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ABSTRACT

In 1992, the UK Government introduced the Private Finance Initiative (PFI) as a policy to allow and regulate privately financed public projects. However, PFI is better understood as an innovative procurement method. PFI involves a private sector entity taking the responsibility to design, build, finance and operate (DBFO) an asset used in the provision of a public service for a contract period of up to four decades. It is widely propositioned that PFI procurement leads to improved value for money (VFM) and profit for the public sector clients and private sector actors respectively as a result of improvements in economic efficiency. The aim of this research is to *generate a detailed understanding of how the economic efficiency of an accommodation service PFI project is determined in its development through contract whole life cost ($CWLC_P$) minimisation.*

This research consists of two case studies on large and complex accommodation service PFI projects. It focuses, in particular, on the effects of PFI procurement on the heating and ventilation design solutions of the project-facilities. The data obtained is self-report interviews, public and private sector issued project documentation and expert opinions. The data is subjected to solution, incentive, opportunity and perception analyses.

The research unexpectedly identifies only a small number of design solutions that are incorporated in the project-facilities with the aim of achieving $CWLC_P$ reductions. In other words, the research finds that the economic efficiency improvement in the procurement of public accommodation services due to the adoption of PFI is considerably smaller than proposed by economic theory. This, however, does not suggest that the economic efficiency of PFI accommodation services is found to be worse than those procured traditionally. The research establishes that the limited improvement is because of: the guidance documentation used to govern the design of PFI project-facilities; the market testing mechanism used to adjust the payment for the service provision in the operational phase; the organisation of the private sector actors in the project development; and the lack of good quality data to estimate expected $CWLC_P$ reductions. The research develops possible strategies to rectify the identified problems. The adoption of these strategies should enable the economic efficiency of future accommodation service PFI projects to be improved through $CWLC_P$ minimisation.

FOREWORD

This publication is an output of a research project titled: *The Contract Whole Life Cost in the Private Finance Initiative (PFI) Development Process* carried out by VTT Building and Transport. The project had a dual aim. First, it was to examine the economic efficiency of accommodation service PFI projects in the United Kingdom (UK). Second, the project was to determine the critical issues in the more successful implementation of such projects in order to provide focus for future development work on the application of PFI-type accommodation service procurement in Finland.

The research in pursuit of the first aim was carried out in the UK. This publication[i] reporting on that research is identical (apart from this foreword) to the thesis that Kai Rintala produced for the degree of Doctor of Philosophy (PhD) in Building Management at the Bartlett School of Graduate Studies (BSGS), UCL (University College London), University of London.

In early 2003, a separate publication titled *Thoughts on DBFO – A Study of UK Accommodation Service Procurement for the Benefit of Finnish Practice*[ii] [in Finnish] authored by yours truly and Kai Rintala came out in the VTT Research Notes series. That report satisfied the second aim of the project.

This research project was funded and directed by:

- The City of Espoo
- The Confederation of Finnish Construction Industries
- JP Building Engineering Ltd
- The National Technology Agency of Finland, ProBuild Program
- Senate Properties
- SRV Viitoset Ltd
- VTT Building and Transport, and
- YIT Construction Ltd.

In my capacity as the project manager responsible for this research, I wish to thank those who made it financially possible and contributed to the project in the steering group meetings. I also want to express gratitude to the staff at BSGS, and others involved, who collaborated with us and enabled our research to capture the leading edge thinking on PFI.

Tampere, Finland
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Pertti Lahdenperä

i) Available at http://www.vtt.fi/inf/pdf/publications/2004/P555.pdf
ii) Available at http://www.vtt.fi/inf/pdf/tiedotteet/2003/T2192.pdf

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London, United Kingdom
September 2004

Kai Rintala

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LIST OF ABBREVIATIONS, ACRONYMS AND INITIALISATIONS

4SS	European Land (Four Surplus Sites) Limited
A&E	Accidents and Emergency
ACB	Active Chilled Beam
ACL	AMEC Construction Limited
ACPL	AMEC Capital Projects Limited
ADB	Activity Data Base
ADL	Anshen Dyer Limited
ANTS	Abbey National Treasury Services plc
AP	Availability Payment
APIL	AMEC Project Investments Limited
ARM	Availability, Reliability and Maintainability
BAFO	Best and Final Offer
BBCL	Balfour Beatty Construction Limited
BBCPL	Balfour Beatty Capital Projects Limited
BCJV	Building Contractor Joint Venture
BCR	Benefit to Cost Ratio
BMI	British Maintenance Industry
BPFML	Building and Property Facilities Management Limited
BPGL	Building and Property Group Limited
BSU	Biological Science Unit
BUKL	Bouygues UK Limited
BV	Bid Vehicle
CBL	Currie & Brown Limited
CFL	College Facilities Limited
CFO	Conventionally Funded Option
CIC	Construction Industry Council
CNML	Clarke, Nicholls & Marcel Limited
CUP	Central Unit of Procurement
CWLB	Contract Whole Life Benefit
CWLC	Contract Whole Life Cost
DB	Design and Build
DBB	Design Bid Build
DBFO	Design Build Finance and Operate
DBO	Design Build Operate
DETR	Department of Environment, Transport and Regions
DLE	David Langdon and Everest
DoH	Department of Health
DPB	Discounted Payback
DSE	Dust Stabilisation Enhancement

DSIR	Discounted Savings to Investment Ration
DSSRL	Donald Smith, Seymour and Rooley Limited
EDH	Eastman Dental Hospital
EGA	Elizabeth Garrett Anderson and Obstetrics Hospital
ELDL	European Land (KC and UMDS PFI) Developments Limited
ELL	Europland Limited
ELPL	European Land and Property Limited
EoI	Expression of Interest
ESL	Ecovert South Limited
EUT	Expected Utility Theory
FBC	Full Business Case
FM	Facilities Management
FMOS	Facilities Management Output Specification
GFA	Gross Floor Area
HCTJV	Health Construction Team Joint Venture
HBN	Health Building Note
HEFCE	Higher Education Funding Council for England
HH	Heart Hospital
HM Treasury	Her Majesty's Treasury
HMG	Health Management Group
HMU	Health Management (UCLH) plc
HTD	Hospital of Tropical Diseases
HTM	Health Technical Memoranda
HV	Heating and Ventilation
HYL	Haden Young Limited
IA	Incentive Analysis
IBD	Initial Briefing Document
IFML	Interservefm Limited
IIL	Interserve Investments Limited
InvestCo	Investment Company
IRR	Internal Rate of Return
ITND	Invitation to Negotiate Documentation
JHSCL	J. Henry Schroder & Co Limited
JV	Joint Venture
KCL	King's College London
LCF	Life Cycle Fund
LDL	Lewelyn-Davis Limited
M&E	Mechanical & Electrical
MH	Middlesex Hospital
MHL	Mathew Hall Limited
MoI	Memorandum of Information
MVQ	Maintenance Viability Questionnaire
NAO	National Audit Office

NHNN	National Hospital for Neurology and Neurosurgery
NHS	National Health Service
NPV	Net Present Value
OA	Opportunity Analysis
OBC	Outline Business Case
OCC	Opportunity Cost of Capital
OGC	Office of Government Commerce
OJEC	Official Journal of European Communities
OMS	Operational Method Statement
OP	Outline Proposal
OS	Output Specification
PA	Perception Analysis
ParentCo	Parent Company
PB	Preferred Bidder
PFCL	Pell Fischmann Consultants Limited
PFI	Private Finance Initiative
PFPE	Private Finance Panel Executive
PIN	Prior Information Notice
PITN	Preliminary Invitation to Negotiate
PM	Payment Mechanism
PMJV	Project Management Joint Venture
PPP	Public Private Partnership
PQ	Prequalification Questionnaire
ProjectCo	Project Company
PSC	Public Sector Comparator
RDS	Room Data Sheet
RH	Relative Humidity
RIBA	Royal Institute of British Architects
RICS	Royal Institute of Chartered Surveyors
RLHH	Royal London Homeopathic Hospital
ROE	Return on Equity
RPI	Retail Price Index
RTP	Risk Transfer Premium
SA	Solution Analysis
SisterCo	Sister Company
SOCC	Social Opportunity Cost of Capital
SP	Service Payment
SPS	Service Provision Solution
SPV	Special Purpose Vehicle
STP	Social Time Preference
TBAL	Troup Bywaters and Anders Limited
TTF	Treasury Taskforce
UCH	University College Hospital

UCL	University College London
UCLH	University College London Hospitals NHS Trust
UCMS	University College Medical School
UMDS	United Medical Dental Schools of Guy’s and St Thomas’ Hospitals
UoL	University of London
UP	Unitary Payment
VAV	Variable Air Volume
VFM	Value for Money
WLC	Whole Life Cost
WLCF	Whole Life Cost Forum
WSACL	WS Atkins Consultants Limited

PART A - INTRODUCTION

Chapter 1 - Introduction

1.1. Background

In the mid seventies, investment in public assets in the United Kingdom began to decline (Clark *et al.*, 2002). Eventually, the decline started to show. In the early nineties, the state of the infrastructure used to provide public services was generally perceived to be unacceptable. The poor condition of the infrastructure was blamed especially on the decade long under-investment under the Conservative Government. However, at the time, an increase in public expenditure was problematic. The Government was about to sign the Maastricht Treaty, which was to restrict public sector borrowing. Moreover, the UK was in the middle of a recession. At such times, current public expenditure tends to increase and tax receipts tend to decrease. As a result, a constraint on public sector borrowing became increasingly restrictive of investment in public assets (Clark and Root, 1999).

At the same time, the public sector was perceived to have an efficiency problem in the delivery of public services. The infrastructure used to provide public services was proving to be expensive to operate and its delivery tended to overrun both in terms of time and cost. In other words, public procurement was yielding sub-optimal value for money (VFM) (HM Treasury, 1994; Clark and Root, 1999).

Thus, in the early nineties, it became apparent that the Government needed to change its policy to intervene in the rapid decline of public infrastructure. This led the Government to search for new ways to finance an efficient improvement in the infrastructure. Accordingly, in November 1992, it introduced the Private Finance Initiative (PFI) as a government policy to allow and regulate privately financed public projects in the UK. This explains its name. However, from an efficiency perspective, PFI can be better understood as an innovative public sector procurement method. According to de Lemos *et al.* (2000), PFI has its origins in concessions and project financing, which both date back to the 17th century.

The Conservative Government gave two arguments for the introduction of PFI. First, the procurement method was to yield improved VFM for the public sector through economic efficiency. Second, it was to reduce the amount of public sector borrowing and yet increase investment into public services (HM Treasury, 1993). The projects that initially qualified under PFI fell into three categories. These were financially freestanding projects, joint ventures and asset-based services provided to the public sector by the private sector (Private Finance Panel Executive (PFPE), 1992).

In May 1997, the Labour Party won the general election and took over in Government. The Labour Government redefined the PFI terminology. The three types of projects that had been previously known as PFI projects were now renamed Public Private Partnerships (PPPs). However, the Labour Government retained the term PFI in use for asset-based private provision of public services. Hence, PFI is a form of PPP. The Labour Government also shifted the emphasis in the argument for the use of PFI onto its ability to improve the efficiency of public sector procurement and, thus, deliver improved VFM projects (HM Treasury, 1997a).

PFI involves a private sector entity taking the responsibility to design, build, finance and operate (DBFO) an asset used in the provision of a public service for a contract period up to four decades. In addition, the private sector entity has the ownership of the project asset for at least the contract period. Hereafter, the private sector entity is referred to as the *project company* (*ProjectCo*). The procurement method is characterised by the relationship of a producer of a service (the ProjectCo) and a purchaser of the service (the public sector client). In addition to enabling private sector investment in public services, the procurement method introduced the use of innovative mechanisms to govern the procurement process. These mechanisms are argued to improve the economic efficiency of public procurement (Construction Industry Council (CIC), 2000).

Since PFI was introduced, the procurement method has been more widely adopted in the provision of public services in the UK than in other countries. PFI has been used extensively to procure accommodation service projects. In other countries, PFI-type procurement has been mostly used in civil engineering projects such as roads and bridges, whereas in the UK the use of PFI has been extended to building projects like schools and hospitals. As a result, the UK practice has attracted considerable interest around the world. This is because the case for the shift to PFI-type procurement in the provision of public accommodation services on VFM grounds remains partially unproven. This is the context of this research. The focus of this research is on individual accommodation service PFI projects.

1.2. Principles of PFI Procurement

In a PFI project, the client defines the quantity and the quality of a service that it wants to procure in order to generate a benefit to society. The client defines the service with an output-based specification. The service that the client specifies is influenced by its affordability, i.e. annual expenditure, constraint. The PFI project will yield a contract whole life benefit to society ($CWLB_S$) over its duration. The $CWLB_S$ is the discounted (at social opportunity cost of capital (SOCC)) present value of all the benefits the project generates over the contract period. It must be noted that it is assumed that external costs (to third parties) have been deducted from the benefits and $CWLB_S$ is, therefore, a net benefit. The $CWLB_S$ is treated as being fixed by the output specification (OS).

The fundamental aim of the client in a PFI project is to procure a service that is the maximum VFM subject to its affordability constraint. The VFM of a project is its benefit to cost ratio. The contract whole life cost to the client ($CWLC_C$) is the discounted (at SOCC) present cost of the unitary payment (UP) stream it has to make for the service provision over the life of the contract. Thus, the benefit to cost ratio is $CWLB_S$ to $CWLC_C$. This ratio also reveals the economic efficiency of a PFI project from the client's perspective. The numerical expression of VFM is given in Formula 1.1.

$$VFM = EE_C = \frac{CWLB_S}{CWLC_C} \tag{1.1}$$

where, VFM is the value for money of the project,
EE_C is the economic efficiency of the project to the client,
$CWLB_S$ is the society's contract whole life benefit, and
$CWLC_C$ is the client's contract whole life cost.

A ProjectCo's aim in a PFI project is to maximise its profit from executing the project. The client needs to align the ProjectCo's aim with its aim of VFM maximisation, using an appropriate incentive structure. The client uses procurement competition to create incentives and, thus, invites ProjectCos to bid for the service provision contract. The bidding competition is based on the $CWLC_C$ of the project. The aim of the competition is to lower $CWLC_C$ by forcing the ProjectCos to simultaneously consider the cost of undertaking each of the tasks involved in the whole duration of the project. The $CWLC_C$ is determined as a result of the procurement competition.

A PFI project will yield a contract whole life benefit to the ProjectCo ($CWLB_P$) over its duration. The $CWLB_P$ is the discounted (at opportunity cost of capital (OCC)) present value of the UP stream it receives from the client. It must be noted that $CWLB_P$ does not equal $CWLC_C$. This is because the discount rates used to convert the UP stream to its present value and cost are different. However, $CWLB_P$ and $CWLC_C$ will move in line with each other. This is because the discounted benefits and costs are the same.

The ProjectCo will incur a contract whole life cost ($CWLC_P$) for providing the service in accordance with the OS over the life of the contract. The $CWLC_P$ is the discounted (at OCC) present cost of undertaking all the tasks included in the project. Thus, the difference between $CWLB_P$ and $CWLC_P$ is the ProjectCo's *economic rent*.

The ProjectCo that offers to provide the service defined in the OS with the lowest $CWLC_C$ is likely to be awarded the contract. If the ProjectCo fails to be awarded the contract, it will not be compensated for its bid costs and it will, thus, incur a loss. Therefore, the ProjectCo has a strong incentive to minimise $CWLC_P$ in developing its service provision solution (SPS) for the PFI project. This is because a reduction in $CWLC_P$ enables the ProjectCo to appropriate the efficiency saving and allocate it between a reduction in $CWLB_P$ and an increase in economic rent. A reduction in $CWLB_P$ will lower $CWLC_C$ and, thus, increase the ProjectCo's probability of being awarded the contract.

In a PFI project, the responsibility to design, build, finance and operate a facility are integrated into a single long-term contract. This gives the ProjectCo an improved opportunity to minimise the $CWLC_P$. First, in comparison to traditionally used input-oriented specification, the OS gives the ProjectCo an improved opportunity to innovate in its SPS development. Second, traditionally in the UK, the accommodation service provision has been very fragmented. In traditional construction and operational service procurement, the tasks that are covered by a single contract in a PFI project have separate contracts or agreements. The opportunities to minimise $CWLC_P$ are therefore limited by organisational and contractual boundaries. Third, the length of a PFI contract enables the ProjectCo to recover any increased capital expenditure as economic efficiency gains in operational expenditure over the project duration.

The client has aligned the ProjectCo's aim with its own aim successfully if $CWLC_P$ minimisation has become the ProjectCo's objective. This is because $CWLC_P$ minimisation in the competitive stage of the project will lower $CWLB_P$ and, thus, $CWLC_C$, if the ProjectCo's required economic rent from the project remains a constant percentage p of $CWLC_P$. This is consistent with the client's VFM maximisation aim as it reduces its cost for procuring a service ($CWLC_C$) that generates a pre-specified benefit to society ($CWLB_S$). Thus, the aims of the client and the ProjectCo can be aligned. It must be noted that once the client and the ProjectCo have agreed the UP stream ($CWLC_C$ and $CWLB_P$), the VFM of the project is fixed. In reality, this is only the case if the contract is complete and enforceable.

Once the client and the ProjectCo have agreed the contractual terms, including the UP stream, the ProjectCo has a further incentive to minimise $CWLC_P$. This is because the ProjectCo's $CWLC_P$ minimisation becomes an exercise in economic rent maximisation subject to successful service delivery in accordance with the OS. A reduction in $CWLC_P$ will increase the ProjectCo's economic efficiency in undertaking the project and, thus, its economic rent as a proportion of its cost of undertaking the project. The mathematical expression of economic efficiency from the ProjectCo's perspective is given in Formula 1.2.

$$EE_P = \frac{CWLB_P}{CWLC_P} = \frac{CWLC_P(1+p)}{CWLC_P} \tag{1.2}$$

where, EE_P is the economic efficiency of the project to the ProjectCo,
$CWLB_P$ is the ProjectCo's contract whole life benefit,
$CWLC_P$ is the ProjectCo's contract whole life cost, and
p is the percentage of the ProjectCo's economic rent.

The client's UP for the service is linked to the performance of the ProjectCo in service provision. In other words, the risk of delivery is transferred to the ProjectCo. If the service provision does not meet the quantity and the quality defined in the OS, the ProjectCo will, in principle, suffer a UP deduction. This mechanism also gives the client increased assurance that it will obtain commencement of a defined service in time and on budget.

1.3. Research Rationale

The history of PFI is relatively short. As a result, only a limited amount of research has been carried out into the implementation of accommodation service PFI projects. Consequently, there are significant gaps in knowledge on how the underlying principles of PFI work in practice. In order for the public sector client to pass its aim to the private sector more effectively, the behaviour of the ProjectCo in relation to the $CWLC_P$ in a PFI project and the underlying rationale of that behaviour need to be understood. This leads to the research aim, which is *to generate a detailed understanding of how the economic efficiency of an accommodation service PFI project is determined in its development process through $CWLC_P$ minimisation.* Research is especially needed:

- to establish whether an accommodation service PFI project delivers VFM and profit for the client and the ProjectCo respectively as a result of $CWLC_P$ minimisation, and
- to establish how the development process of a PFI project encourages or discourages $CWLC_P$ minimisation.

In 2004, the first accommodation service PFI projects are only a few years into their operational phases. Therefore, the expected outturn $CWLC_P$ savings over the project duration cannot be measured *ex post*. Furthermore, there is no PFI-specific historical cost data that could be used to estimate the expected outturn $CWLC_P$ reductions *ex ante*. As a result, research that seeks to obtain evidence of $CWLC_P$ minimisation must use indirect measurement. The ProjectCo's incentives and opportunities in a PFI project to minimise $CWLC_P$ are hypothesised to result in different types of solutions in design, build and operation of the project-facility from the solutions that would have resulted from traditional construction and operational service procurement. These departures from traditionally procured solutions are defined as *$CWLC_P$ driven design solutions* and are used as an indirect measure of outturn $CWLC_P$ reduction. In order to understand the rationale for the implementation of $CWLC_P$ driven design solutions, the differences in the PFI and the traditional development processes also need to be established. Once the development process difference and the $CWLC_P$ driven design solutions are known, it will be possible to establish how and why they relate to each other. This will allow conclusions to be drawn on what, in the development of accommodation service PFI projects, either encourage or discourage the implementation of $CWLC_P$ driven design solutions. These conclusions can be used to clarify the future research agenda on PFI.

In conclusion, this research is needed to explore the proposition arising from economic theory that accommodation service PFI projects should be more economically efficient in terms of design, build and operation than traditionally procured accommodation services. It is believed that the future of PFI as a procurement method will be largely determined based on whether this proposition holds true in practise. Therefore, this research must focus rigorously on analysing how the key theoretical proposition is arrived at and how it applies on actual PFI projects.

It is acknowledged that a separate body of literature that includes Gaffney and Pollock (1999), Gaffney *et al.* (2001), Price and Pollock (2002), Rowland *et al.* (2002) and Price *et al.* (2004) exists on the VFM of PFI projects, and thus their economic efficiency. However, this body of literature is sometimes inconsistent with the definition of economic efficiency used in this research. As a result, this research begins the pursuit of its aim from the examination of the guidance governing PFI procurement in the light of economic theory.

