPONSIBILITIES**

Clustering is a process of delegation aimed to prevent the traditional split between design, costing, and construction and to support the early active involvement of specialist suppliers. Accordingly, during scheme design the PC and the CLs will have to negotiate, clarify and agree which design responsibilities are transferred to the Cluster leaders and which remains with the Core team design consultants. While delegating design responsibilities, it is of critical importance that clear and reliable co-ordination mechanisms are in place between CLs and designers and among CLs. The negotiation about design responsibilities needs to be carried out together with the definition of suitable commercial relations (see below). Three major options are available for the delegation of design responsibilities to CLs:

*a) Design responsibilities are assumed in full by CLs' in-house designers*

When CLs have sufficient in house design capabilities and experience they can accept full responsibility for the development of the later stages of the scheme design and detail design (RIBA stages late D, E and F).

*b) Design responsibilities are assumed in full by the Cluster Leader but design activity is outsourced*

In some situations the CLs may want to take on full responsibility for the design even though they do not have sufficient capabilities or experience to carry out all the required

design work. In this case, the design of the agreed work package can be carried out by a designer appointed and paid by the CL. In this way the CL retains full control of its work package. Designers can come either from the pool of CL's strategic partners, or alternatively the CL can hire the member of the Core team who carried out the scheme design

c) *Design responsibilities are retained by the Core team*

Finally, the responsibility for the advanced scheme and detailed design stages can be retained by the relevant member of the Core Team (e.g., the architect or a design consultant) who will work in strict consultation with Cluster leaders. The Prime contractor will pay the designer on a fee basis.

It is very likely that in the same project different Clusters will agree diverse arrangements for design responsibilities. The division of design labour in the BDB is summarised in Table 2 below, which also shows how design responsibility in some Clusters changed during the course of the design.

**Table 2: Design responsibilities In The Two BDB Pilot Projects**

<i><b>WATTISHAM PILOT</b></i>		<i><b>ALDERSHOT PILOT</b></i>	
<i><b>CLUSTER</b></i>	<i><b>WHO DID THE DESIGN</b></i>	<i><b>CLUSTER</b></i>	<i><b>WHO DID THE DESIGN</b></i>
<b>Groundwork</b>	Scheme design undertaken by Core Team consultant; Detail design by Core Team consultant advised by Cluster Leader	<b>Civils and Groundwork</b>	Scheme design undertaken by Core Team consultant; Detail design by Core Team consultant advised by Cluster Leader
<b>Frame and Envelope</b>	Scheme design undertaken by Core Team consultant; Detail design by Core Team consultant advised by Cluster Leader	<b>Dry Envelope</b>	Scheme design undertaken by Core Team consultant; Detail design led by Cluster Leaders
<b>Swimming Pool (including water treatment)</b>	In-house Designers	<b>Building and Construction (block work and finishes)</b>	Core team (Architect)
<b>Internal Finishes</b>	Core team member (Architect)	<b>Water Treatment</b>	In-house Designers
<b>Mechanical and Electrical Services.</b>	Scheme design undertaken by Core Team consultant; Detail design led by Cluster Leader	<b>Sports Equipment</b>	Core team (Architect)
		<b>Mechanical and Electrical Services</b>	Scheme design undertaken by Core Team consultant; Detail design led by Cluster Leader

## COMMERCIAL RELATIONS

There are three possible forms for commercial relationships:

a) *Between PC and CL, who then has direct commercial arrangements with each CM*

This is the Building Down Barriers “ideal”, because each CL can be fully responsible for value engineering, through-life costing, agreeing the price and delivering to cost and time scale within the area of the overall project for which their Cluster has taken responsibility.

One realistic concern that needs to be addressed within this kind of arrangement stems from the way that sub-contractors and suppliers who make up the Cluster will then have commercial relations with the CL rather than the PC. In the building industry, not having a direct contract with the “main contractor” has come to be seen as an additional risk in terms of being paid on time, since it adds an extra rung in the payment hierarchy which starts with the client, where delay can occur.

The solution is for the PC and Client to ensure that at the beginning of the Concept Stage a payment schedule for all parties in the project is published. This indicates who should be receiving what amount at each project milestone, without any delays in passing payments up the chain. Payments will then only be delayed when progress at the milestone point has not been reached and all parties will suffer the same delay. There will however be a need for the PC and Client to set up an Appeals Procedure, so that if any CM feels they have not been paid on time as agreed, they can have an open hearing.