1.4. Outline of the Thesis

This thesis is structured into five parts: (A) Introduction, (B) Literature Review, (C) Methodology Development, (D) Case Studies and (E) Discussion and Conclusion. Part B (Chapters 2 and 3) reviews the existing literature both on PFI procurement and on the economic theories relevant to the use of the procurement method. Part C (Chapter 4) develops a methodology that can be used to achieve the aim of this research. Part D (Chapters 5 and 6) presents the case study research. Part E (Chapters 7 and 8) discusses the findings arising from the case study research in the context of the contemporary PFI market and draws conclusions from that discussion.

Chapter 2 focuses on the privileged role that the public sector client has in a PFI project as a rule maker and first mover. It explores the way the client sets the rules for procurement that the ProjectCo actors need to conform to in pursuing and implementing a PFI project. The chapter analyses the mechanisms used by the client to both select the service provider and to govern the service provision in the context of economic theories on incentives.

Chapter 3 explores the behaviour of the ProjectCo actors in the development of a SPS for a PFI project. It covers the possible strategies the ProjectCo can use in response to the rules set by the client. The chapter examines the use of whole life costing techniques in the development of a SPS with the absolute minimum $CWLC_P$. The chapter increases the understanding of this process by placing the development of a SPS in the context of economic theories on decision-making that can be used to explain the behaviour of the ProjectCo actors.

Chapter 4 develops a research methodology that will allow the aim of this research to be achieved. The methodology is based on a case study strategy that primarily makes use of qualitative methods. This is due to the exploratory nature of the research and the established difficulties in advancing knowledge in the research domain by quantitative surveys – see CIC (2000). The research design consists of two case studies. The small number of case studies is justified by the primary purpose of this research, which is to focus future PFI research, and the fact that the selected case studies are large and complex projects. Two case studies, as opposed to just one, will enable the possibility for misinterpretation of research findings to be reduced. The case studies will focus in particular on the effects of PFI procurement on the heating and ventilation (HV) design solution. It is anticipated that the forces that affect this particular aspect of design will affect all aspects of building design in accommodation service PFI projects. The main type of data to be used in the case study analysis is self-reports obtained as interviews. Supporting data will be extracted from public and private sector issued project documentation and expert assessment. The data will be subjected to incentive, opportunity, perception and solution analyses. The overall case study analysis will describe the HV design solutions of the project-facilities and identify $CWLC_P$ driven design solutions implemented within them. Furthermore, the analysis will identify the forces in the PFI development process that either encourage or discourage the implementation of such solutions.

Chapters 5 and 6 present and analyse the two case study projects respectively. The case studies are King’s College London Site Rationalisation project and University College London Hospitals NHS Trust Gower Street Redevelopment project. The chapters scrutinise the mechanisms used in the case study projects, by the clients to govern the procurement, the PFI development processes followed by the ProjectCo actors in the projects and the HV design solutions implemented. The two chapters draw conclusions from the analyses of the projects on what encouraged or discouraged the implementation of $CWLC_P$ driven design solutions.

Chapter 7 discusses the findings that arise from the case study research in the context of the contemporary PFI market. It also proposes a number of possible improvements in PFI procurement and development based on the discussion. Subsequently, Chapter 8 draws the conclusions from this research as a whole. In addition, it outlines the future course for PFI research and comments on the execution of this research.

1.5. Research Outcomes

This research will contribute to existing knowledge in a number of areas. It will:

- strengthen the theoretical understanding of the procurement and the development of accommodation service PFI projects by analysing the processes using economic theories,
- develop a novel methodology enabling a rigorous examination of accommodation service PFI projects,
- provide evidence on whether PFI projects deliver both VFM for the client and profit for the ProjectCo via improvements in economic efficiency achieved through implementation of $CWLC_P$ driven design solutions,
- identify the forces in the PFI development process that either encourage or discourage the implementation of $CWLC_P$ driven design solutions,
- develop potential solutions to the problematic issues identified in the procurement and development of accommodation service PFI projects, and clarify the future research agenda on PFI.

The research findings will be of interest to a wide range of individuals, from people concerned with the state of the public services to those working on PFI projects. However, the findings will have specific value in the provision of public services in the UK for both the public sector clients in central and local governments and for private sector actors working on PFI projects in various roles, from facilities management (FM) service providers to financiers and architects. As PFI-type procurement is rapidly gaining popularity around the world, the findings will also be of value in countries that are currently experimenting with the procurement method.

PART B - LITERATURE REVIEW

Chapter 2 - Client Governance in PFI Procurement

2.1. Introduction

This chapter explores the public sector client's governance in the procurement of accommodation service PFI projects. First, it sets out the approach to analysing the procurement process. Second, in order to provide the appropriate context, it outlines the key stages of PFI procurement and the client's tasks at those stages. Third, it shows the importance of risk transfer, output-based specification, task integration, long-term contract, competition and incentive contract for the client in improving the value for money (VFM) of a PFI project by generating incentives and opportunities for the ProjectCo to minimise contract whole life cost ($CWLC_P$). In conclusion, the chapter builds a hypothesis that the client's governance of PFI procurement can be expected to result in VFM improvements through $CWLC_P$ reductions.

2.2. Approach to Analysis

This thesis makes a distinction between the procurement and development of an accommodation service PFI project. The difference is one of perspective. The client begins PFI procurement when it starts a review of its needs that leads to a decision to procure an accommodation service. The ProjectCo initiates development as a PFI project is advertised and it becomes aware of the client's need and, thus, responds by beginning to develop a Service Provision Solution (SPS). This research uses *ProjectCo* as a term to refer to a set of private sector actors who come together to pursue and, subsequently, undertake a PFI project, regardless of the nature of their legal relationships with each other. The end point for both procurement and development is the expiry of the design, build, finance and operate (DBFO) contract between the public and private sector actors.

The clients' procurement of PFI projects has a number of common features, regardless of the project type. These features arise from Government policy. The policy is embedded in a number of guidance documents issued by various public sector bodies. This chapter uses these documents as the starting point to analyse PFI procurement. Chapter 3 will analyse PFI development.

The documentation that constrains the client's procurement of a PFI project exists at three levels. First, the client needs to conform to general procurement guidance issued by the Office of Government Commerce (OGC), applicable to all public procurement. Second, the client must follow PFI-specific guidance documents issued mainly by the former Treasury Taskforce (TTF), which is now part of the OGC. TTF (1999a) outlines the key stages in the procurement process and the tasks and considerations for the client in each of those stages. In addition, TTF has issued several policy statements and technical notes that deal with specific issues that arise at the various stages of a PFI project. Third, the client has to comply with sector specific guidance on PFI procurement issued by Government Departments and other non-departmental public sector bodies. These guidance documents, such as the National Health Service (NHS) Executive (2000) and Higher Education Funding Council for England (HEFCE) (1998), are in line with the OGC and TTF guidance. The documents, however, give specific advice on the issues that the client is likely to face in procuring a PFI project in the relevant sector.

This chapter analyses the client's governance of PFI procurement at the level of the TTF guidance. It compares the key aspects of PFI procurement with traditional accommodation service procurement in order to establish the incentives and opportunities the client creates for the ProjectCo to deliver an improved VFM project through $CWLC_P$ minimisation. In other words, it identifies the expected drivers and sources of economic efficiency in a PFI project.

In this thesis, the term *traditional accommodation service procurement* (or *traditional procurement*) has a specific meaning. It is used to refer to a process where the client obtains each component of the accommodation service sequentially and independently. This thesis does *not* use the term traditional procurement to refer to design, bid and build (DBB) procurement. However, it must be noted that DBB procurement is part of traditional accommodation service procurement.

In traditional accommodation service procurement, first the client obtains finance for the design and construction of a new building from Central Government. Typically, it bids for the finance in competition with other clients under the same Government Department. Second, the client appoints designers of its choice, usually based on their reputation, to develop design solutions for the facility. Third, once the detail design solutions are complete, through bidding competition, the client appoints a contractor to build the facility. Fourth, once the building is nearing completion, through competitions the client appoints a number of operators to service the facility. The client awards a number of operational service contracts of limited scope and duration. Once the operational service contracts expire, it organises new competitions to re-award them. In addition, as the need arises later in the life of the building, through competitions the client appoints building maintenance contractors to undertake major maintenance and replacement on the facility. This thesis treats these building maintenance contractors as operators.

It is acknowledged that a number of variant methods of design and construction procurement, such as design and build (DB), exist and that the client can produce operational services in-house. However, it is felt that traditional procurement as defined in this section is the most representative of the current non-PFI practice. This thesis refers to the process from the private sector actors' perspective as *traditional accommodation service provision* (or *traditional provision*). Traditional provision ends as the client abandons the facility. However, in order to achieve comparability, this thesis defines the duration of traditional provision as the same as that of PFI accommodation service provision.

2.3. The Client's Privileged Role

The public sector is responsible for generating benefits to society by making services available to the public. As a result, in PFI procurement, the public sector client has a privileged role as a rule maker and a first mover. The procurement of an accommodation service PFI project enables the client to provide a core service, such as healthcare or education, to the public. Thus, as part of the core service provision, the client consumes the support service. Therefore, by procuring an accommodation service PFI project, the client generates a contract whole life benefit ($CWLB_S$) to society. The client will make a unitary payment (UP) to the ProjectCo in return for its accommodation service provision and, thus, incur a contract whole life cost ($CWLC_C$).

This research assumes for the sake of simplicity that the client will always seek to maximise the benefits it is able to generate to society with its limited resources through their efficient allocation. In other words, client is assumed to behave rationally in its procurement. An example of irrational behaviour would be a situation where a local authority procures a PFI project incorporating a newly built school facility because of the prestige it will yield, instead of a project based on refurbished facilities that would cost the same, but enable it to make a greater improvement in the standard of its educational provision.

The VFM of a project is its benefit to cost ratio (BCR). Therefore, the BCR of a PFI project is the ratio of $CWLB_S$ to $CWLC_C$. This ratio also reveals the economic efficiency of a PFI project from the client's perspective. The numerical expression of VFM is given in Formula 2.1. It must be noted that this is the same formula as Formula 1.1.

$$VFM = EE_C = \frac{CWLB_S}{CWLC_C} \tag{2.1}$$

where, VFM is the value for money of the project,
EE_C is the economic efficiency of the project to the client,
$CWLB_S$ is the society's contract whole life benefit, and
$CWLC_C$ is the client's contract whole life cost.

Ideally, the client should procure all PFI projects that have higher $CWLB_S$ than $CWLC_C$. However, in reality, projects with BCR above one are not always procured. This is because the client has an affordability constraint that arises from the allocation of limited resources between the clients under a Government Department. The *affordability constraint* is the maximum amount the client has available to generate a specific benefit to society ($CWLB_S$). In the context of PFI procurement, the affordability constraint is defined as the client's maximum annual expenditure on the UP.

The affordability constraint can also limit the scope (the quantity and the quality) of a PFI project. The client must define a scope for the project that it anticipates to be below its affordability constraint. This fixes the $CWLB_S$ the project will generate. As a result, the PFI project will not be the absolute maximum VFM, but the maximum VFM subject to affordability. In other words, the client's affordability constraint shifts its attention from procuring the maximum VFM project to procuring a project of fixed $CWLB_S$ with the minimum $CWLC_C$. This $CWLC_C$ must not violate the client's affordability constraint. This principle is illustrated in Figure 2.1.

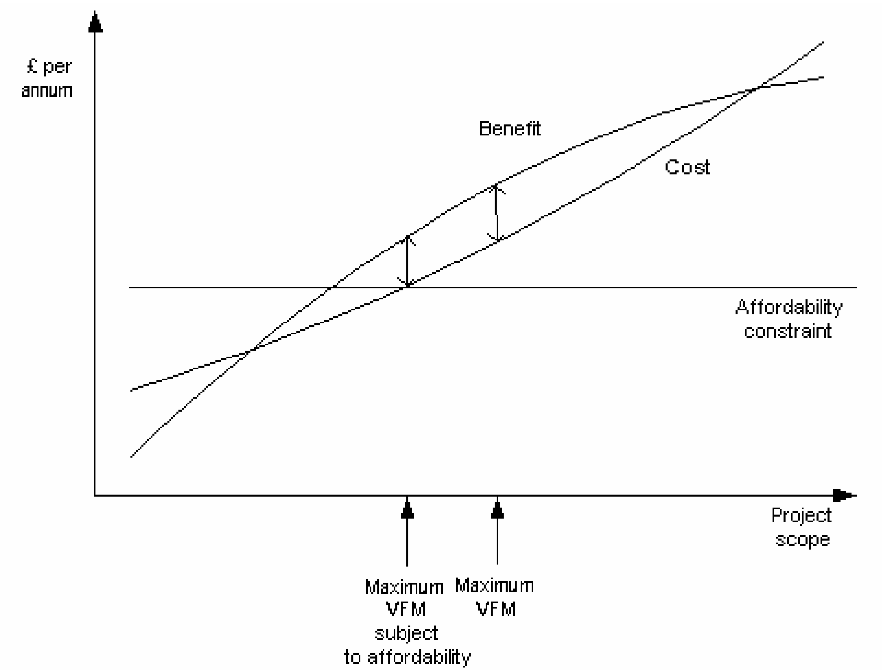

Figure 2.1. Value for money and project scope.

The fundamental aim of the client is to procure an accommodation service that is the maximum VFM subject to affordability. The client can, in principle, achieve its aim more effectively in PFI procurement than in traditional procurement. This is because it uses different types of mechanisms to govern PFI procurement. These mechanisms allow it to generate incentives and opportunities for the ProjectCo to minimise the contract whole life cost ($CWLC_P$) it will incur for the accommodation service provision. The ProjectCo will translate a proportion of the $CWLC_P$ savings into $CWLC_C$ reductions. Thus, the client can make the ProjectCo pursue its aim. These mechanisms are:

- risk transfer,
- output-based specification,
- task integration,
- long-term contract,
- competition, and
- incentive contract.

2.4. PFI Procurement Process

This section outlines the key stages of the generic PFI procurement process and the tasks that the client undertakes at each stage. Thus, it provides a context for the mechanisms that the client uses to improve the VFM of public procurement. The key stages of PFI procurement are illustrated in Figure 2.2.

2.4.1. Procurement Preparation Stage

PFI procurement begins when the client starts a review of its needs. If the review indicates that it has a need that requires procurement, it proceeds to investment option appraisal. In the appraisal, structured by HM Treasury (1997b), the client explores procurement alternatives. The appraisal helps the client to understand the type of project it needs to procure and, thus, to define a scope for a project that meets its need and fits its strategy. At this stage, the affordability of the project is a key consideration. If the option appraisal establishes that an affordable procurement option to meet the identified need is likely to exist, the client proceeds to develop an Outline Business Case (OBC) in order to justify the procurement. The client must submit the OBC for approval to the relevant Government Department or the Project Development Group in the case of Local Authorities (TTF, 1999a).

The client includes an output-based definition of its required service in the OBC. This definition is the first draft of the Output Specification (OS) – see Section 2.8. In addition, the client compiles an early version of the Public Sector Comparator (PSC) project as part of the OBC. TTF (1999b, 5) defines the PSC project as *"a hypothetical risk-adjusted costing, by the public sector as a supplier, to an output specification produced* *as part of a PFI procurement exercise."* In other words, the PSC project is an affordable publicly financed alternative that the client can procure in order to obtain the accommodation service described in the OS. The client needs to develop the PSC project to a level of detail that enables it to estimate the cost of its implementation. The PSC project should not only cover the construction of a facility but also its long-term operation, and consider the risks inherent in the project. Thus, in principle, the client uses the PSC project to demonstrate that the accommodation service defined in the OS can be procured within its affordability constraint (TTF, 1999a).

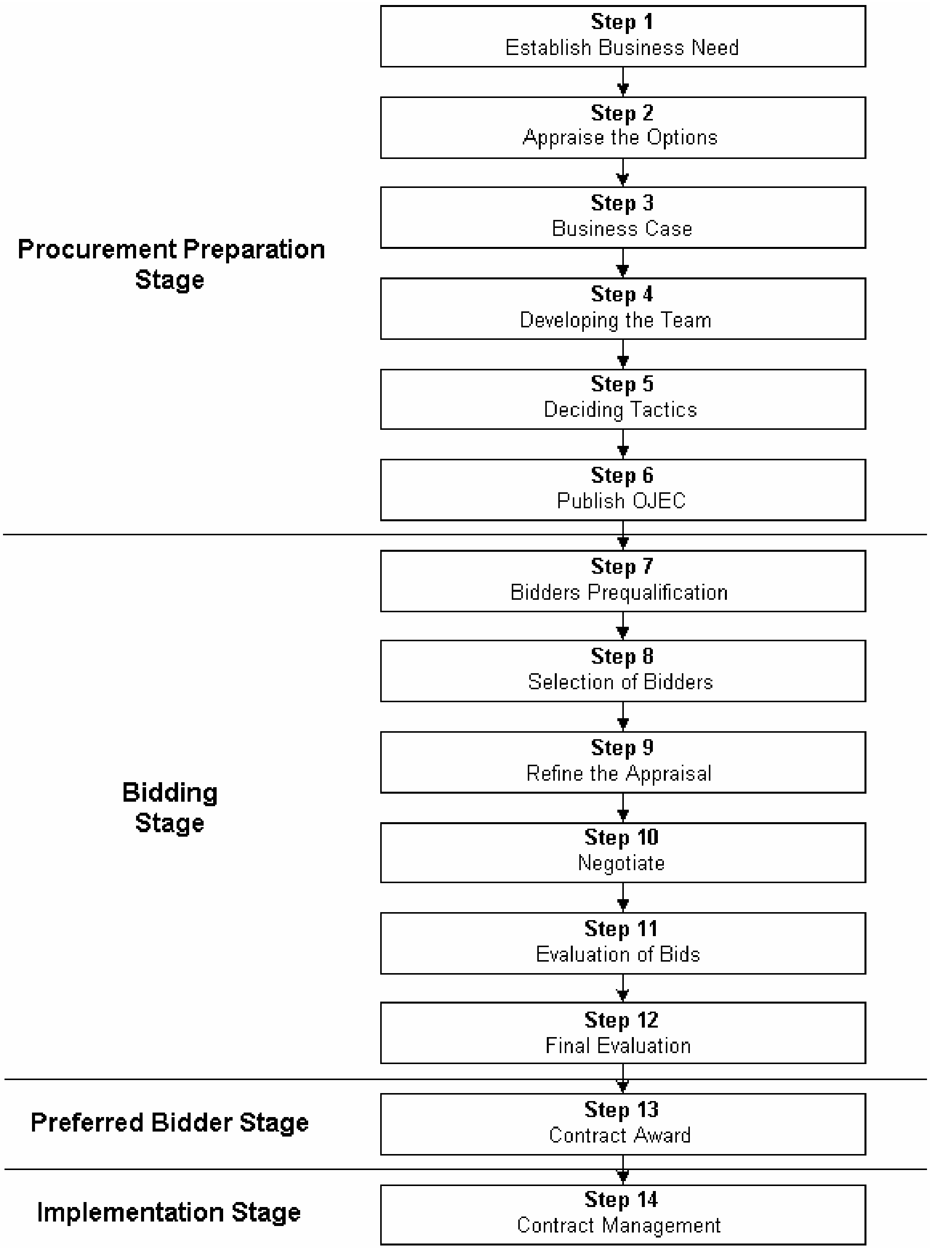

Figure 2.2. The key stages of PFI Procurement (adapted from TTF (1999a)).

2.4.2. Bidding Stage

2.4.2.1. Prequalification

Once the OBC has been approved, the client advertises the project in the Official Journal of European Communities (OJEC), inviting Expressions of Interest (EoIs) from private sector actors. The client subjects the ProjectCos interested in undertaking the project to prequalification. In the assessment, it evaluates the ProjectCos for their technical capacity; economic and financial standing; and ability. In PFI procurement, ability is usually interpreted as performance on past PFI projects. The prequalification assessment is limited to these three aspects by law. The client should assess the ProjectCos' competences only once and not repeat the assessment in the later stages of the project (Fox and Tott, 1999).

Once the client has evaluated the prequalification submissions, it has a longlist of ProjectCos that meet the minimum requirements and, thus, prequalify to bid for the project. However, the number of ProjectCos that meet the minimum requirements may be greater than the number that the client wants to invite to negotiate. The client should, therefore, adopt a point scoring methodology to establish the ProjectCos that best meet the prequalification criteria. This enables the client to rank the ProjectCos according to the extent that they satisfy the prequalification requirements (Fox and Tott, 1999).

The process of selecting the ProjectCos to be invited to negotiate is known as shortlisting. The client needs to undertake the process if the number of ProjectCos that meet the minimum prequalification requirements exceeds the number of ProjectCos it wants to invite to negotiate. The client may use two alternative strategies to produce the shortlist. It may use one-stage or two-stage procurement (TTF, 1999a).

The first strategy is to compile a shortlist based on prequalification and shortlist the ProjectCos that best satisfy the prequalification requirements. However, if the client adopts this approach, it also needs to interview the ProjectCos on the approaches they intend to take in their SPS proposals. This enables the client to ensure that it should only receive proposals that meet its accommodation requirements. Once the interviews have been completed, the client announces the shortlist (TTF, 1999a).

The second shortlisting strategy available to the client is to issue a Preliminary Invitation to Negotiate (PITN) that requests each ProjectCo to submit an Outline Proposal (OP). The client requests OPs in novel, large and/or complex projects. This is because it needs to understand how the ProjectCos envisage undertaking the project before requesting them to commit substantial resources to SPS development. Subsequently, the client evaluates the submissions and shortlists the ProjectCos based on the evaluation (TTF, 1999a).

2.4.2.2. Competitive Negotiation

The client invites the ProjectCos it has shortlisted to negotiate and provides them with the Invitation to Negotiate Documentation (ITND). The documentation should include information that the ProjectCos require to bid for the project. According to TTF (1999a), ITND should include:

- output-based specification, i.e. OS_{ITN},
- proposed contractual terms,
- proposed payment mechanisms (PM),
- proposed risk allocation in a matrix format, and
- bid evaluation criteria.

The contractual terms and the risk allocation matrix should make the risk allocation (see Section 2.5) in the project clear. The contractual terms should also outline how the client intends to monitor that the ProjectCo's accommodation service delivery meets the OS_{ITN}. The PM (see Section 2.10) should make the relationship between the UP and the ProjectCo's performance in service provision explicit (TTF, 1999a).

The client should make the bid evaluation criteria clear and precise. The criteria should be divided into mandatory and desirable. The *mandatory criteria* typically include affordability, VFM (see Section 2.9.1.3) and compliance with relevant design guidance etc. The *desirable criteria* usually encompass subjective measures such as architectural quality. This information is essential to the ProjectCos as they decide on their approaches to developing SPS proposals (TTF, 1999c). Typically, the client uses a weighted point scoring system to establish the differences in intangible benefits that the SPSs are likely to yield. NHS Estates (1994), for example, gives a framework for the system to be used in the evaluation of healthcare PFI projects. It must be noted that the client is not obliged to disclose the details of its evaluation methodology to the ProjectCos.

According to TTF (1999a), the client should maximise the competitive pressure in procurement. However, it should also seek to keep the procurement and development costs reasonable to all the project actors. If the client uses one-stage procurement, it should invite three or four ProjectCos to bid for the project. If it uses a two-stage process, it should initially invite the maximum of six ProjectCos at the PITN stage and proceed with two or three ProjectCos to the second stage.

In order to maximise the design quality of the project-facility, the client needs to encourage the ProjectCos to engage with the users of the accommodation service during their SPS development. The users are the providers of the core public service, such as healthcare or education. The users will know the type of accommodation service that will enable the economic efficiency and quality of the core service to be improved. This will increase the benefits generated by the project improving its VFM (TTF, 1999d). It must be noted that it may not always be clear to the ProjectCos how the client will take these improvements into account in its bid evaluation.

Once the ProjectCos submit their SPS proposals, the client begins bid evaluation. The client assesses the SPS proposals in accordance with the bid evaluation criteria. The evaluation seeks to establish the most economically advantageous SPS. According to TTF (1999c), the client should ensure the following in the evaluation process:

- the SPS will be able to meet the OS_{ITN} over the duration of the DBFO contract,
- the VFM of the SPS is assessed in terms of net present value (NPV),
- the UP will be affordable for the contract duration,
- the ProjectCo accepts the proposed contractual terms,
- the SPS and the proposed contractual terms will allow the ProjectCo to finance the project, and
- the ProjectCo behind the SPS is a united single entity.

In the bid evaluation, the client should exclude the proposals that do not meet its mandatory requirements from further analysis. Subsequently, it should evaluate the relative merits of the submissions using its chosen methodology. The client should use a methodology that is rigorous, systematic and maintains integrity. Once the evaluation is completed, the client should nominate the ProjectCo with the best SPS as the preferred bidder (PB) (TTF, 1999c).

If the bid evaluation concludes that the project is unaffordable, the client may request a Best and Final Offer (BAFO) from one or two ProjectCos with the best SPSs. Once the client has received the more detailed SPSs, it repeats the bid evaluation. Subsequently, it appoints the ProjectCo with the best proposal as the PB (TTF, 1999a).

The client needs to sustain competition in the procurement process as long as reasonable. This is because competition has a key role in achieving VFM improvements through $CWLC_C$ reductions – see Section 2.9. Taken literally, this would mean that the appointment of the PB should be delayed until the contractual terms of the project are agreed. However, the client needs to acknowledge that prolonged competition will result in unnecessary costs for both the client and the ProjectCos. In addition, prolonged competition may provoke a withdrawal of a ProjectCo from the bidding process. This will have an adverse effect on the VFM of the project, especially if the client intended to nominate the withdrawn ProjectCo as the PB (TTF, 1999c).

Before nominating the PB, the client must put together a strategy for dealing with the possibility that the chosen ProjectCo will attempt to renegotiate some of the contractual terms. The first possible strategy is to appoint the ProjectCo with the second best SPS as a reserve bidder. If the client fails to reach financial close with the PB, it is able to open negotiations with the reserve bidder. The second possible strategy is to request updated SPSs from the shortlisted ProjectCos. However, the ProjectCos are unlikely to be willing to commit further resources to pursuing a contract they have no realistic chance of being awarded (TTF, 1999c).

2.4.3. Preferred Bidder Stage

Once the PB has been nominated, the client and the ProjectCo commence negotiations on the details of the contractual terms and the SPS. According to TTF (1999a), the process from the announcement of the PB to financial close should be straightforward. However, it needs to be acknowledged that in practice this is not always the case.

The client and the ProjectCo negotiate and agree the nature of the project-facility and the operational service provision in more detail. The two actors also agree the basis for the performance related UP. The client and the ProjectCo capture these in OS_{FC} and the PM that become part of the DBFO contract at financial close – see Sections 2.8 and 2.10 respectively. In effect, the two actors agree the constraints for the ProjectCo's detailed design and operational solution development in the implementation stage. The client should avoid changes in the details of the project after the PB has been nominated. This is because the lack of competitive pressure is likely to compromise the VFM of such changes (TTF, 1999c).

Once the client and the ProjectCo have agreed the DBFO contract to a state where it only needs to be signed, the client must have the project approved. The client produces a Full Business Case (FBC) to justify the award of the contract. It is approved by the relevant Government Department or, in the case of a local government project, the Project Development Group. The approval gives the client the authority to proceed to financial close. However, prior to financial close, the client needs to allow time for the ProjectCo's financier to carry out a due diligence assessment of the project in order to ensure that it will not be subjected to unacceptable risks (TTF, 1999a).

2.4.4. Implementation Stage

At financial close, the PFI project moves into its implementation stage. The client does not commence the UP before the project-facility has been commissioned and the accommodation service is operational. At commissioning, the client inspects the facility and approves it as being available. Subsequently, the project moves into its operational phase, where the client's primary role is to ensure that it receives the service that it is paying for. The client should not interfere with the ProjectCo's service provision as long as it meets the OS_{FC} (TTF, 2000a).

Usually, the ProjectCo self-monitors the quality and quantity of its accommodation service provision. The client audits the ProjectCo's monitoring. If the ProjectCo delivers the service in accordance with OS_{FC}, a payment is made. If the client disagrees with the ProjectCo's assessment of its service performance and, as a result, makes a UP deduction, the issue is dealt with using a dispute resolution procedure specified in the DBFO contract. If the ProjectCo repeatedly fails to deliver the specified service, the client may terminate the contract (TTF, 2000a).

In the operational phase, the client needs to agree and execute benchmarking and market testing. The purpose of these exercises is to ensure that the UP continues through time to reflect the true cost of operational service provision, such as cleaning (TTF, 2000a).

As the DBFO contract begins to approach its end, the client assesses the condition of the project-facility and ensures that it will be in a pre-specified condition at the end of the contract period. Typically, the assessment takes place five years before the end of the contract period. This gives the client the opportunity to withhold UP if the condition of the project-facility is below the expected standard. The DBFO contract usually states that the facility must have at least a ten-year-life at contract expiry (TTF, 2000a).

2.5. Risk Transfer

A distinction needs to be made between two different types of risk. These are mathematical risk and management risk. *Mathematical risk* is the degree of dispersion of an outcome around the mean expected outcome. The mean expected outcome is the probability weighted average of all possible outcomes of an event. Mathematical risk is neither negative nor positive. The larger the dispersions, the larger the mathematical risk. It must be noted that mathematical risk can only occur in a portfolio. This is because the generation of a probability distribution requires a sample of occurrences (Milgorm and Roberts, 1992). TTF (1999b, 6) definition of risk in a PFI project is in line with the concept of mathematical risk as it states that: *"risk is uncertainty as to the amount of benefits. It includes both potential gain and exposure to loss."*

CIC (2000) has placed the *utility theory* (see, e.g. Schoemaker (1982)) concepts on attitudes to risk in the context of a PFI project. An actor is *risk neutral* if it has no preference for two probability distributions with the same mean expected outcome but different dispersions. An actor is *risk averse*, if it tries to avoid risk and pursues solutions with more certain outcomes, i.e. smaller dispersions of outcome. A risk averse actor is willing to accept additional risk only if the expected rewards also increase. An actor that sees risk as an opportunity rather than a threat is *risk prone.* Thus, the client's and ProjectCo's attitudes towards risk determine the precise risk allocation in the DBFO contract.

Management risk, as opposed to mathematical risk, is an event that will have negative consequences. There are two main types of management risk. First, there is an event that has a high probability, but minor negative implications. This type of risk is often referred to as a portfolio creep. A frequent occurrence of, for example, a small capital cost overrun becomes significant for a client that procures a portfolio of projects. Second, there is an event that has a low probability, but disastrous consequences. A fire on site is an example of this type of risk. This type of risk is usually covered with insurance (Winch, 2002).

The risk allocation in a DBFO contract is problematic. The VFM of a project will deteriorate if the client allocates too much risk to the ProjectCo. This is because the ProjectCo will increase $CWLC_C$, if the client requires it to take responsibility for managing risks that it will be unable to fully control. TTF (1999b) illustrates the VFM of a PFI project as a function of risk transfer – see Figure 2.3.

In each PFI project, a specific risk allocation exists where VFM is at its maximum. This is the level of *optimum risk transfer*. As the client begins to transfer traditionally retained risks to the ProjectCo, the VFM of the project starts to improve. This is because the ProjectCo has more expertise than the client to manage and/or a greater portfolio to absorb risks efficiently. The VFM of the project increases until the client reaches the level of optimum risk transfer. If the client continues to allocate further risks to the ProjectCo, the VFM of the project begins to decrease. This is because the ProjectCo can no longer manage and/or absorb these additional risks efficiently and becomes risk averse. Eventually, a level of risk transfer is reached where the client and the ProjectCo can no longer agree a DBFO contract. This is because the $CWLC_C$ has become so high that the implementation of the PSC project is better VFM to the client.

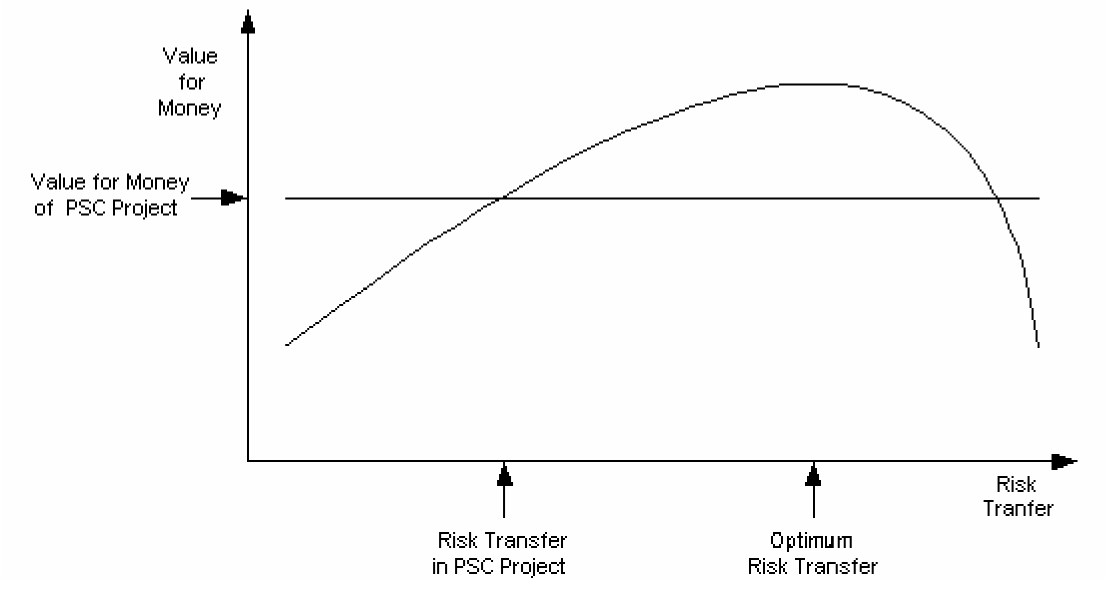

Figure 2.3. VFM as a function of risk transfer (adapted from TTF (1999b)).

TTF (1999b) has classified and defined the types of risks that are likely to be encountered in a PFI project – see Table 2.1. Alternative risk classifications and definitions, such as Akintoye *et al.* (1998) and National Audit Office (NAO) (1999a), also appear. The allocation of these risks between the client and the ProjectCo will depend on whether the two actors are risk averse, neutral or prone. The actor that a risk is allocated to is the residual beneficiary of the rewards that arise from managing the risk.

NAO (1999a) advocates that the client should always seek to achieve the optimum risk transfer. The client should not let TTF (1999e) guidance on accounting treatment influence the risk allocation. In other words, the client should proceed with a PFI project even if it remains on the public sector balance sheet and, thus, increases public sector liabilities. NAO (1999a) has established guidelines for the risk allocation that is most likely to result in the maximum VFM project.

2.5.1. Design and Construction Risks

In virtually all PFI projects, the client should allocate the design and construction risks to the ProjectCo. This is because it is best positioned to manage the risks. Thus, it is willing to take the responsibility for the risks without a high premium, i.e. $CWLC_C$ increase. The client should, however, retain the risk of user-initiated design changes. This is because the client is able to control such changes whereas the ProjectCo is not. Therefore, the ProjectCo would be likely to charge a high premium for managing the risk (NAO, 1999a).

Traditional accommodation service procurement is plagued by capital cost and construction time overruns (HM Treasury, 1998; HM Treasury, 1999). This is because the client cannot transfer the design and construction risks effectively. First, the responsibility for design and construction is fragmented. This enables the contractor to claim compensation from the client for unanticipated capital cost increases that originate from the design solution. Second, the client has legal difficulties in demonstrating and, thus, imposing liquidated damages. This enables the contractor not to complete buildings on programme without incurring disproportionate revenue losses.

Cost and time overruns should not happen in a PFI project. This is because the client can achieve an effective transfer of design and construction risks to a single entity by paying for the delivery of an accommodation service. In addition, PFI procurement creates a strong incentive for the client not to initiate design changes once it has issued the ITND.

Table 2.1. Risk types in PFI projects (TTF, 1999b).

Availability risk	The risk that the quantum of the service provided is less than required under the contract.
Construction risk	The risk that the construction of the physical asset is not completed on time, to budget and to specification.
Decant risk	The risk arising in accommodation projects relating to the need to decant staff/clients from one site to another.
Demand risk	The risk that demand for the service does not match the levels planned, projected or assumed. As the demand for a service may be (partially) controllable by the government, the risk to the public sector may be less than that perceived by the private sector.
Design risk	The risk that the design cannot deliver the services at the required performance or quality standards.
Inflation risk	The risk that actual inflation differs from assumed inflation rates.
Legislative risk	The risk that change in legislation increases costs. This can be sub-divided into general risks such as changes in corporate tax rates and specific ones, which may discriminate against PFI projects.
Maintenance risk	The risk that the costs of keeping the asset in good condition vary from budget.
Occupancy risk	The risk that a property will remain untenanted – a form of demand risk.
Operational risk	The risk that operating costs vary from budget, that the performance standards slip or the service cannot be provided.
Planning risk	The risk that the implementation of a project fails to achieve the terms of planning permission, or that detailed planning permission cannot be obtained, or, if obtained, can only be implemented at costs greater than in the original budget.
Policy risk	The risk of changes in policy direction not involving legislation.
Residual value risk	The risk relating to the uncertainty of the value of physical asset at the end of the contract period.
Technology risk	The risk that changes in technology result in services being provided using non-optimal technology.
Usage risk	The risk that actual usage of the service varies from the level forecast.

However, it must be noted that as a result of the increased risk transfer, the price of the design and build (DB) component of a PFI project is likely to be higher than the market price for procuring design and construction independently. This is because the ProjectCo's price includes a premium for design and construction risk management, as it will not be able to claim compensation for unexpected capital cost increases.

2.5.2. Availability and Maintenance Risks

Availability risk and maintenance risk as defined by TTF (1999b) are interrelated. This is because the main cause of unavailability is sub-optimal maintenance. In PFI projects, the client should transfer the availability and maintenance risks to the ProjectCo as it is best placed to manage them (NAO, 1999a).

In traditional procurement, the client retains availability and maintenance risks. The client meets its maintenance costs from its operating budget. This may lead to sub-optimal maintenance that results in increased subsequent maintenance costs, unavailability and/or disruption to core service provision. This is because the client has other competing uses for its operating budget and, thus, may be unable to control its expenditure on maintenance.

In a PFI project, the clients can achieve an effective transfer of availability and maintenance risks by linking the UP to the availability of the project-facility – see Section 2.10. The ProjectCo is fully in control of the maintenance of the project-facility. Thus, it is less likely that sub-optimal maintenance will occur in a PFI than in traditional accommodation service provision.

2.5.3. Operational Risk

In PFI procurement, the client should allocate the risk of providing operational services to the appropriate standard and with the anticipated amount of resources to the ProjectCo. In traditional procurement, the client transfers the operational risk to the operators. Thus, the transfer of operational risk in a PFI project is unlikely to be a source of VFM *per se*. However, transfer of the responsibility for operation using a long-term integrated incentive contract is likely to yield improved VFM – see Sections 2.6, 2.7 and 2.10.

2.5.4. Demand, Occupancy and Usage Risks

TTF (1999b) risk classification features three different types of demand risk. These are demand, occupancy and usage risks. According to NAO (1999a), it is likely that best VFM is found where none or only a small portion of demand risk is allocated to the ProjectCo. If some demand risk is allocated to the ProjectCo, at least one of the following should apply:

- the client is unable to affect the demand for the service,
- the cost of service provision ($CWLC_P$) is a function of its usage,
- the ProjectCo is able to influence the demand for the service by means of the SPS,
- the ProjectCo faces only limited or non-existent competition in service provision, or
- the ProjectCo finances a high proportion of the project by equity investment.

The allocation of demand risk is affected by its predictability. If the demand can be predicted accurately, the client may be able to allocate the risk to the ProjectCo cost effectively. In addition, the ProjectCo should take the responsibility for generating the demand for third party revenues using the project-facility. This is because it will be most able to influence demand for the services (NAO, 1999a).

2.5.5. Residual Value Risk

The client can either retain residual value risk or transfer it to the ProjectCo. If there is no alternative market for the project-facility, the ProjectCo cannot manage the residual value risks efficiently. Therefore, in such circumstances, the client should retain the risk. However, the allocation of the residual value risk to the ProjectCo may improve VFM, if the project-facility can be contracted to alternative use after the initial contract period (NAO, 1999a). An example of this type of facility is a higher education building that can be easily converted to office accommodation at the end of the DBFO contract. In traditional procurement, the client always retains residual value risk.

2.5.6. Technology Risks

The client may retain technology risk or it may be shared. The client may, for example, structure incentives for the ProjectCo to renew high technology assets in the contract period (NAO, 1999a). The option to refresh medical equipment in a healthcare accommodation service PFI project in return for additional payment is an example of a situation where technology risk is shared. In traditional accommodation service procurement, the client retains technology risk.

2.5.7. Planning Risk

In PFI projects where a specific site exists, the client should obtain outline planning permission for the site and, thus, retain the risk. This is because the ProjectCo is likely to reflect the uncertainty associated with obtaining outline planning permission in its price. In projects where the site for the building is not specified, the client should allocate the outline planning risk to the ProjectCo. In both cases, the ProjectCo should retain the risk of gaining detail planning permission as it is responsible for developing the documentation required to obtain the permission and, thus, best placed to manage the risk (TTF, 1999d). In traditional procurement, the client retains both outline and detail planning risk as it procures the design solutions that are used to obtain the planning permissions.

2.5.8. Legislative and Policy Risk

According to NAO (1999a), the basic rule in the allocation of regulation, legislation and policy related risks is that the ProjectCo should transfer the risks of general regulation, legislation and policy changes in its operating environment. The client, in turn, should take responsibility for the risk of changes that are PFI specific or that relate to a specific sub-section of an industry that is dominated by PFI projects. In traditional procurement, the client retains all the regulation, legislation and policy risks.

2.5.9. Financing Risk

TTF (1999b) risk classification does not include financing risk. However, it is a significant risk in PFI projects. NAO (1999a) divides financing risk into disposal and external finance risk. *Disposal risk* is the risk of being able to sell the client's existing facilities in order to finance the PFI project. This risk may be allocated either to the client or to the ProjectCo, depending which actor is better positioned to manage the risk. In traditional procurement, the client retains disposal risk.

External finance risk is the risk of being able to obtain finance for the project. The ProjectCo should be responsible for managing the risk. This is because it is responsible for developing the SPS that is used to provide the accommodation service. The ProjectCo obtains the finance for the project against its ability to receive the UP for the service provision. The external finance risk also includes the risk that the cost of capital may not be known at financial close. This can be due to the use of variable interest rate finance or potential refinancing later in the contract period. In traditional procurement, the client retains the external finance risk, i.e. the risk of being able to obtain finance for design and construction from Central Government (NAO, 1999a).