*b) Between PC and CL, but where CMs have direct relations with PC*

This is an interim relationship needed when CMs are reluctant to give up a direct commercial relationship with the CL, or when the CL does not yet have the capability or credibility to manage their own subcontracts. It will always be used in combination with (c) below.

*c) Between PC & CM, who however works under the direction of the CL.*

### **6.3. Confirm Cluster leaders and Convene the Cluster Team Start-Up Workshop**

Soon after signing off of the Design Strategy, the PC should confirm the selected Cluster Leaders and convene the first meeting of the Cluster Leaders team

The meeting should be convened following the process spelled out in tool C.7 “Forming new teams and inducting new project members” and should cover at least the following issues:

- Review and clarify responsibilities and commercial arrangements.
- Agreeing procedures for interaction with other Clusters, observing overall project procedures.
- Agree co-ordination mechanisms and supports (Interface Register, IT arrangements and standards)
- Producing procedures for information flow e.g. drawing standards and authorities to issue them, to comply with overall project standards and procedures.
- Agreeing an outline programme for the work of the Scheme Design
- Agree meetings schedule and attendance.
- Introduce techniques and methods at cluster level (VE, RM)
- Introduce principles and obtain commitment on CI activity



#### **6.4. Shortlist and select cluster members**

Cluster members are selected by Cluster Leaders and/or Prime contractor (depending on the existing commercial relations between the two) at the earliest appropriate stage of the scheme design. The appointment of Cluster Members is likely to proceed in an incremental manner, for the emergence of technical solution and the identification of appropriate specialist proceeds hand in hand.

Cluster members are selected through a process similar to that described for the Cluster Leaders. They are shortlisted and interviewed, and their contribution to the project assessed. Before becoming active part of Clusters, Cluster members need to agree a suitable commercial relation with the Prime contractor and/or Cluster Leader.

#### **6.5. Start up Cluster activity**

The CL should convene a start-up workshop, guided by Tool C.7 “Forming a New Team”. In assessing “needs and interests” and setting the workshop agenda, the following minimum items will need to be addressed:

- Producing and agreeing a detailed process for the work of the Cluster during the Concept Phase, involving the sequencing of design decisions use of VM/VE, RA/RM tools at several points, production of increasingly refined TLC estimates and the development of a plan for construction.
- Agreeing an outline programme for the work of the Scheme Design.
- Allocating responsibilities for different aspects of the Cluster’s work, probably using some form of process/member matrix chart.
- Identifying training needs for Cluster Members.
- Producing a plan for compliance with CDM regulations.
- Agreeing the basis for a Cluster Quality Plan.
- Producing procedures for information flow e.g. drawing standards and authorities to issue them, to comply with overall project standards and procedures.
- Agreeing procedures for interaction with other Clusters, observing overall project procedures.

#### **6.6. Review Cluster membership**

The Prime Contractor and Cluster Leaders should review on a regular basis whether the membership of the Cluster is adequate for the Cluster’s work, or whether extra inputs are required. In the latter case new or different cluster members are taken on board reiterating the process described above.

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Contact Don Ward (Chief Executive):

(E) [don.ward@beonline.co.uk](mailto:don.ward@beonline.co.uk) (W) [www.beonline.co.uk](http://www.beonline.co.uk)  
PO Box 2874, London Road, Reading RG1 5UQ. (T) 0870 922 0034

**Collaborative Working Centre – [www.collaborativeworking.co.uk](http://www.collaborativeworking.co.uk)**

The Collaborative Working Centre of Be is a not-for-profit organisation set up from members of the team that facilitated *Building Down Barriers* to provide consultancy, training and other continuous improvement services to support the development and implementation of collaborative working.

Contact Neil Jarrett or Vassos Chrysostomou (Directors):

(E) [neil.jarrett@collaborativeworking.co.uk](mailto:neil.jarrett@collaborativeworking.co.uk) or [vassos@collaborativeworking.co.uk](mailto:vassos@collaborativeworking.co.uk)  
c/o PO Box 2874, London Road, Reading RG1 5UQ. (T) 0870 922 0034