2.5.10. Inflation risk

The client should retain inflation risk in relation to provision of operational services. This can be achieved by UP indexation, benchmarking and market testing. This is because the ProjectCo is unable to control the market price of the resources it requires to provide the operational services. Therefore, it is likely to require a high premium for managing the risk (NAO, 1999a). In traditional procurement, the client also retains inflation risk.

2.5.11. Force Majeure

All PFI risk types may include specific risks that neither the client nor the ProjectCo will be able to manage efficiently. These risks are called *force majeure* – type risks. Because of their nature, the realisation of these types of risks is outside the control of either actor. Therefore, the client and the ProjectCo must negotiate the allocation of these risks individually. A nuclear war is an example of a *force majeure* -type risk.

2.6. Task Integration

2.6.1. PFI Procurement

The client awards a PFI project using a single DBFO contract. The contract leaves the project-facility to the ProjectCo's ownership for at least the contract period. Thus, in procuring a PFI project, the client brings a number of private sector actors together into a ProjectCo at the inception of its development. This is because a wide range of skills is required to bid for and to undertake a PFI project. It is unlikely that any one actor would posses all the skills required (CIC, 1998).

Thus, the client generates an opportunity for the ProjectCo actors to consider all the tasks included in the DBFO contract simultaneously at the inception of SPS development. This enables increased interaction between the ProjectCo actors and, thus, creates an environment where innovation can easily occur (CIC, 2000).

2.6.2. Traditional Procurement

Traditional accommodation service procurement is fragmented and sequential. As a result, the private sector actors do not have an opportunity to consider all the components of accommodation service provision simultaneously. The designers, contractor and operators are not able to influence each other's solutions or to receive feedback from each other on their own solutions. Figure 2.4 illustrates the main flow of information between the key project actors over time. This is often referred to as the *Over the Wall Syndrome*.

Furthermore, the operators are unable to take an integrated view of servicing the facility. This is because the client awards a number of operational service contracts (e.g. cleaning and catering) with a narrow scope and places separate contracts for specific major maintenance and replacement tasks. This limits the private sector actors' opportunity to take an integrated approach in the operation and maintenance of the building.

2.6.3. Concluding Remarks

The client's use of PFI procurement and, thus, task integration improves the ProjectCo's opportunity to minimise $CWLC_P$. This is because the fragmented and sequential traditional procurement creates contractual and organisational barriers between the private sector actors, which come under a single DBFO contract in PFI procurement. In addition, some of the private sector actors that are involved from the inception of PFI project development are only introduced to traditional service provision at a stage when the functionality and the quality of the building has already been determined. Figure 2.5 shows why the Over the Wall Syndrome should cease to prevent innovation from occurring in PFI projects.

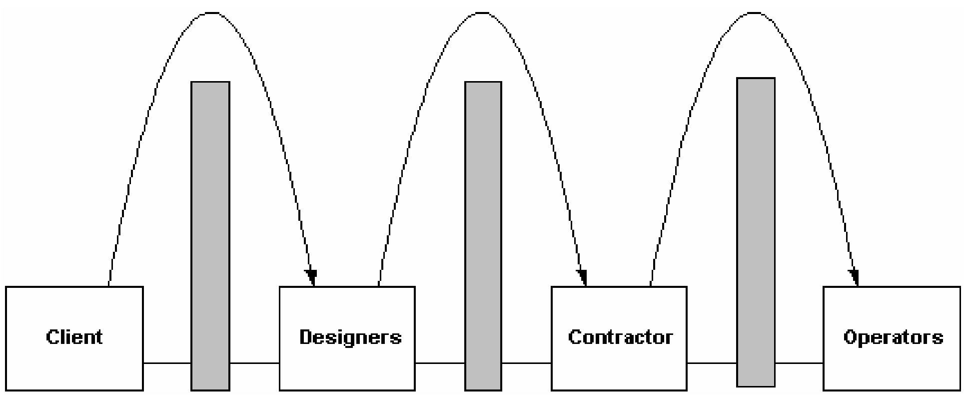

Figure 2.4. Traditional accommodation service procurement and Over the Wall Syndrome (adapted from Evbuomwan and Anumba, 1995).

2.6.4. Concluding Remarks

The client's use of PFI procurement and, thus, task integration improves the ProjectCo's opportunity to minimise $CWLC_P$. This is because the fragmented and sequential traditional procurement creates contractual and organisational barriers between the private sector actors, which come under a single DBFO contract in PFI procurement. In addition, some of the private sector actors that are involved from the inception of PFI project development are only introduced to traditional service provision at a stage when the functionality and the quality of the building has already been determined. Figure 2.5 shows why the Over the Wall Syndrome should cease to prevent innovation from occurring in PFI projects.

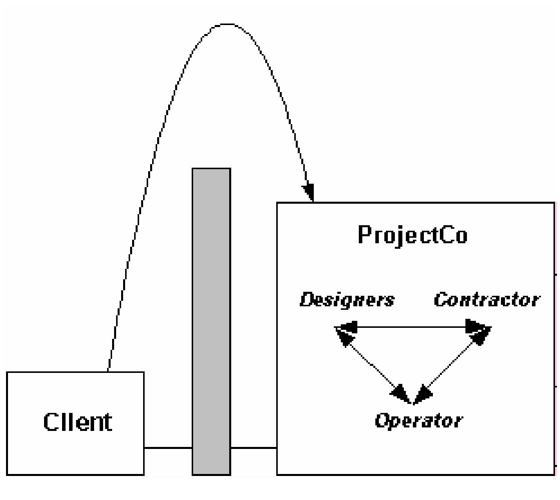

Figure 2.5. PFI procurement and task integration.

2.7. Long Term Contract

2.7.1. PFI Procurement

The client typically uses a DBFO contract that has a 25-year duration. However, the contract period can be up to four decades. The length of the contract enables the ProjectCo to increase its capital expenditure on the project-facility and, subsequently, recover the additional investment as savings in operational expenditure that exceed the additional capital expenditure over the duration of the contract. Such expenditure increases will reduce $CWLC_P$. Figure 2.6 demonstrates this principle.

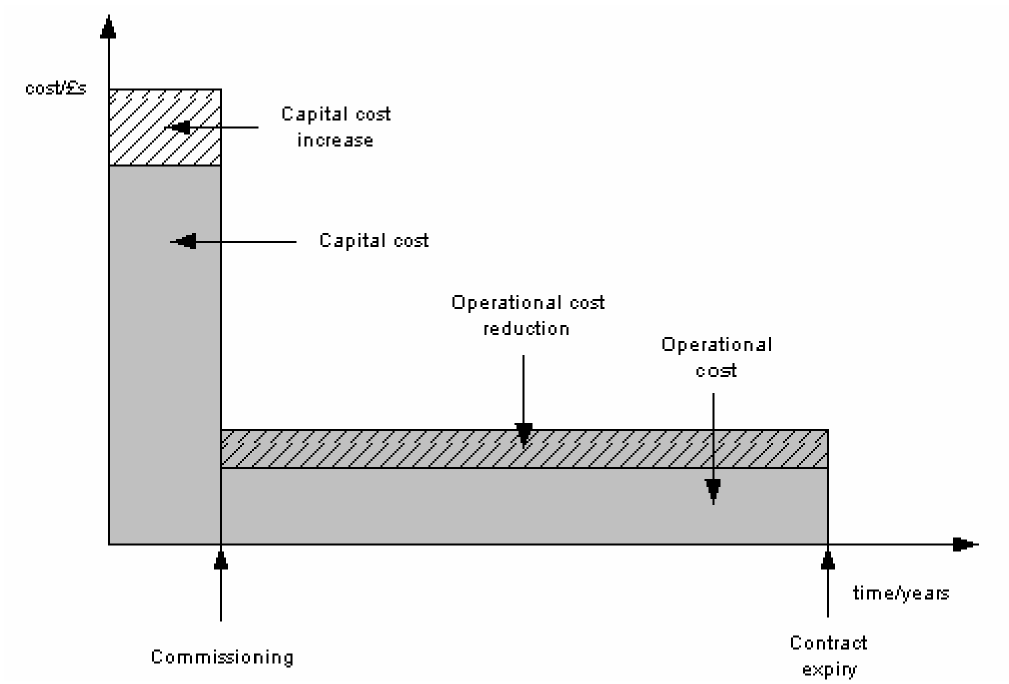

Figure 2.6. Reduction in operational expenditure through increased capital expenditure.

2.7.2. Traditional Procurement

In traditional procurement, the client fragments the tasks involved in accommodation service provision into separate short-term contracts. First, it appoints designers to develop the detail design solutions for the building. Once the building has been commissioned, the client pays the designers in full and their active involvement in the project ends. Second, after a detail design solution has been completed, the client appoints a contractor to build the facility in accordance with the design solution. Once the building has been successfully commissioned, the client compensates the contractor in full, ending its active involvement. Therefore, post commissioning, the designers and the contractor will not receive any revenue from the client. As a result, they do not have an opportunity to recover increased capital expenditure as efficiency savings in the operational phase. Consequently, the designers and the contractor do not have an incentive to increase capital expenditure, even if it could lead to $CWLC_P$ savings. It must be noted that the designers and the contractor determine the design and the quality of a building and, thus, its operational efficiency.

At a state when the building is nearing its completion, the client appoints operators to service the facility on contracts of 3–5 years duration. The operators have to re-bid for the contracts once they expire. Thus, the operators can recover only a limited amount of increased capital expenditure as operational cost savings over such a short period. As a result, the operators have only a weak incentive to increase capital expenditure to generate efficiency savings. Moreover, it must be noted that the operator cannot easily improve the operational efficiency of the building as its quality and functionality has already been determined.

2.7.3. Concluding Remarks

The long duration of the DBFO contract creates an opportunity and an incentive for the ProjectCo to minimise $CWLC_P$. The use of a single long-term contract, as opposed to a number of short-term contracts, gives the ProjectCo an opportunity to recover increased capital expenditure as efficiency savings in operation. As the ProjectCo is entitled to use the efficiency savings towards increasing the probability of its bid success or its economic rent, it has an incentive to increase capital expenditure if it leads to $CWLC_P$ savings. In traditional provision, the designers and the contractor do not have an incentive and the operators have only a weak incentive to pursue $CWLC_P$ reductions.

2.8. Output-based Specification

2.8.1. PFI Procurement

In an accommodation service PFI project, using an OS_{ITN} the client defines the quantity and the quality of the service that it wants to procure. The service defined in the OS_{ITN} is influenced by the client's affordability constraint. As a result, the OS_{ITN} fixes the benefit the project will generate to society ($CWLB_S$).

This thesis makes a distinction between the OS_{ITN} that the client issues at the beginning of the procurement competition and the OS_{FC} that it appends to the DBFO contract at financial close. The difference is one of level of detail. In the PB stage, through negotiation, the OS_{ITN} evolves into the OS_{FC}. Thus, the OS_{FC} is considerably more explicit in detail than the OS_{ITN}. The OS_{FC} can be described as an output-oriented input specification.

Central Unit of Procurement (CUP) (1991) and Private Finance Panel Executive (PFPE) (1996a) provide guidance for clients on OS_{ITN} writing. The client should use the document to describe a complete service solution. However, in the OS_{ITN}, the client must refrain from describing how the ProjectCo should provide the service.

According to PFPE (1996a), output-based specification enables the ProjectCos to develop more efficient SPSs. This is because the OS_{ITN} gives the ProjectCos increased flexibility in SPS development – see Figure 2.7. CIC (2000) tested this hypothesis. It established that the amount of perceived cost savings in PFI projects is not directly correlated with the level of output-based definition in the OS_{ITN}. Therefore, the proposition put forward by PFPE (1996a) remains unproven.

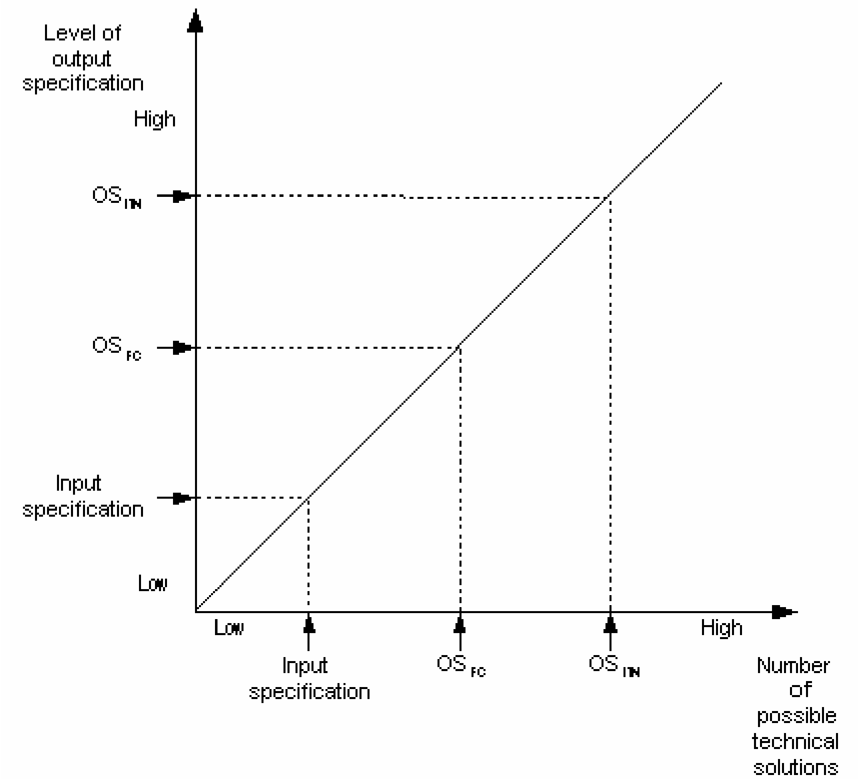

Figure 2.7. Flexibility as a function of output vs. input based definition.

The core public service provider consumes the output of the ProjectCo's accommodation service provision. Therefore, the output is not the project-facility that the ProjectCo uses to produce the service. A secondary school, for example, is not a service output. Instead, the output is the serviced accommodation for the provision of secondary education (PFPE, 1996a).

In the OS_{ITN}, the client should describe the service performance output in sufficient detail to allow the ProjectCos to develop SPSs and produce $CWLC_P$ estimates. However, the details in the OS_{ITN} should not be restrictive of innovation. For example, in procuring serviced accommodation for secondary education, the OS_{ITN} should only include the building layout set by the outline planning permission. This is because further details, such as spatial layout, could restrict the ProjectCos in SPS development and, thus, reduce their opportunity to improve the efficiency of the SPSs and achieve $CWLC_P$ reductions (PFPE, 1996a).

An example of a detailed service performance output is the requirement for the temperature in a secondary school classroom to be 22°C with a 2°C tolerance. This type of specification gives the ProjectCos the freedom to propose any technical solution that is able to provide the specified output. However, it is acknowledged that in some cases service performance output is not sufficient to describe the desired service. In such cases, the client should support the performance descriptions with technical specification (PFPE, 1996a).

2.8.2. Traditional Procurement

In a traditional project, the client uses an input-oriented specification to procure a building. In other words, the designers complete a detail design solution in line with the client’s objectives. This solution and the associated specifications become the input-oriented specification that the contractor uses to build the facility. Subsequently, the operators work within the boundaries of the completed building. As a result, once the detail design solution has been completed, the contractor and the operators have only very limited opportunities to improve the economic efficiency of the accommodation service provision.

2.8.3. Concluding Remarks

The client’s use of output-based specification in PFI procurement improves the ProjectCo’s opportunity to achieve $CWLC_P$ reductions through increased flexibility in SPS development. This is because in traditional procurement the private sector actors’ flexibility in the accommodation service provision is restricted, initially, by an input-oriented specification and, subsequently, by the completed building.

2.9. Procurement Competition

2.9.1. PFI Procurement

2.9.1.1. Discounted Cash Flow

An actor makes an investment expecting it to generate benefits that are greater than its costs. These costs and benefits occur at different points in time. Therefore, it must be acknowledged that money has a time value. In other words, the value of a benefit or a cost differs depending on when it occurs. An income of £100 in January 2001, for example, is more valuable than an income of £100 in January 2002. If an actor had £100 in January 2001, it would be able to invest the capital and have £100 plus the annual return on that investment in January 2002 (Flanagan and Norman, 1983; Brealey and Myers, 1996).

In order to compare the ProjectCos' SPSs with each other and with the PSC project, the client must convert the future benefits and costs of each of the procurement alternatives to their present value equivalents using an appropriate discount rate. The *discount rate* is a compound percentage used in Formula 2.2 to achieve the conversion (Flanagan and Norman, 1983; Brealey and Myers, 1996). Thus, a high discount rate reduces the importance of future benefits and costs relative to the initial investment. A low discount rate has the opposite effect.

$$NPV = \sum_{t=0}^{t=n} \frac{V_t}{(1+d)^t} \tag{2.2}$$

where NPV is the net present value,
t is a year in the contract period,
n is the contract duration,
V_t is the value of the benefit or cost in year t, and
d is the discount rate.

The discount rate can be understood in alternative ways. First, it can be seen as the *opportunity cost of capital* (OCC). This is the best return for the initial capital investment from an alternative investment with a similar level of risk (Ashworth, 1994; Brealey and Myers, 1996). In the context of public sector procurement, the OCC is referred to as the *social opportunity cost of capital* (SOCC). In other words, it is the best return *as benefits to society* that the capital investment could generate if invested in alternative use with a similar level of risk (Thirlwall, 1999). Second, the discount rate can be treated as the actual cost of capital for the initial investment (Royal Institute of Chartered Surveyors (RICS), 1986). Third, it can be seen as the public sector client's social time preference (STP) as it reflects the value of benefits and costs to the client when they occur at different points in time (Thirlwall, 1999).

HM Treasury (1997b) suggests that the client should use a discount rate of 6% in its assessment of procurement alternatives. The 6% discount rate can be seen as either SOCC or STP. The use of the 6% discount rate in the VFM assessment has been subject to much debate. This is mainly because it is higher than the client's actual cost of capital (Grout, 1997; Klien, 1997). This thesis treats the 6% discount rate as SOCC. A further discussion on the appropriate discount rate is beyond the scope of this thesis. However, it must be noted that, if the client used a different discount rate in the VFM assessment (see Section 2.9.1.3), its outcome might change.

Present Value is the discounted value of the present and future benefits that a project generates (Ferry and Flanagan, 1991; Brealey and Myers, 1996). The client procures a PFI project with the aim of making a service available and, thus, generating benefits to society. The present value of these benefits is a contract whole life benefit ($CWLB_S$) discounted at SOCC. It must be noted that it is assumed that intangible external costs to third parties, such as pollution, have been deducted from the benefits discounted to arrive at $CWLB_S$. Therefore, in fact, $CWLB_S$ is a net benefit even if this thesis treats it as a present value of benefits. It must be noted that the $CWLB_S$ does not equal the project's present value to the ProjectCo. The contract whole life benefit ($CWLB_P$) to the ProjectCo is the discounted (at OCC) UP stream it receives from the client for its accommodation service provision over the life of the DBFO contract.

Present Cost is the discounted value of the present and future costs of a project (Ferry and Flanagan, 1991; Brealey and Myers, 1996). The contract whole life cost ($CWLC_C$) of a PFI project to the client is the discounted (at SOCC) present cost of the UP stream the client makes for the accommodation service. It must be noted that $CWLC_C$ does not equal $CWLB_P$. This is because the client and the ProjectCo use different discount rates in converting the UP stream to its present value and cost respectively. However, $CWLB_P$ and $CWLC_C$ will move in line with each other. This is because the benefits and costs discounted, namely the UP stream, are the same. The ProjectCo incurs a contract whole life cost ($CWLC_P$) for providing the accommodation service.

NPV is one of the most commonly used indicators of economic value. It is calculated by subtracting the present cost from the present value or by using Formula 2.2 (Ferry and Flanagan, 1991; Brealey and Myers, 1996). NPV_C of a PFI project to the client does not equate to the NPV_P to the ProjectCo. The NPV_C is the present value of the benefits generated to society ($CWLB_S$) by the project minus the present cost of the UP stream ($CWLC_C$). NPV_P is the present value of the UP stream to ProjectCo ($CWLB_P$) minus the present cost of the accommodation service provision ($CWLC_P$). Thus, NPV_P is the ProjectCo's economic rent.

2.9.1.2. Competition

The client's aim is to procure a PFI project that is the maximum VFM subject to affordability. A ProjectCo's aim is to maximise its profit from executing the PFI project. The client needs to align the ProjectCo's aim with its own aim by generating the appropriate incentives for the ProjectCo. The procurement competition has a key role in generating these incentives.

The client invites the ProjectCos to bid for a DBFO contract. The required accommodation service provision over the contract period is defined in the OS_{ITN}. The client requests each ProjectCo to price their SPSs in terms of the UP. The ProjectCo that offers to provide the service with the lowest $CWLC_C$ is likely to be awarded the contract at its bid price – see Section 2.9.1.3 for exceptions. Thus, the $CWLC_C$ is determined as a consequence of the procurement competition.

If the ProjectCo fails to be awarded the contract, it will not be compensated for its bid costs and it will, thus, incur a loss. Therefore, the ProjectCo has a strong incentive to minimise $CWLC_P$ in developing its SPS for the PFI project. The ProjectCo can translate a $CWLC_P$ reduction either into a lower $CWLC_C$, and, thus, increase its probability of being awarded the contract, or into increased economic rent – see Figure 2.8.

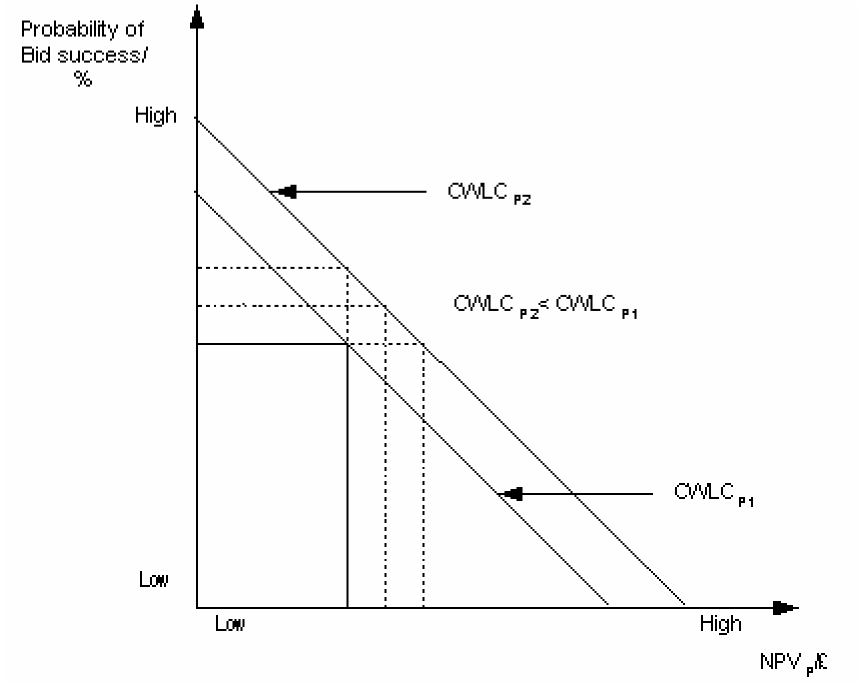

Figure 2.8. The ProjectCo's appropriation of a $CWLC_P$ reduction.

The client must seek to structure the procurement competition so that the ProjectCo awarded the contract appropriates all $CWLC_P$ reductions in the competitive stages of the project into lowering $CWLC_C$. This results in a situation where the ProjectCo's NPV_P is zero. Thus, the profit it will make from undertaking the project will equal its OCC. This is consistent with the client's VFM maximisation aim as it reduces its cost of procuring a service ($CWLC_C$) that generates a pre-specified benefit to society ($CWLB_S$).

The ProjectCo's NPV_P from project execution is the difference of $CWLB_P$ and $CWLC_P$. Once the client and the ProjectCo have agreed the UP, the ProjectCo will be able to appropriate all $CWLC_P$ reductions as NPV_P increases. Thus, after the appointment of the PB, the ProjectCo's $CWLC_P$ minimisation becomes an exercise of economic rent maximisation subject to successful service delivery. As a result, the ProjectCo has an incentive to persist with $CWLC_P$ minimisation until the end of the contract. This is because it will be entitled to the resulting surplus. It must be noted that the client cannot access these savings on the particular project. This is because the UP has already been agreed. However, the client will be able to do so on subsequent PFI projects through competition as the $CWLC_P$ reductions achieved post contractual close on previous PFI projects begin to be reflected in ProjectCos' bid prices.

2.9.1.3. Value for Money Assessment

The VFM assessment has a significant influence on the outcome of the procurement competition. The client will appoint a ProjectCo as the PB only if its SPS is better VFM than the competing ProjectCos' proposals and the PSC project. As part of the assessment, the client calculates $CWLC_{C/PSC}$ for the PSC project. It may also have to adjust the $CWLC_C$ of each of the SPSs to achieve comparability between the procurement alternatives. In other words, the client uses the PSC project as a benchmark in the VFM assessment (TTF, 1999b).

The client's focus in the VFM assessment is on the $CWLC_C$ of each SPS rather than on the benefits that the implementation of the solutions would generate. This is because the quantification of social benefits is problematic. Therefore, for reasons of simplicity, the client assumes that the ProjectCos' SPSs and the PSC project will generate the same benefits ($CWLB_S$) fixed by the OS_{ITN}. As a result, the client's objective in the VFM assessment is to establish which project provides the predefined $CWLB_S$ with the lowest $CWLC_C$. Thus, the client compares the $CWLC_C$ of each of the SPSs with each other and the $CWLC_{C/PSC}$ to decide which one of the projects to procure (TTF, 1999b).

The client estimates the capital and operational costs of the PSC project based on historical public procurement costs. The *capital cost* is the cost of making the facility operational. The *operational cost* is the cost of providing a set of operational services using that facility. The facility and the operational services must meet the OS_{ITN} (TTF, 1999b). Section 3.5 explores the ProjectCo's costs in accommodation service provision in detail.

In reality, the client's initial capital and operational cost estimates are best-case scenario estimates. They are not estimates of mean outcomes. The fact that public procurement has a history of persistent cost and time overruns supports this – see e.g. HM Treasury (1998) and HM Treasury (1999). As a result, the client needs to adjust the capital and operational cost estimates of the PSC project. It must account for the risk of unanticipated cost increases. A *risk transfer premium* (RTP) is the price that the client is willing to pay to remove a variation in its outturn procurement cost by transferring a specific risk to the ProjectCo. The client needs to include the RTPs to $CWLC_{C/PSC}$ (TTF, 1999b).

According to TTF (1999b), the client must take the following steps to establish the RTPs to be included in the $CWLC_{C/PSC}$:

1. create a risk matrix that identifies all project risks,
2. identify the actor (the client or the ProjectCo) that each risk is allocated to in the PFI project,
3. estimate the cost the client will incur if each of the risks allocated to the ProjectCo materialises,
4. estimate the probability of each of the risks materialising, and
5. calculate the RTP for each risk by multiplying cost and probability.

The client may find it difficult to assign a monetary value to some of the risks allocated to the ProjectCo in the PFI project. However, HM Treasury (1998) and HM Treasury (1999), for example, give historical data that the client can use to estimate the likely costs of time and cost overruns in construction procurement. Moreover, some public sector clients possess data on historical operational cost overruns. Unfortunately, this information is fairly dispersed. In addition, the client may obtain a quote for an insurance against a specific risk. This will provide the client with a valuation of the RTP without it having to estimate the probability and cost implications of the risk (TTF, 1999b).

The $CWLC_{C/PSC}$ also needs to include any third party revenues that the client may generate using the facility. In addition, it should include the valuations of the facility at critical points of the contract period. The most critical point usually occurs at the end of the contract period. The facility may remain in the ProjectCo's ownership; it may revert to the client's ownership, or the client may have an option to assume its ownership for a pre-agreed sum of money (TTF, 1999b).

The client must assign the capital and operational costs, RTPs, third party revenues and facility valuations at a likely time of occurrence in the contract period. Subsequently, using Formula 2.3, it can calculate $CWLC_{C/PSC}$ by discounting them (at SOCC) into a single figure. The client should subject the $CWLC_{C/PSC}$ to an explicit sensitivity analysis around its key assumptions (TTF, 1999b).

$$CWLC_{C/PSC} = \sum_{t=0}^{t=n} \frac{(CC_t + OC_t + RTP_t + R_t + FV_t)}{(1+d)^t} \qquad (2.3)$$

where $CWLC_{C/PSC}$ is the contract whole life cost of the PSC project to the client,
t is a year in the contract period,
n is the contract duration,
CC_t is the capital cost in year *t*,
OC_t is the operational cost in year *t*,
RTP_t is the risk transfer premium in year *t*,
R_t is the third party revenue in year *t*,
FV_t is the facility valuation in year *t*, and
d is the discount rate.

The client compares $CWLC_{C/PSC}$ and the $CWLC_C$ of each of the SPSs with each other in order to determine which one of the procurement alternatives is the best VFM. However, in practice the comparison may not be as straightforward as portrayed in this section. This is because it is possible that the competing SPSs generate different amounts of tangible benefits. The most important of the benefits is efficiency saving in core service provision. Therefore, the client may choose to adjust each $CWLC_C$ according to the tangible benefits they generate (TTF, 1999b). It must be noted that at the bidding stage the ProjectCos may not know how and whether the client will take tangible benefits into account in its VFM assessment. Therefore, the ProjectCos must focus on $CWLC_P$ and, thus, $CWLC_C$ minimisation in the bidding competition in order to maximise their chances of being appointed the PB.

2.9.2. Traditional Procurement

In traditional procurement, the client initially compiles an OBC to make a case for the procurement of a building. Subsequently, it submits the case to the relevant Government Department in a bid to obtain finance for designing and building the facility. If successful, the amount that the client is awarded dictates its maximum expenditure on procuring the facility and, thus, sets its capital cost affordability constraint. After commissioning, the client will finance the operation of the facility from its formula funding budget, which it uses to meet the cost of all its operations. The client's formula funding budget is determined by the volume and diversity of its core service provision.

Once the client's case for procurement is approved, it proceeds to procure a detail design solution for the building. The client has only a weak incentive to ensure that it achieves the optimum balance between its capital and operational expenditures. This is due to its financing arrangements. Instead, it has an incentive to achieve the maximum possible increase in its formula funding budget as a result of procuring a new building.

This is because the client's operational expenditure on its facilities will consume only a minor proportion of its formula funding budget. Therefore, it is likely that it will be able to increase its formula funding budget in excess of the additional operational expenditure arising from not achieving the optimum balance between capital and operational expenditures. Consequently, the client instructs its designers to develop a design solution for a facility that will enable it to obtain the maximum accommodation within its capital expenditure budget and, thus, enables it to maximise its formula funding budget. The designers have an incentive to develop the design solution in line with the client's objective. This is because designers usually gain work through reputation, and the ability to design buildings that meet their clients' objectives enhances their reputation.

The client invites a number of pre-selected contractors to bid in competition for the construction of the building. The main contractors price their bids based on the detail design solution. The client predominantly selects the contractor offering to undertake the construction with the lowest capital cost. This gives the contractor an incentive to minimise its expenditure on building the facility. In other words, the client procures a building that is minimised in capital cost. However, it must be noted that some sophisticated clients may use bid evaluation criteria additional to capital cost.

Subsequently, through competitions, the client selects operators to service the facility. It awards the operational service contracts to operators willing to provide specific services with the lowest costs. This is because the client's operational affordability is restricted by its formula funding budget. The less the client spends on the operation of its accommodation, the more it can spend on its core service provision and, thus, the more formula funding it will receive. As a result, the operators have an incentive to minimise the cost of their service provisions in order to increase their chances of securing the contracts.

CUP (1992) recommends that the client should consider the whole life cost (WLC) of a facility in its procurement. However, in practice, the client's operational cost affordability tends to be less constraining than its capital cost affordability. This is because the capital cost affordability is restricted by a clearly defined capital expenditure budget, whereas the operational expenditure is met from the client's annual formula funding budget. As a result, the client does not have an incentive to procure an accommodation service that has an optimum balance between capital and operational expenditures. Consequently, in the procurement competitions, the client does not give the private sector actors an incentive to engage in such optimisation.

2.9.3. Concluding Remarks

In PFI procurement, the client selects a single accommodation service provider as a result of $CWLC_C$ based competition. Consequently, the ProjectCo actors have an incentive to minimise $CWLC_P$, which will translate into an improved VFM project for the client. In traditional procurement, the client selects a number of private sector actors to perform fragmented tasks that constitute accommodation service provision based on competitions driven either by capital or operational costs. The client awards the contracts to the private sector actors willing to perform the tasks with the lowest costs. Thus, the private sector actors have an incentive to minimise the costs of the specific tasks they are bidding to undertake. As a result, the client does not obtain a service that is minimised in $CWLC_C$. Instead, it obtains a sub-optimal accommodation service that is minimised in the costs of its components.

2.10. Incentive Contract

The theoretical foundations for the client's use of an incentive contract to align the aims of the ProjectCo with its own aim are laid down in the Principal-Agent Theory. The development of the theory can be credited to a number of individuals. However, the origins of the theory are often identified in the work of Spence and Zeckhauser (1971) and Ross (1973). The Principal-Agent Theory is concerned with two contracting actors, namely the principal and the agent. The principal makes an investment. However, it does not take the decisions that determine how the investment is used. Instead, the agent takes the decisions. In this context, the Principal-Agent Theory is concerned with mutually acceptable agreements to the principal and the agent. A central assumption of the theory is that both actors will pursue their own aims. Thus, it postulates that the agent prefers to receive the maximum rewards and contribute the minimum effort (Milgrom and Roberts, 1992; Douma and Schreuder, 1998).

Mumford (1998) has placed the Principal-Agent Theory in the context of DBFO contracts. In an accommodation service PFI project, the principal is the client that purchases a facility-based service. The agent is the ProjectCo that provides the client with the accommodation service.

The DBFO contract allocates some of the responsibilities, risks and rewards that the client retains in traditional procurement to the ProjectCo (see Section 2.5). As a result, the client creates an incentive for the ProjectCo to begin the delivery of a VFM accommodation service on time and continue delivering it to a predefined standard throughout the operational phase. The two specific mechanisms the client uses to achieve the risk allocation are the OS_{FC} (see Section 2.8) and the Payment Mechanism (PM). This is because it cannot readily measure the amount of resources the ProjectCo requires to produce the accommodation service. It can more easily measure the output of the service provision and link the UP for the service to that output (Douma and Schreuder, 1998; Grout, 1997).

The client will pay the ProjectCo only for services provided. This means that the client will not pay the ProjectCo before the project-facility has been designed, built, commissioned and made operational. This gives the ProjectCo an incentive to ensure that it will complete the project-facility and make the service operational on time. It will not receive the anticipated revenue and it will incur additional costs if it fails to do so. As a result, the amount of profit it will make from the project will be reduced. The difference in timing of payments in PFI and traditional procurement is illustrated in Figure 2.9.

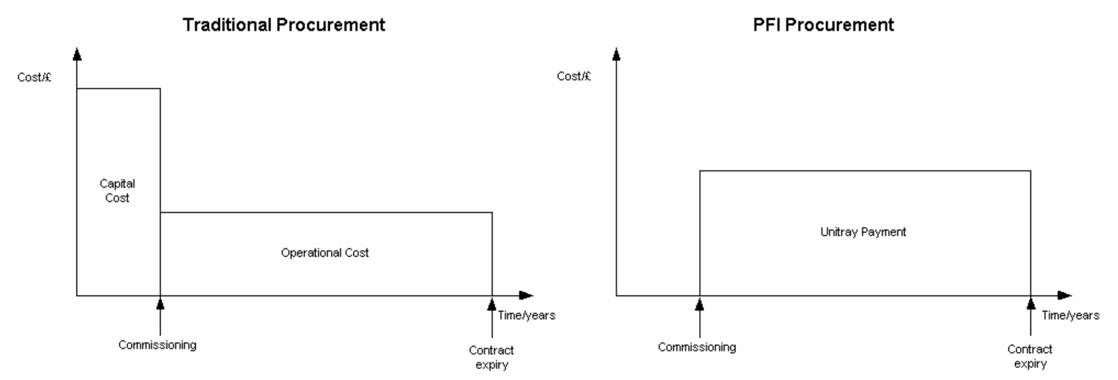

Figure 2.9. Comparison of payment in traditional and PFI procurement (adapted from PFPE (1996b)).

The client links the UP and the ProjectCo's service provision using the PM. If the ProjectCo's service provision does not meet the quantity and quality specified in the OS_{FC}, the ProjectCo will, in principle, suffer a UP deduction. Consequently, the amount of revenue the ProjectCo will receive from the project will be reduced. The prospect of deductions gives the ProjectCo an incentive not to reduce the service. A failure to meet the OS_{FC} can result in the termination of the DBFO contract. This type of contract is known as a *forcing contract.* It should give the client increased certainty that it will receive a service that meets the OS_{FC} throughout the operational phase (Douma and Schreuder, 1998).

The client assesses the condition of the project-facility, usually five years before the end of the contract period. This gives the client the opportunity to withhold UP and, thus, the ProjectCo an incentive to maintain the project-facility in a condition specified in the OS_{FC} (TTF, 2000a).

The PM defines the accommodation service performance indicators that the client monitors in the operational phase. If the service provision does not meet the performance indicators, the ProjectCo will suffer a UP deduction. However, the ProjectCo will not receive additional payment if its service quality and/or quantity exceed the performance indicators. Therefore, the ProjectCo does not have an incentive, and thus is unlikely, to improve the service provision beyond the minimum required output.

According to PFPE (1996b), the UP should consist of availability, service and volume components. The *availability component* is related to the availability of the project-facility. Say, is the temperature in a secondary school classroom within the specified tolerances? The *service component* is related to the performance of the operational services. Cleanliness, for example, is a performance indicator for cleaning which is part of the operational service provision. The *volume component* is linked to the amount of services provided. In the early days of PFI, the client transferred significant volume risk to the ProjectCo in order to keep PFI projects on the ProjectCos' balance sheets. However, NAO (1999a) argued that in most cases the transfer of volume and, thus, demand risk erodes VFM – see Section 2.5.4. Subsequently, the use of volume as the basis for payment has been largely abandoned. It must be noted that payment for some operational services, such as catering, must be linked to volume as the number of meals provided largely determines the cost of providing the service.

The PM can be seen as a mathematical formula that defines the UP based on the availability and performance of the service. There are two general approaches to structuring a PM formula. The first approach is to have a small number of performance indicators. A failure to deliver in those areas will result in a substantial UP deduction. This approach should ensure that a situation where the client needs to impose a penalty does not arise. Thus, a PM using this type of an approach is often referred to as *single threshold* PM – see e.g. Department of Environment, Transport and Regions (DETR) (1998). The client should design the single threshold PM so that the UP deduction to the ProjectCo is greater than the saving from not meeting the OS_{FC}. It must be noted that the client has the right to terminate the contract if the ProjectCo frequently incurs UP deductions.

A lecture theatre with 100 spotlights is an example that can be used to illustrate the principle. The example given is of the availability component. However, the same principle applies to the performance component. The sole performance indicator used in a single threshold PM is the level of lighting. If the lighting level in the lecture theatre is less than the minimum acceptable standard of 1000 Lux, the client will impose a 50% UP deduction – see Figure 2.10. This situation will be reached if 10 of the 100 spotlights fail. Once eight spotlights have failed, the ProjectCo has an incentive to react with remedial action. If a ninth spotlight expires, the incentive is considerably strengthened, as the failure of an additional spotlight will have severe financial consequences. In other words, by using a single threshold PM, the client gives the ProjectCo a strong incentive not to reduce its service to a level where it incurs a UP deduction.

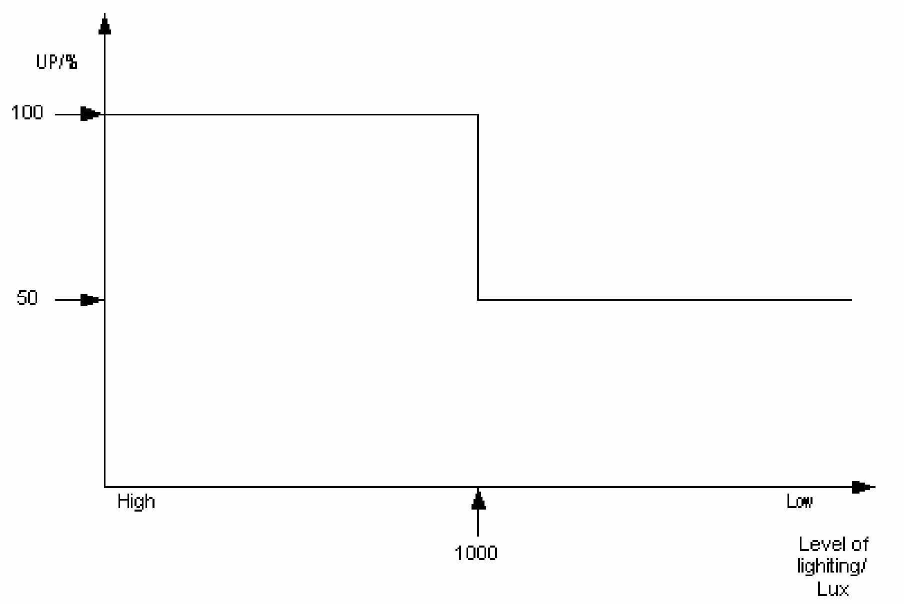

Figure 2.10. An example of a single threshold payment mechanism.

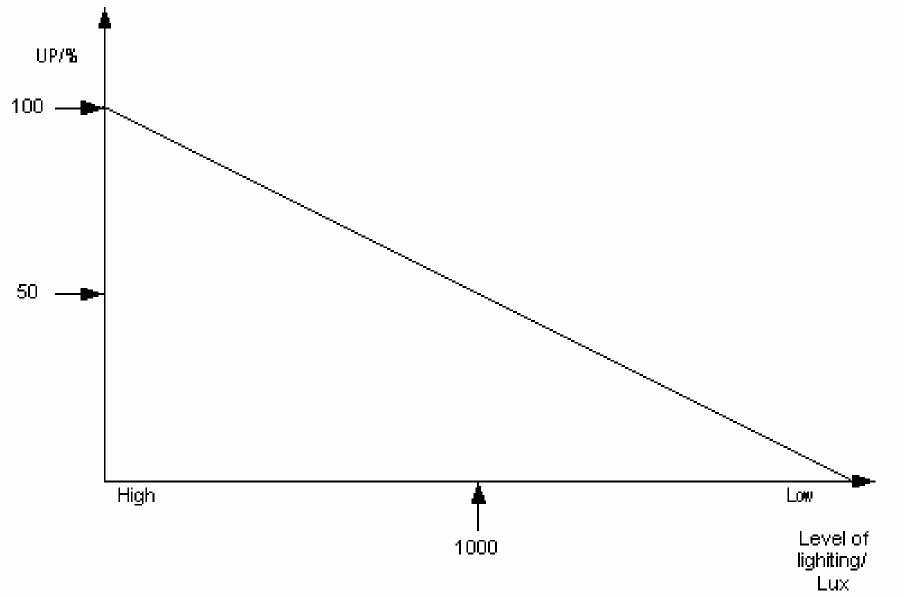

Figure 2.11. An example of a sliding scale payment mechanism.

The second approach is to have several performance indicators and attach a small UP deduction to failure in each and every one of them – see Figure 2.11. A PM using this approach is often referred to as a *sliding scale* PM – see e.g. DETR (1998). The client should design the sliding scale so that at the desired level of service provision the marginal UP deduction becomes greater than the marginal saving from reducing the level of service.

In the case of the lecture theatre with 100 spotlights this would mean monitoring all of them and attaching a 1% UP reduction to each and every one of them. As a result, the ProjectCo's incentive to take remedial action strengthens as lighting in the lecture theatre begins to affect its use. The client should design the sliding scale to give the ProjectCo an incentive to always provide a level of service that does not affect its core service provision.

Milgrom and Roberts (1992) have laid down four principles that should be taken into account in structuring incentive contracts. The *informativeness principle* states that the principal's cost of incentives increases with the amount of variance in the performance indicators used. The *incentive intensity principle* states that the intensity of the incentives used should depend on:

- the increase in profit for the principal,
- the exactness of measuring agent performance,
- the agent's responsiveness to the incentives, and
- the agent's ability to manage risks.

The *monitoring intensity principle* states that increased monitoring strengthens incentives, but since monitoring is costly, the optimal intensity of incentive and the level of monitoring should be determined jointly. The *equal compensation principle* states that if the principal desires the agent to devote its effort equally to a number of tasks, it should give equal incentives for these tasks.

TTF (2000a) recommends that the client should monitor easily measurable performance indicators. It should focus on the essential performance indicators of the critical services and avoid irrelevant and/or extensive monitoring. These recommendations are in line with the principles for structuring incentive contracts.

2.10.1. Traditional Procurement

In traditional procurement, the client pays the designers and the contractor in full once they have completed their respective tasks. In other words, the actors do not have outstanding payments once the building has been successfully commissioned and it has become operational. As a result, the actors do not have an incentive to minimise $CWLC_P$ nor to ensure that the accommodation service always meets its expected standards. The designers would not be entitled to any of the savings in capital or operational costs. The contractor would not be entitled to any of the operational cost reductions. In addition, the client cannot withhold or easily claim back payment from the designers or the contractor if the accommodation service provision does not meet its anticipated standards due to the design and/or construction of the facility. It must be noted that the client is able to give incentives for the operators to provide their operational services to pre-specified standards and to reduce the cost of their services. However, the operators' ability to do so may be adversely affected by the existing facility.

2.10.2. Concluding Remarks

In PFI procurement, the client generates incentives for all the ProjectCo to provide a service that meets the OS_{FC} throughout the DBFO contract period and to reduce $CWLC_P$ of its service provision. In traditional procurement, the client is unable to give the private sector actors incentives that are as effective. This is because the designers and the contractor are no longer actively involved in the operational phase of the accommodation service provision.

2.11. Concluding Remarks

The client's aim in a PFI project is to procure a service that is the maximum VFM subject to affordability. The client seeks to make the ProjectCo pursue its aim by using risk transfer, output-based specification, task integration, long-term contract, competition and incentive contract. The client's use of these mechanisms generates incentives and opportunities for the ProjectCo to minimise $CWLC_P$, which will translate to improved VFM. Thus, by using PFI procurement, the client is able to align the aim of the ProjectCo with its own aim.

Chapter 3 - ProjectCo Strategies in PFI Development

3.1. Introduction

This chapter examines the ProjectCo's strategies in developing a service provision solution (SPS) for an accommodation service PFI project. First, the chapter examines the composition of the ProjectCo and explores its aims. Second, it analyses the different types of costs that a ProjectCo incurs in PFI accommodation service provision. Third, the chapter introduces whole life costing techniques with which the ProjectCo can develop a SPS in line with its aim. Fourth, the chapter explores the limitations of the whole life costing techniques in the development process.

3.2. Approach to Analysis

On the one hand, PFI procurement and, thus, the tasks that the client undertakes at various stages of the process are documented in great detail in numerous guidance documents. In addition, a solid theoretical understanding exists on how the client creates incentives and opportunities for the ProjectCo actors to pursue its aim of procuring the maximum value for money (VFM) project subject to affordability – see Chapter 2. On the other hand, however, the private sector actors' behaviour in the PFI development process is not well documented. CIC (1998) describes the PFI development process in the greatest detail. Nevertheless, it is felt that that presentation does not capture all the possible organisational permutations that the private sector actors involved can adopt, nor does it outline all the tasks the actors need to undertake in the course of the development process. Thus, it is not known how the ProjectCo actors sustain their incentives and opportunities to pursue the client's aim in PFI project development. As a result, the analysis presented in this chapter does not begin to speculate on the details of the development of an accommodation service PFI project. Instead, it seeks to establish the strategies that the private sector actors can adopt in pursing the aim of the client in developing a SPS for a PFI project.

3.3. The ProjectCo

This thesis uses the term *ProjectCo,* to refer to a group of private sector actors that come together to pursue and, subsequently, to undertake a PFI project regardless of their contractual relationships. The type of actors that a ProjectCo includes depends on the skills required to execute the project (CIC, 1998). In an accommodation service PFI project, the key ProjectCo actors usually include an investment company (InvestCo), a contractor, an operator, a financier, an architect, a building service designer and a structural designer. The term *InvestCo* is used to refer to a company that bids for and invests equity in PFI projects. Typically, an InvestCo is a subsidiary of a large construction or FM organisation. In addition, at various stages of project development, the ProjectCo may include a wide range of consultants, construction subcontractors and operational service subcontractors.

At the beginning of the PFI development process, the ProjectCo actors come together in order to bid for a PFI project with the aim of securing a DBFO contract. Typically, the ProjectCo uses a bid vehicle (BV) in the bidding and preferred bidder (PB) stages of the development process. The BV is usually based on a joint venture (JV) agreement between two or more of the ProjectCo actors. However, the ProjectCo uses a Special Purpose Vehicle (SPV) to enter into the DBFO contract with the client. The SPV is formed just prior to the financial close of the project for the sole purpose of implementing it. The SPV is owned by the InvestCos involved in the project. The ProjectCo uses the SPV because it finances the vast majority of the SPS development and implementation until the project has become operational using project finance. In other works, the ProjectCo secures the finance against the revenue, namely the unitary payment (UP) it will receive from the client for providing the service (CIC, 1998).

According to Akintoye *et al.* (2001a), the SPV will seek to subcontract all the tasks involved in the project for the following reasons:

- the financiers do not allow any significant risk to be left with the SPV,
- the amount of equity investment in the SPV does not allow it to retain any significant risk,
- subcontractors are likely to be in a better position to manage the project risks,
- it is rational for the SPV to protect itself from the consequences of risks in case they materialise.

3.4. The ProjectCo's Aim

This chapter treats the ProjectCo as a rational profit maximising entity. Thus, its fundamental aim in a PFI project is to maximise its economic rent from undertaking the project. However, before the ProjectCo can make any profit from the project it needs to secure the DBFO contract. In the bidding stage, this translates into an incentive to minimise the contract whole life cost ($CWLC_P$) it will incur subject to developing a SPS that can be used to provide the accommodation service successfully. The ProjectCo is able to appropriate $CWLC_P$ savings between a lower bid price, i.e. contract whole life cost ($CWLC_C$) for the client, and increased economic rent from the project. A reduced bid price will increase the ProjectCo's probability of being nominated as the preferred bidder.

Once the ProjectCo has agreed the contractual terms, including the UP, with the client, it has an incentive to minimise $CWLC_P$ subject to successful service delivery. This is because the $CWLC_P$ savings the ProjectCo achieves will increase its economic rent from the project.

The constraint to develop a SPS that can be used for successful service delivery and the subsequent successful service delivery gives the ProjectCo two alternative incentives. First, the ProjectCo must develop a SPS that can be made operational on programme. If the operational date is delayed, the ProjectCo will not begin to receive the UP as anticipated and will incur additional costs from rescheduling its finance repayment. In addition, its total revenues and, thus, profit from the project will be reduced. Second, the ProjectCo needs to develop a SPS that can be used to deliver the service successfully to the standard set in the OS_{FC}. This is because if it fails to do so, it will incur UP deductions. As a result, its revenue and, consequently, profit from the project will be reduced.

The ProjectCo has the opportunity to achieve $CWLC_P$ reductions in SPS development. This is because the client uses risk transfer (see Section 2.5), output-based specification (see Section 2.8), long-term contract (see Section 2.7) and task integration (see Section 2.6) in PFI procurement.

3.5. Revenue and Cost in a PFI Project

Flanagan and Norman (1983, 2) define whole life cost (WLC) as "the total cost of an asset over its operating life, including initial acquisition costs and subsequent running costs." RICS (1986, 1) presents a more elaborate definition, which states that the WLC of an asset is "the present value of the total cost of an asset over its operating life, including initial capital cost, occupation costs, operating costs and the cost or benefit of the eventual disposal of the asset at the end of its life." These are just two of the numerous definitions. Generally, WLC is accepted as the total cost of an asset over its life. However, some variation exists on what is included in that total cost.

This section focuses on the revenues the ProjectCo obtains for its PFI accommodation service provision and the costs it incurs in that provision, i.e. $CWLC_P$. It must be noted that $CWLC_P$ excludes costs that arise from accommodation service provision beyond the expiry of the DBFO contract and the costs that arise from tasks that are outside the scope of the project. Thus, $CWLC_P$ does not equal the WLC of a project-facility.

3.5.1. Unitary Payment

The accommodation service that the ProjectCo provides the client with is defined in the output specification (OS_{FC}) appended to the DBFO contract – see Section 2.8. Once the ProjectCo commences the service delivery, the client begins to make the UP for that service. The UP is performance related and, thus, subject to deductions – see Section 2.10. In the vast majority of PFI projects, the UP is the ProjectCo's main source of revenue.

3.5.2. Miscellaneous Revenues

In the life of a PFI project, the ProjectCo may obtain miscellaneous revenues that are not part of the UP. First, the ProjectCo may obtain third party revenues by offering the project-facility for alternative uses. The classic example is the use of a secondary school's sports facilities such as a gym that is open to the public outside school hours (PFPE, 1996a). Second, the ProjectCo may obtain the ownership of the client's existing properties, which the project will make surplus to the client's requirements as part of the DBFO contract. The receipts from the sale of these properties are miscellaneous revenues (PFPE, 1996a). These are just two of many possible revenues that the ProjectCo may obtain in addition to the UP over the DBFO contract.

3.5.3. Financing costs

The ProjectCo uses primarily equity investment, debt finance and/or bond finance to finance a PFI project. It finances all PFI projects at least partially by equity. The equity contribution is usually between 5% and 15% of the total financing requirement. The ProjectCo needs to use at leas some amount of equity finance for three principal reasons. First, equity finance ensures that the InvestCos retain an interest in the performance of the PFI project over the DBFO contract period. Second, equity finance gives the InvestCos an incentive to minimise $CWLC_P$ and, thus, maximise the economic efficiency of the project. Third, it will act as a cushion if the ProjectCo experiences difficulties in delivering the service to the agreed standard (CIC, 1998).

The cushion of equity finance prevents the SPV from going bankrupt. The more innovative and, thus, risky the SPS, the larger the proportion of equity finance the financiers require to protect their debt/bond finance. A SPV default would result in the discontinuation of the accommodation service delivery. This would lead into the termination of the DBFO and the project becoming a liability of the financiers (CIC, 1998).

The ProjectCo finances the project against the project-facility and the revenues due for accommodation service delivery under the DBFO contract. However, the financiers may require the ProjectCo actors to provide additional guarantees of the completion of the design and construction of the project-facility (CIC, 1998).

It is acknowledged that as the PFI market has matured, financiers have become more willing to invest in PFI projects. This is because PFI projects are seen as low risk investments. This has made it possible for ProjectCos to finance PFI projects at fairly low rates of interest (CIC, 1998).

The financiers may arrange a bond issue to finance a PFI project. This is because bond finance tends to have a lower rate of interest than debt finance. However, the lower rate of interest may be offset by the high cost of a bond issue and additional insurance to reduce project risks and, thus, keep the interest rate of the bond finance low (CIC, 1998).

The ProjectCo may refinance a PFI project. The refinancing takes place at a time where there is a substantial decrease in the project risks. The major discontinuity in the risk profile of a project is at a point where the project-facility has been commissioned and the service has become operational. This enables the ProjectCo to refinance the project at a lower rate of interest as the design and construction risks of the project have almost completely diminished (PFPE, 1996c). The vast majority of PFI projects include a clause for sharing the benefits of refinancing between the client and the ProjectCo (Price Waterhouse Coopers, 2001).

RICS (1986, 11) defines *financing cost* as *"the cost of raising the capital to finance a project."* However, an alternative view is that the discount rate used should be the opportunity cost of capital (OCC) (Ashworth, 1994). The financing cost does not feature in the $CWLC_P$ of a PFI project as a separate cost. Instead, what is important is the discount rate that the ProjectCo uses to calculate $CWLC_P$ and the present value of the UP stream, i.e. contract whole life benefit ($CWLB_P$), by converting the costs and revenues of the project to their present value equivalents. The discount rate is expressed as a percentage. The ProjectCo's OCC is a combination of the InvestCos' OCC for the equity finance and the financiers' OCC for the debt/bond finance.

3.5.4. Capital Costs

According to RICS (1986, 11), the capital cost is the "total costs to the owner of acquiring an item and bringing it to the condition where it is capable of performing its intended function." Both Flanagan and Norman (1983) and RICS (1986) have proposed frameworks for categorising costs that occur in the life of a built asset. According to these frameworks, capital costs include the costs of land, construction, design, professional fees, furniture, equipment, relevant taxes etc. The capital cost of an accommodation service PFI project can be seen as the total cost that the ProjectCo has incurred in designing and building the project-facility until it has been successfully commissioned.

The cost of bidding for a PFI project contributes significantly towards the capital cost. The ProjectCo incurs especially significant costs in terms of professional fees. The reason why bidding costs are often highlighted in the context of PFI is that bidding usually takes place at risk. In other words, if the client awards the DBFO contract to a competitor or does not award it at all, the ProjectCo is not be compensated for its bidding costs. The bidding costs arise from developing the SPS until financial close, the legal fees associated with negotiating the DBFO contract and the cost of obtaining finance for the project. According to Birnie (1999), the bidding costs in a PFI project can be several times higher than those in a traditional project. However, It is acknowledged that as the PFI market has matured, the costs of bidding have reduced. This is because the bidding process has become more standardised.

The equipment included in the capital cost of a PFI project depends on the scope of the accommodation service project. For example, in the case of hospital accommodation, the DBFO contract may or may not include the responsibility for the provision of specialist medical equipment such as x-ray machines. The client NHS Trust may wish to exclude such equipment from the scope of the project for a number of reasons. First, the client may choose to procure the equipment through its existing procurement channels if it feels that the use of its existing suppliers will enable it to obtain superior VFM equipment. If the client uses a separate contract, the cost of acquiring the equipment is not a capital cost for the ProjectCo. Second, it is possible that the NHS Trust has equipment in its existing hospitals that it wants to be installed in the project-facility. The client may exclude the equipment from the scope of the DBFO contract and, thus, from the capital cost of the project. Third, the client may feel that it can manage the technology risk on medical equipment more efficiently than the ProjectCo and, thus, exclude the equipment from the scope of the project.

3.5.5. Operational Cost

The existing literature defines operational cost variably and no agreed categorisation exists. Generally, operational costs are broken down into running and maintenance costs. These two categories can be broken down further. Flanagan and Norman (1983), for example, have made a distinction between annual and intermittent maintenance costs.

FM can be seen as the set of activities related to operating a building. Therefore, it follows that the cost arising from FM can be seen as the operational cost. CIC (2000, ix-x) defines FM as the *"process by which an organisation delivers and sustains agreed levels of support service in a built environment facility, to meet the business need of the occupier of that facility. Support or ancillary services included in an FM contract vary but will include facility operations, maintenance and asset management."*

FM is typically divided into soft and hard FM. This division is similar to the breakdown of operational costs into running cost and maintenance cost. CIC (2000, xi) defines *soft FM* as the *"allocation of space, services and equipment to meet management objectives and user needs through time"* and *hard FM* as the *"provision of sites and buildings, fit-outs and adaptations, operations and maintenance of buildings."* The respective definitions by RICS (1986, 11) are that *running cost* is the *"cost of the rates, cleaning, energy, portering etc., necessary for the building to be used"* and *maintenance cost* is the *"cost of maintaining the building, to keep it in good repair and working condition."*

The operation that determines both hard and soft FM costs is included in most accommodation service PFI projects. However, in some cases the operation of some specialist equipment may be excluded from the scope of the DBFO contract. The example on capital cost of specialist medical equipment in the provision of hospital accommodation (see Section 3.5.4) applies equally to operation. The client NHS Trust may feel that the ProjectCo is not offering a VFM service for the operation of the equipment moved from its existing facilities to the new project-facility. The ProjectCo's price for the service is likely to be seen as high because it reflects the uncertainty related to the condition of the equipment. Thus, the client may decide to exclude the operation from the scope of the DBFO contract and procure it independently using a separate contract. Thus, the cost of procuring that contract is not part of the operational cost of the PFI project and, thus, $CWLC_P$.

The exclusion or inclusion of the cost of energy consumption from the scope of an accommodation service PFI project is one of the most debated issues in relation to operational costs. The amount of energy costs included in a PFI project will depend on the allocation of the energy risk between the client and the ProjectCo. The allocation has two extremes. First, the client may retain all energy risk and, thus, the responsibility for the full cost of energy. In this case, energy cost is not part of the $CWLC_P$. Second, the ProjectCo may take the energy consumption management risk. However, it is unlikely that the ProjectCo will be allocated the energy price risk. This is because the ProjectCo is unable to manage the changes in the energy price over the duration of the PFI contract. Thus, the client is likely to retain the energy price risk. In this case, energy cost is part of the $CWLC_P$, but at the price agreed in the DBFO contract (OGC, 2002).

3.5.6. Occupancy Cost

According to RICS (1986, 11), *occupancy cost* is the *"cost of performing the functions for which the building is intended."*

In some non-accommodation service PFI projects, occupancy cost is an integral part of the $CWLC_P$. For example, in PFI-prison projects the custodial service is included in the scope of the DBFO contract. Thus, the cost of providing custodial service is an occupancy cost that is part of $CWLC_P$. However, the amount of occupancy cost included in $CWLC_P$ in accommodation service PFI projects depends on the scope of the service provision. For example, the provision of school meals is typically included in the scope of school PFI projects. In such projects, this makes the cost of catering an occupancy cost and, therefore, part of $CWLC_P$.

3.5.7. Residual Value

RICS (1986, 11) defines *residual value* to be the value that *"the residual life may have to another owner to the benefit of the present owner."* Flanagan and Norman (1983) point out that residual value, also known as re-sale value, can also be negative, if the disposal of an asset at the end of its life costs more than can be recovered from it. A classic example of a building that could be a liability at the end of a PFI project is a nuclear power plant.

The residual value of a PFI project can be determined in two ways. First, the project-facility may revert to public sector ownership at the end of the contract period for a predetermined sum. In the vast majority of cases, the client has the option to take the ownership of the asset at the end of the contract period without additional payment (Smith, 2000). If the client exercises this option, the residual value is zero. However, it must be noted that the client may wish not to exercise this option. Second, the project-facility may remain in the ownership of the ProjectCo. The value, whether, positive or negative, that the facility has to the ProjectCo is the residual value of the project. If the ProjectCo enters into a new services provision contract with the client, the residual value of the facility is the difference between the net value of the project with that facility and the net value of a hypothetical project with a new facility.

3.6. Whole Life Costing – History and Use

In the late 1970s, the United States Federal Government took an active role in promoting whole life costing in the US construction industry. This was due to the awareness of the large operational costs of federal buildings. This led into the obligation to submit a WLC estimate for all construction projects undertaken wholly or partially with federal funding (Woodward, 1997).

In the UK, approximately at the same time, the Department of Industry began to actively promote whole life costing (Woodward, 1997). However, it was not until the early 1980s that whole life costing was introduced to the UK construction industry by work commissioned by RICS. Flanagan and Norman (1983) laid down the initial framework to *Life Cycle Costing for Construction*. Subsequently RICS (1986), RICS (1987), Flanagan *et al.* (1989) and Ferry and Flanagan (1991) refined the framework.

The scope for the application of whole life costing in the construction industry is considerable. Hoar and Norman (1992) have described general uses for whole life costing in design choice, maintenance management, energy management, cleaning, component and material selection, property portfolio management and investment appraisal. According to Flanagan and Norman (1983), taking a WLC approach is crucial to effective decision making in four ways. First, the approach considers the impact of all costs rather than only the initial investment. Second, it enables alternatives requiring initial investment and subsequent expenditure to be evaluated effectively. Third, it generates detailed understanding of the current operational costs. Fourth, it can contribute to the effective management of existing buildings. Woodward (1997, 335) captures the essence of a WLC approach by stating that whole life costing *"is concerned with optimising the value for money in the ownership of physical assets by taking into consideration all the cost factors relating to the asset during its operational life."*

Despite the strong rationale for adopting a WLC approach, the use of whole life costing (or discounted cash flow) techniques has failed to become a dominant mainstream practice. Ferry and Flanagan (1991) have outlined three fundamental explanations for its unpopularity. First, predicting the future tends to be difficult. There are uncertainties surrounding all the variables that are needed to calculate the WLC. For example, the timing of replacing floor finishing changes in an unpredictable way. Second, it is widely believed that in order to be able to predict future costs by whole life costing, vast amounts of historical cost data are needed. Third, individuals have a limited time horizon and tend not to think more than a few years ahead. They find it difficult to relate to costs occurring in the distant future. In considering alternatives for capital expenditure, the present constraints on capital and maintenance expenditure are perceived as real while the future costs are seen as imaginary. According to Ferry and Flanagan (1991), it would be extremely unusual if an amount equivalent to capital cost savings today were to be put aside to meet future operational costs.

Ferry and Flanagan (1991) presented their views before the introduction of PFI. As the number of PFI projects has increased, whole life costing has started to receive considerable attention from the private sector. This is because PFI procurement gives the ProjectCo an incentive to minimise $CWLC_P$. The allocation of funds between capital expenditure and operational expenditures in the implementation phase has a key role in the ProjectCo's pursuit of its aim. In order to increase their understanding of this allocation, the ProjectCo actors have started to collect data to be used to predict the costs in the life of a PFI project more accurately. The major change in the use of whole life costing techniques in the context of PFI is that it is applied only to the costs the ProjectCo incurs for service delivery over the life of the DBFO contract.

3.7. Whole Life Costing Techniques

All whole life costing techniques include discounting, i.e. converting future revenues and costs to their current value equivalents. The ProjectCo can use the techniques to identify $CWLC_P$ savings in SPS development. These savings increase the ProjectCo's economic rent from the project if their pursuit does not jeopardise successful accommodation service delivery.

In SPS development, the ProjectCo needs to decide between an almost indefinite number of alternative design, construction and operational solutions. In deciding on the details of the SPS, the ProjectCo can use whole life costing techniques to establish which of the alternatives is best in line with its aim. The specific example used in this section to illustrate the principles is one where the ProjectCo decides between three alternative types of floor finishing for a secondary school. Each floor finishing has a capital cost, running cost (e.g. cleaning) and maintenance cost (e.g. replacement).

The ProjectCo can calculate a *solution* $CWLC_P$ (discounted at OCC) for each of the floor finishing. Subsequently, it can select the type of floor finishing that has the lowest solution $CWLC_P$. Applied to all aspects of the SPS, this will enable the ProjectCo to develop a SPS with the minimum $CWLC_P$.

However, a situation is likely to arise where the ProjectCo develops a preliminary version of the SPS without rigorous whole life costing. Subsequently, it considers whether it should change aspects of the SPS in order to improve it. In other words, the ProjectCo would have selected a specific type of floor finishing for the secondary school. Subsequently, it considers whether it should switch to one of the two available alternatives. The ProjectCo could calculate the solution $CWLC_P$ for each of the alternatives and switch to the one with the lowest solution $CWLC_P$. However, there are other whole life costing techniques that are more suitable for this purpose.

The ProjectCo can use the *Internal Rate of Return* (IRR) technique to calculate the discount rate at which the NPV of the accommodation service PFI project is zero (Brealey and Myers, 1996). It is assumed that at this stage the ProjectCo has ensured the project's IRR is equal or greater than the ProjectCo's OCC and, thus, the ProjectCo actors will benefit from undertaking the project. Subsequently, the ProjectCo needs to establish the costs and the savings that would arise from switching from the incumbent floor finishing to each of the two alternatives. The ProjectCo can then calculate the IRR for each of the changes. This enables the ProjectCo to rank the two proposed changes in the order of the return they would generate. The ProjectCo should adopt the change with the higher IRR only, but only if its IRR is higher than the IRR of the whole project. It must be noted that a situation may arise where the IRR of a change is between the ProjectCo's OCC and the project's IRR. The ProjectCo should not adopt such a change as it would reduce its economic rent from the project. The advantage of calculating IRR over the solution $CWLC_P$ is that the ProjectCo actors are likely to feel more comfortable with making decisions guided by a percentage figure than an absolute value.

The ProjectCo can also use a technique called *Discounted Savings to Investment Ratio* (DSIR) in deciding whether to change its SPS and, subsequently, which of the two alternative solutions to adopt. The DSIR is calculated by dividing the discounted (at

OCC) savings by the discounted (at OCC) costs of that switch (Flanagan *et al.*, 1989; Ferry and Flanagan, 1991). If the DSIR is below one, the ProjectCo should retain the existing floor finishing. However, if one or both of the alternatives have a DSIR above one, the ProjectCo should switch to the floor finishing with the highest DSIR. The application of the DSIR technique to every aspect of the SPS will result in an overall solution with the absolute minimum $CWLC_P$. This will result in the maximum profitability and return on investment in the project. The DSIR also has the advantage of producing a ratio to be used in decision-making as opposed to an absolute value.

The ProjectCo can use the *Discounted Payback* (DPB) technique to produce a measure of the time required to return the increased initial expenditure from switching one solution to another as subsequent savings. DPB is calculated by subtracting the discounted (at OCC) savings from the initial increased expenditure until the residual value is zero (Ferry and Flanagan, 1991). In the context of an accommodation service PFI project, the DPB method can be seen as an attempt to quantify risk. The longer the payback period is, the greater the risk. The weakness of the DPB technique is that it does not give any measure of rate of return. As more sophisticated risk identification and analysis techniques, like the ones discussed in de Lemos *et al.* (2001), have become common in PFI projects, the use of the DBP method in SPS development has become of limited value.

The ProjectCo should carry out sensitivity and scenario analyses around the key assumptions it uses in whole life costing. This can enable some of the risks inherent in the SPS to be revealed (Flanagan *et al.*, 1989).

3.8. Contract Whole Life Cost Decision-making

3.8.1. Contract Whole Life Cost Quantification

The PFI was introduced 1992. Thus, it is a relatively new method of public procurement. The very first PFI projects are around ten years into their operational phases. The DBFO contract period is typically around 25 years and, as a result, there are no completed projects. Consequently, the ProjectCos do not have PFI-specific historical cost data for whole life costing in SPS development.

The ProjectCos could use historical cost data from non-PFI projects for developing SPSs. However, this data would not be ideal. This is because PFI procurement creates an incentive for the ProjectCo to pursue $CWLC_P$ minimisation through optimising the amount and timing of its expenditure on the project-facility over the contract duration. This approach is rarely adopted in traditional procurement. This is because the client has to meet the cost of maintaining its facilities from its annual operating budget, which has other competing uses. However, the ProjectCos could choose to ignore the unsuitability of cost data from traditionally procured facilities. The data could be used for whole life costing in order to obtain an indication of how changes in the SPS affect $CWLC_P$. Unfortunately, the ProjectCos cannot readily obtain this type of cost data. If the ProjectCos can obtain the date, it is unlikely to be in the desired format. This is because in the pre-PFI period there was only a weak incentive to collect such data.

It needs to be noted that even if the ProjectCos had PFI-specific cost data available today, the date would not be completely suitable for $CWLC_P$ minimisation in SPS development. This is because technical development is likely to enable new type solutions that the ProjectCos can use to reduce $CWLC_P$ to emerge in the project duration. The use of inappropriate data questions the contribution that the use of more sophisticated whole life costing techniques, like the one developed by Kirkham *et al.* (2002), can make to SPS development.

It must be concluded that the ProjectCos develop SPSs for accommodation service PFI projects using cost data of questionable quality. This indicates that the ProjectCo actors take the decisions that determine the details of the SPS under considerable uncertainty of the outcome $CWLC_P$. Thus, it is important to understand how these decisions are taken.

3.8.2. Visions of Rationality

Individuals make decisions based either on rational choice or on decision rules. Even if decisions are based on rules, they include some amount of rationality. According to Gigerenzer and Todd (1999), there are four levels of rationality. These *visions of rationality* are unbounded rationality, optimisation under constraints, satisficing and fast and frugal heuristics.

Expected Utility Theory (EUT) is the most radical theory of rational choice. Its origins are in the early work of von Neumann and Morgenstern (1947). However, the theory has evolved since its introduction (Schoemaker, 1982). EUT assumes that the human mind has indefinite computing ability, that complete information is readily available and that there are no time constraints on decision-making. In other words, EUT is a theory of *unboundedly rational decision-making* that always produces the optimum outcome. The theory partly acknowledges that this is not the case in the real world. However, the strength of the expected utility theory lies in its suitability for computation. In SPS development, unboundedly rational decision-making would lead to the ProjectCo adopting a solution with the absolution minimum $CWLC_P$ subject to being able to provide the required level of service.

The criticism of EUT and unbounded rationality arose from the obvious limitations of the human mind. Simon (1955) recognised that decision-making can be seen as intendedly rational, but the search for and implementation of an optimal solution is constrained by both the individual and the environment. *Optimisation under constraints* differs from unboundedly rational decision-making only by involving a limited information search. Information is searched only until the benefit that can be achieved by continuing the search remains greater than the marginal cost of continuing the search. It is assumed that unboundedly rational decisions are made within these constraints.

In the context of an accommodation service PFI project, this would mean that the ProjectCo searches for possible $CWLC_P$ reductions until the saving that can be achieved becomes smaller than the marginal cost of continuing the search. For example, the ProjectCo may pursue $CWLC_P$ savings in detail design development. It will stop when the $CWLC_P$ savings that can be achieved by continuing the search are outweighed by the losses that the ProjectCo will incur if the completion of the project-facility is delayed.

Satisficing means that the search for alternatives is terminated once a solution that satisfies pre-set criteria is encountered and the solution is adopted. Satisficing includes concept of a *stopping rule*, which defines the criteria that need to be met (Simon, 1956). The ProjectCo may, for example, search for an elevator that does not need to be replaced in the 25 year contract period. Once it finds such an elevator, it ends its search for alternative solutions.

Nelson and Winter (1982) introduced meta-satisficing rule-based decision-making. According to them, an information search for new and better decision rules is triggered only if the current rules do not lead into satisfactory results. This leads to the evolution of decision rules through competition. In the context of PFI, for example, if the ProjectCo's existing decision rules do not lead to it being nominated the PB, it begins a search for new decision rules.

Gigerenzen and Todd (1999) define *fast and frugal heuristics* as the mechanisms used to make adaptive decisions. They require minimal time, knowledge and computation. March (1994) outlines four processes in decision-making that people use to simplify complex situations. These processes can be seen as fast and frugal heuristics at work as they adapt solutions to situations.

Editing is the process of presenting complex information in simple terms. For example, the ProjectCo can present the $CWLC_P$ of floor finishing as single figures for capital and operational costs without probability distributions. It is very unlikely that the single figure estimates are correct. However, the ProjectCo can use the single figures as interpretations of the situation to take a decision. These types of simplifications are done in order to cope with vast amounts of information.

Decomposing is a process of breaking problems into smaller entities so that solutions to the sub-problems enable a solution to the main problem to emerge. In SPS development, the ProjectCo may, for example, break down the selection of a heating and ventilation (HV) solution to selection of its components, such as air-handling units and chillers, and consider the selection of each of the components separately. This enables the ProjectCo to solve the HV solution selection problem.

Following heuristics is a process recognising past situations and adopting a similar solution to the decision at hand. A structural designer may, for example, recognise that s/he is designing a hospital and, subsequently, reflect back on the structural solution of that hospital. Consequently, s/he will design a similar structure for the new hospital.

Framing is a process of attaching additional information to the decision context that defines the situation. A building service designer may, for example, recognise that the lighting system that s/he designed for a traditionally procured hospital needs to be minimised in $CWLC_P$ because s/he is working on a PFI project.

3.8.3. Decisions Based on Rational Choice

According to March (1999), rational decision-making is a process based on four components. First, the decision maker has information on a set of alternatives. Second, s/he knows the consequences of adopting each of those alternatives. The information on the consequences is at least the probabilities of possible outcomes. Third, s/he has a value system that is consistent. The decision-maker uses this system to evaluate the consequences of each of the alternatives. Fourth, s/he has rules to choose an alternative based on his/her preferences of the consequences of each alternative.

In considering alternatives, the decision-maker must predict the consequences of each alternative. S/he must also predict the preferences that s/he will have for the predicted consequences. These predictions cannot be completely accurate. Trying to predict the consequences of a decision introduces the concept of uncertainty into decision-making. The decision-maker cannot have a complete understanding of the situation where the decision is needed. This is due to incomplete information and limitations on the human mind. Therefore, the decision-maker can neither predict accurately the future consequences of each alternative nor his/her preferences for those consequences (March, 1999). In SPS development, incomplete information relates to the quality of historical cost data used for whole life costing. The decision-maker's preferences become significant when, say, a designer developing the SPS chooses between two alternative design solutions that have different probability distributions for outturn implications on $CWLC_P$.

March (1988) has identified three common inaccurate assumptions on preferences. First, preferences are seen as stable. A decision is made in accordance with the preferences for the predicted consequences of a specific alternative at a specific moment in time. These preferences are seen not to change. Second, preferences are perceived as consistent and precise. Third, preferences are said to be exogenous. This means that it is assumed that the consequences of a decision do not influence future preferences. People gain experience through time and, thus, change, as do their preferences. This includes the changes influenced by past decisions made on past preferences. As a result, the prediction of future preferences is difficult. In addition, individuals may possess preferences that are conflicting or inaccurate. The manager of a ProjectCo may, for example, want to implement a SPS that will reduce $CWLC_P$ and, thus, increase the ProjectCo's economic rent. However, the manager may prefer not to pursue additional profit if it increases the probability of UP deduction.

It is acknowledged that attitude to risk is a major component of preferences affecting decision-making (Shapira, 1995). According to March and Shapira (1987), managers tend to actively minimise or avoid risk rather than treat it as a trade off for greater profit. March (1999) divides the factors that affect risk taking into three categories. First, the decision-maker predicts the risk of each alternative. These predictions are influenced by the limitations of the human mind. They are also affected by biases, which arise from past experience. According to Shapira (1995), decision makers will attempt to reduce risk by increasing search to improve the quality of information and attempt to substitute for missing information with imagination. In the PFI market, this desire to reduce risk has led ProjectCo actors to pay more attention to the collection of historical cost data.

Second, risk preference is highly context dependent. This is the case especially in the context where the outcome (success or failure) materialises. According to Singh (1986), a decision-maker tends to choose a less risky solution if s/he is close to target performance. If the performance is above target, a more risky solution is likely. This is because with having an above target performance, there is less fear of failure. The risk preference of a decision-maker performing below target is more complicated. In this type of situation a risky solution can be seen as an opportunity to compensate for below target performance. Alternatively, the preference may be to avoid risky solutions, as there is a possibility that performance can fall even further below target. According to Khaneman and Tversky (1979), risk preferences with a close to target performance depend on the situation. Managers take risks to avoid a decrease in performance. However, they do not take risks to improve performance. Considering this, it is possible that the ProjectCo may use more innovative and risky solutions to minimise $CWLC_P$ and, thus $CWLB_P$ in order to become the PB. Once a ProjectCo has become the PB, it might prefer solutions that increase operational certainty rather than decrease $CWLC_P$ since the ProjectCo is, in effect, close to its target performance. The preference of operational certainty will increase the probability that a ProjectCo will make a profit from undertaking the project even if it is acknowledged not to be the maximum possible profit.

Third, the organisation itself affects risk taking. However, this only happens unconsciously. The inability of an organisation to service the decision-maker with trust, information etc. will increase the level of perceived risk involved in the decisions (March, 1999). Thus, the ProjectCo needs to provide the actors involved in SPS development with good quality cost data in order to enable decisions that lead to $CWLC_P$ reductions to be taken.

3.8.4. Decisions Based on Rule Following

The rational approach to decision making has been subject to criticism. This is because it is apparent that a substantial proportion of decisions are made intuitively and not as a result of a reasoning process. In addition, individuals can make decisions that are clearly not in their self-interest. This is an illustration of rule-based decision-making (March and Simon, 1993).

Cyert and March (1992) present rule-based decision-making as a three-stage process. First, the decision-maker identifies a situation where a decision is needed. Second, the decision-maker assesses his/her own identity. Third, the decision-maker determines the appropriate action in line with his/ her identity and the identified situation. March (1999) use the terms *situations*, *identities* and *matching* for these three stages since the process involves matching situations with identities and subsequently acting in accordance with those identities. Thus, rule-based decision-making can be seen as the pursuit of a personal identity rather than a specific goal.

According to March (1999), there are four ways in which rules can develop. First, they can be devised as result of a rational decision-making process (March, 1999). Second, rules can develop through learning from past experience (Huber, 1991). Third, rules can be seen as information that spreads in an organisation and results in their adoption (Sevon, 1996). Fourth, rules can develop through natural selection (Nelson and Winter, 1982).

March (1999) distinguishes the development and implementation of decision rules. This is because the existence of a decision rule does not mean that it will be implemented. Once a rule is developed, it needs to be socialised in order to be implemented. Socialisation can be seen as a process of discovering one’s identity and the appropriate behavioural model, namely a set of rules that goes with it. However, situations arise where several rules apply or the rule that applies is unclear. These situations require interpretation, which links the rules and their implementation (March, 1999).

It must be noted that rule following may be a major obstacle to $CWLC_P$ minimisation. PFI has a relatively short history and, thus, it is likely that the existing decision rules have not had time to fully adapt to suit PFI projects. This may lead the ProjectCo to develop a SPS that is in line with the principles of traditional procurement such as *try to reduce the capital cost of a facility*. It is likely that the new decision rules for SPS development will evolve through competition as suggested by Nelson and Winter (1982). As the implementation of old decision rules ceases to be effective, the ProjectCo will search for and adopt new rules.

3.9. Concluding Remarks

The aim of a ProjectCo is to maximise its profit from undertaking an accommodation service PFI project. This transforms into an incentive to minimise $CWLC_P$ subject to developing a SPS that can be used to deliver and, subsequently, delivering the accommodation service successfully. The ProjectCo can use a range of whole life costing techniques to establish the type of SPS that will enable it to achieve its aim. However, the use of whole life costing is hindered by the absence of PFI-specific good quality cost data. As a result, the ProjectCo needs to take decisions that determine the SPS under considerable uncertainty of the outturn $CWLC_P$. The two main approaches that can be used to explain decision-making in such circumstances are rational choice and rule following. It is likely that the risks inherent in the PFI projects will influence intendedly rational decision-making in SPS development. Rule-based decision-making can be seen as a potential threat to the ProjectCo's ability to achieve its aim as PFI projects require a different set of decision rules from traditional procurement and it is possible that these rules have yet to develop.

PART C - METHODOLOGY DEVELOPMENT

Chapter 4 - Research Methodology

4.1. Introduction

This chapter develops a research methodology to examine the development of accommodation service PFI projects with the focus on the ProjectCo's contract whole life cost ($CWLC_P$). First, the chapter defines the research problem and positions the research in its theoretical context. Second, it discusses the choice of an appropriate research strategy and research methods. Third, the chapter develops a research design, including the research framework, question, focus, data collection and data analysis methods.

4.2. Research Problem

The client's aim in the procurement of an accommodation service PFI project is to obtain the maximum value for money (VFM) project subject to affordability. The client's governance in PFI procurement should ensure that the ProjectCo actors have an incentive to minimise the $CWLC_P$ subject to developing a service provision solution (SPS) that can be used to deliver and, subsequently, delivering the service successfully. Such minimisation will improve the VFM and, thus, the economic efficiency of the project for the client. Thus, the question that needs to be answered is: how can a ProjectCo successfully minimise $CWLC_P$?

The identified gap in knowledge exists due to the relatively short history of the PFI procurement. Only a limited amount of research has been carried out into the practical implementation of projects. This is especially the case with research that takes a private sector viewpoint and, thus examines the development process. Consequently, it is not known how the underlying theory of PFI works in practice.

In order to enable public sector clients to procure PFI projects of improved VFM in the future by enabling effective $CWLC_P$ minimisation, the understating of the problem domain needs to be improved. This leads to the definition of the research aim. *The aim of this research is to generate a detailed understanding of how the economic efficiency of an accommodation service PFI project is determined in its development process through $CWLC_P$ minimisation.*

The research aim can be broken down into three research objectives, which are:

1. to highlight the implemented $CWLC_P$ driven design solutions,
2. to establish how PFI development is different from the development of traditionally procured projects, and
3. to identify the forces in the PFI development process either encouraged or discouraged the implementation of $CWLC_P$ driven design solutions.

The first objective refers to *$CWLC_P$ driven design solutions*, which is a key term in this research. The term is used to emphasise the importance of $CWLC_P$ minimisation for the ProjectCo in order to increase its likelihood of becoming the preferred bidder (PB) and to increase its economic rent from undertaking the project. $CWLC_P$ driven design solutions are the aspects of a design solution of the project-facility that can be attributed to the ProjectCo's desire to minimise $CWLC_P$ and that would not have been incorporated in the design solution if the same building had been procured using traditional methods.

The $CWLC_P$ savings that result from $CWLC_P$ driven design solutions cannot be measured *ex post* in PFI projects. This is because the first projects are only a few years into their operational phases. Thus, this research uses $CWLC_P$ driven design solutions as an alternative method to quantify the ProjectCo's $CWLC_P$ performance.

The identification of $CWLC_P$ driven design solutions will in itself be of value. The argument for the adoption of PFI procurement is largely based on the proposition that it will improve the economic efficiency of pubic sector procurement through the implementation of $CWLC_P$ driven design solutions. Thus, the proposition that is used to justify the use of PFI as a public procurement method will be explored in the course of this research.

The research objectives were structured following a simple logic. The first and second objectives are to establish the outputs and inputs of the PFI development process respectively. The third objective is to understand how the inputs relate to the outputs.

4.3. Theoretical Context

Construction management theory is defined by Wing *et al*. (1998, 99) as "that body of knowledge … which currently is established and accepted as explaining the most effective management of construction projects." However, this is not perceived to be a particularly good definition. According to Weihrich and Koontz (1993, 13), theory is "a systematic grouping of independent concepts and principles that gives a framework to, or ties together, a significant area of knowledge." Weihrich and Koontz (1993, 4) define management as "the process of designing and maintaining an environment in which individuals, working together in groups, efficiently accomplish selected aims."

These quotes can be merged to arrive at the following definition: construction management theory is a systematic grouping of independent concepts and principles that gives a framework to, or ties together, the most effective process of designing and maintaining an environment in which individuals, working together in groups, efficiently accomplish selected aims of construction projects.

Betts and Lansley (1993) reviewed the first ten years of the leading construction management journal. They did this in order to gain an insight into how construction management evolved as a discipline. They found that 70% of the articles in the journal were based on original or nearly original data. This data had been collected for the research reported in the articles. This observation highlights the empirical nature of construction management research.

The focus of this research is on the PFI development process where construction takes place. Considering the compiled definition of construction management theory it can be argued that this research seeks to make a contribution to that theory. Therefore, it follows that this research is construction management research. This is further confirmed by the research having the characteristics of typical construction management research. It tackles an original problem by collecting and analysing empirical data collected solely for the purpose of solving the particular problem (see Sections 4.6 to 4.8).

4.4. Quantitative vs. Qualitative

There has been an extensive debate over the use of research methods in social science research. The two opposing views are those of quantitative and qualitative research methods. This debate has also heated up among construction management researchers (Seymour and Rooke, 1995; Seymour *et al.*, 1997; Rooke *et al.*, 1997; Runeson, 1997; Harriss, 1998; Wing *et al.*, 1998; Seymour *et al.*, 1998; Raftery *et al.*, 1997; Lenard *et al.*, 1997).

The debate on the most appropriate research method in construction management has yet to reach a conclusion. The most refreshing suggestion comes from Wing *et al.* (1998, 99), who state that *"since construction management is a practical subject, we suggest that the choice of approach should be a pragmatic one: the approach that is likely to generate practical solutions should be adopted."*

Quantitative research is characterised by the development of hypotheses that are subsequently tested. The hypotheses are drawn out of a literature review. The data that represents the relationships between certain factors in the research domain to test these hypotheses is gathered using, for example, questionnaires or interviews. Subsequently, typically, statistical analysis is used to produce research findings (Fellows and Liu, 1997; Amaratunga and Baldry, 2001).

Qualitative research is usually used in an exploration of a subject area in which only a limited amount of knowledge exists. Therefore, the nature of qualitative research is often explanatory. The objective is to gather and analyse information from which new knowledge can be inducted. The objects of qualitative research are usually people and their perceptions. The data gathered in qualitative research tends to be complex. This makes a rigorous analysis of data difficult. As a result, the objectivity of such data and its analysis is often questioned. Qualitative research is sometimes referred to as hypothesis generating research. This derives from the fact that qualitative research needs to precede quantitative research (Fellows and Liu, 1997; Amaratunga and Baldry, 2001).

TTF (2000b) and CIC (2000) identified a number of sources from which improved VFM for the client may arise from in PFI projects. This research seeks to advance the knowledge generated by TTF (2000b) and CIC (2000). TTF (2000b) used a methodology that included a questionnaire survey of public sector PFI project managers' perceptions and an analysis of public sector comparator (PSC) projects. CIC (2000) used a questionnaire survey targeting both private and public sector participants in PFI projects and case studies.

TTF (2000b) and CIC (2000) demonstrated that it is possible to draw hypotheses out of a literature review in PFI research and test them using quantitative methods. However, the quantitative research was identified as having a weakness in this particular research domain. It arose from two sources. First, the number of forces in PFI development that could potentially affect $CWLC_P$ that could be drawn out of a literature review was considerable. Second, the total number of signed accommodation service PFI projects at research commencement was around 250 (OGC, 2001). The weakness was that it would not be possible to isolate the effects of individual forces in a total population as small as the total number of projects available. CIC (2000) highlighted this difficulty in its conclusions.

It was perceived the number of accommodation service PFI projects available at research commencement did not make it possible significantly to further the knowledge generated by TTF (2000b) and CIC (2000) using quantitative methods. It was believed that qualitative research was required to improve the understanding of PFI development by identifying the key forces that affected the implementation of $CWLC_P$ driven design solutions out of a large number of potential candidates. It was also felt that there was an opportunity to generate new knowledge by more rigorous qualitative research than had been used by CIC (2000) in its case studies. Consequently, this research uses qualitative methods.

4.5. Research Strategy

The choice to use qualitative research methods should not be confused with the choice of a research strategy. Yin (1994) outlines three research strategies that could be considered for this research. These are experiments, surveys and case studies. Each of these strategies can use either quantitative or qualitative methods or their combination. According to Yin (1994), the choice of an appropriate research strategy depends on the question that the research seeks to answer, the control over the phenomenon studied and whether the phenomenon is historical or contemporary.

According to Yin (1994, 9) the case study strategy has a particular advantage when *"a 'how' or 'why' question is being asked about a contemporary set of events over which the investigator has little or no control."* It appeared that this distinct advantage would materialise in this research domain. This is because the research sought to find out how (which forces in PFI development) the expected $CWLC_P$ was determined and why (were the forces encouraging or discouraging,) particular $CWLC_P$ driven design solutions were implemented. In addition, the researcher could not have control over PFI development or $CWLC_P$. As a result, it was felt that case studies were the most appropriate research strategy.

Case study research has also been subject to considerable criticism. Yin (1994) has identified three sources for this criticism. First, it arises from the potential lack of rigour. The researcher is solely in control of the systematic application of the research methods. Thus, the research quality is a function of the researcher. Second, the value of case studies for generalisation tends to be modest. Third, case studies can be massive documents that are laborious to compile. A vast amount of data is available for each case study. As a result, it is difficult to know what is important and what data needs to be collected.

Carroll and Johnson (1990, 38) characterise case study strategy by stating that *"the primary goal is to understand the case itself; only later might there be efforts to generalise from the case to broader principles."* This quote underlines that the strength of case study research is in understanding, not in generalisation. This research sought to harness this strength of the case study strategy as it was used to increase understanding of PFI development and $CWLC_P$. The criticism that relates to the potential lack of rigour and filtering vast amounts of information on each case study was acknowledged and taken into account in the development of the case study design.

4.6. Case Study Design

Once case studies were chosen as the research strategy, a case study design needed to be developed. According to Yin (1994), the case study design needs to consider the research framework, research question, potential proposition, unit of analysis, linkage of data, and the proposition, and interpretation of findings.

4.6.1. Research Framework

A research framework enables the research clearly to articulate what it aims to achieve and how it aims to achieve it. The framework assembled for this research is illustrated in Figure 4.1. It relates back to the research objectives outlined in Section 4.2. This research sought to highlight the differences in traditional and PFI development

(Objective 2). In addition, it aimed to identify $CWLC_P$ driven design solutions (Objective 1). Subsequently, qualitative analysis was used to establish the relationship of the differences in the development processes and the $CWLC_P$ driven design solutions (Objective 3).

The proportion of the research methodology that was seen to make a contribution to knowledge was highlighted in Figure 4.1. The assessments of the actual PFI development process and the resulting PFI solution are included in the area. This is because it is perceived that these have not been previously subject to as rigorous a research methodology as that developed in this chapter.

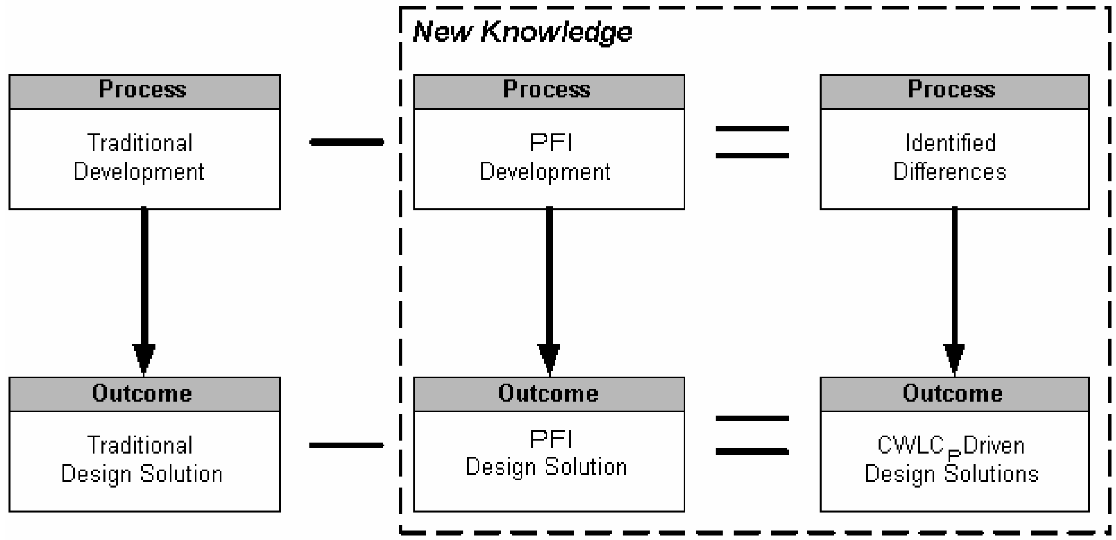

Figure 4.1. Research framework.

4.6.2. Research Question and Proposition

The nature of this research is explanatory. Therefore, three research questions were formulated and used as a proposition. The research questions relate back to the respective research objectives. The desired outcome of this research was to enable the formulation of hypotheses to be tested in future PFI research. The research questions formulated for the use of this research are:

1. What $CWLC_P$ driven design solutions have been implemented in accommodation service PFI projects?
2. How is the development of accommodation service PFI projects different from the development of traditional accommodation service projects?
3. What are the forces in the PFI development that either encourage or discourage the implementation of $CWLC_P$ driven design solutions?

The existing literature gave some idea of how PFI development might be different and what the forces that affected the implementation of $CWLC_P$ driven design solutions might be. Thus, the second and the third research questions were broken down into sub-questions. The sub-questions also serve as propositions in this research as it is proposed that these aspects of PFI development might be different and that these forces may have had an effect. The sub-questions are:

- Did the PFI development differ, and if so how, from traditional development in terms of roles and tasks (content and sequence) undertaken by the private sector actors?
- Was the implementation of $CWLC_P$ driven design solutions in any way, and if so how, affected by:
    - issues arising from the client's procurement process, the public sector or external factors,
    - contractual issues between the client and the ProjectCo,
    - issues internal to the ProjectCo, and/or
    - issues affecting $CWLC_P$ decision-making?

4.6.3. Case Study Boundaries

This research focused on accommodation service PFI projects that required a newly built project-facility. The ProjectCo uses this building in its service provision over the duration of the design, build, finance and operate (DBFO) contract. The research focused on projects with newly built facilities because such projects give the ProjectCo more scope to implement $CWLC_P$ driven design solutions. In refurbishment projects, The ProjectCo's opportunities to implement such solutions may be limited by the existing facility.

The research chose the timeframe to be studied as from the Expression of Interest (EoI) notice in the Official Journal of European Communities (OJEC) to the commissioning of the facility. Thus, the timeframe begins as the ProjectCo becomes aware of the PFI project and it ends when the construction is completed and the operational phase commences. As the research questions imply, this research focused on PFI development and its effects on the design of the project-facility. The design and the operation of a building are determined by the core public service, such as education, that is provided in the accommodation. It must be noted that the operational solution used in the project-facility is also influenced by its design solution. The rationale to focus on the chosen timeframe was that the $CWLC_P$ is to a large extent determined by the design solution of the facility, which is determined in the timeframe. Once the project-facility has been commissioned, the ProjectCo takes subsequent decisions on the operation of the building. These decisions also affect the $CWLC_P$, but not as much as the decisions on the design solution. Thus, these decisions were excluded from the scope of this research.

This research considered two alternative units of analysis. These were $CWLC_P$ in PFI development in relation to a project and in relation to a ProjectCo actors' practice. The development process used by a ProjectCo actor was seen to vary according to the particular project being undertaken. Thus, PFI development and its effects on the implementation of $CWLC_P$ driven design solutions in a project were chosen as the unit of analysis.

The focus on the effects of PFI development on the complete design of a building was not seen as feasible within the case study projects. This was due to the limited resources available for the research. Thus, the research focuses on $CWLC_P$ driven design solutions in one particular aspect of building design. It was anticipated that the forces in PFI development that affected one particular aspect of design would affect all aspects of building design.

The chosen focus was the effects of PFI development on the implementation of $CWLC_P$ driven design solutions in heating and ventilation (HV) design solution. There were five reasons for this particular focus. First, the capital and subsequent operational costs (soft and hard FM) of HV equipment will represent a significant proportion of $CWLC_P$ in accommodation service PFI projects.

Second, the internal environmental condition requirements of a building are defined in the output specification (OS). The specification may state, for instance, that the office space temperature may not be below 19°C nor exceed 26°C. Thus, the output-based HV requirements are clear and simple and give the ProjectCo the opportunity to adopt its chosen technical solution.

Third, the $CWLC_P$ of HV provision is largely dependent on the design solution and the equipment used. This makes it possible for technological development to present the ProjectCo with opportunities to implement $CWLC_P$ driven design solutions by innovative design. In 2002, a design that uses solar heating extensively would be seen as an example of harnessing technological advancement.

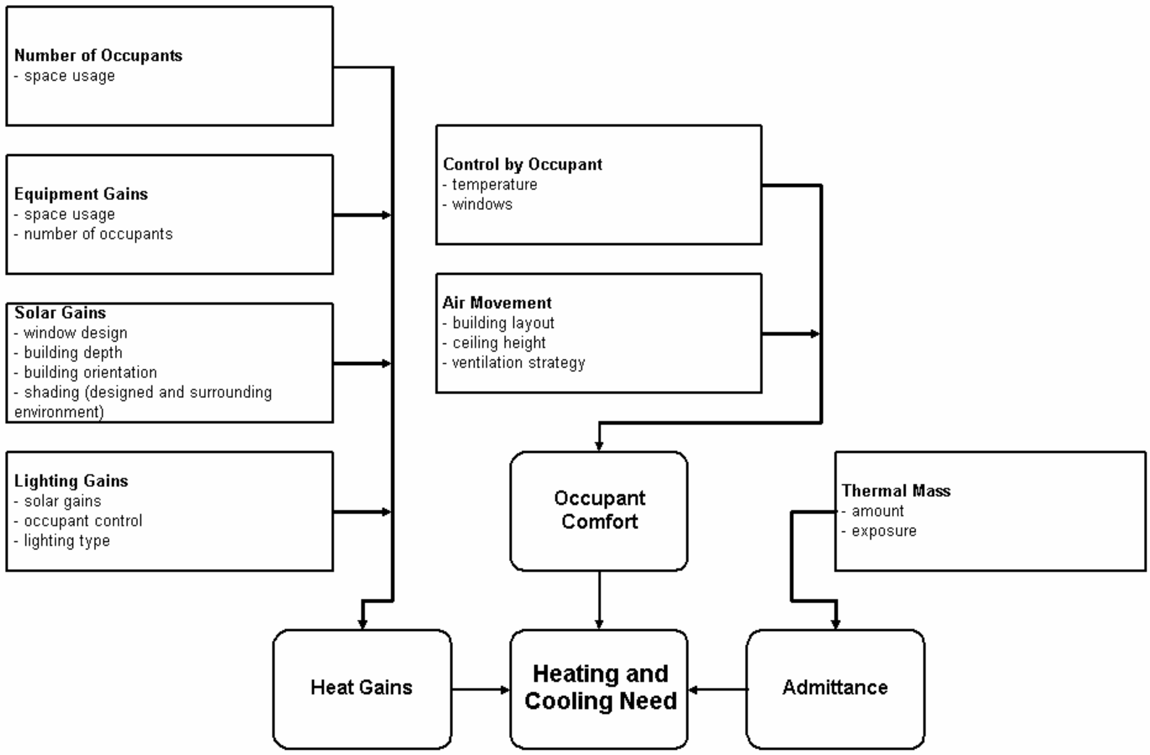

Figure 4.2. Factors affecting the need for heating and cooling provision (adapted from Building Research Establishment Conservation Support Unit, 1995).

Fourth, HV provision is a separate management entity. A building services designer that has specialist HV expertise designs the solution. In addition, HV contractors are an acknowledged professional segment within the construction industry. However, despite being a separate management entity, the required level of heating and cooling provision is influenced by factors outside the specialist designer's control. These factors are illustrated in Figure 4.2.

Fifth, the traditional procurement process is fragmented and sequential. The HV design by the building services designer takes place at the latter stages of design development. At this time, the majority of decisions affecting the range of possible solutions for heating and cooling provision are already made. The architect may, for example, take decisions on the design that affect the HV solution without consulting the building services designer. The roles integration and thereby the removal of some obstacles from interaction in PFI development gives all actors increased influence over the decisions of other actors. As a result, it was felt that PFI procurement would have a particularly high impact on the HV solution implemented.

4.6.4. Case Study Selection

The number of case studies was a key consideration in research design. The use of two case studies was justified using some of the arguments that are commonly used to justify single case study research:

- the primary purpose of this research is to clarify the future research agenda on PFI,
- the methodology used was to be extremely rigorous, which would make the nature of the research revelatory,
- the selected case studies would be large and complex projects (Yin, 1994), and
- the use of two case studies as opposed to just one would allow the possibility of misinterpretation of the research findings to be reduced.

CIC (2000) divides the PFI market into the following segments: accommodation (non-housing), education, healthcare, custodial, housing, transport and utilities. It must be noted that IT projects are not part of this segmentation. By default, the focus on accommodation service projects excluded transport and utilities segments from further analysis. In addition, the custodial PFI projects include the core service provision within their scope and, thus, the custodial segment does not include any accommodation service projects. This leaves four market segments.

This research focused on office-like and non-office-like space. The reason for focusing on office-like space was that it has relatively simple heating and cooling needs in comparison to other types of spaces such as research laboratories in university buildings. In addition, the range of possible HV solutions for office-like space with varying $CWLC_P$ performance is considerable. In the climate conditions of the UK, the cooling of office-like space can be arranged using solutions based on: mechanical cooling, mechanical ventilation, and/or natural ventilation.

The focus on office-like space did not mean that the research focused on office accommodation. If a building has some office-like space, it could be used as a case study. A component of office-like space was required of the case study project-facilities in order to achieve comparability across cases. Of the remaining four PFI market segments, housing was unlikely to contain projects with office-like space. Thus, the housing segment was excluded from further analysis. At first, it appeared that the healthcare segment could also be excluded. However, a healthcare building could be a teaching hospital. Such buildings could contain a proportion of office space to accommodate academic staff. In addition, the outpatient areas in hospitals could be seen as office-like space due to their highly similar heating and cooling needs.

In each case study project, the research also focused on the HV design solution of a non-office-like space. This is because office-space space was seen to be one of the least critical spaces in terms of environmental condition control. Therefore, a sole focus on office-like space would not have given a holistic view of the implementation of $CWLC_P$ driven design solutions. It was anticipated that heavy unitary payment (UP) deductions for not meeting the minimum required environmental conditions in critical spaces might affect the implementation of $CWLC_P$ driven design solutions. Operating theatres in hospitals are an example of this type of space.

The case study projects could be selected from the same or different market segments. The benefit of focusing on just one market segment would have been that the findings could have had more depth. However, the disadvantage was that the findings would be valid for that market segment only. If the case study projects were chosen from two different market segments, the findings could be seen as representative of a wider range of PFI projects. To achieve the maximum generalisation of the research results, the case studies were chosen to represent the two different market segments of education and healthcare.

The projects chosen as case studies were 'live projects'. However, a choice needed to be made on the phase that the case study projects would be in. The research focused on the effects of PFI development between the EoI notice and the commencement of the operational phase on the HV design solution. Therefore, the case study projects needed to be at least in the latter stages of construction, where the HV design solution had been mostly completed, but not necessarily installed.

In the selection of the case study projects, it was decided that the primary ProjectCo actors should have *ex ante* or *ex post* PFI experience to the case study project. This was because participation in PFI projects requires a considerable amount of knowledge. It was perceived that prior or subsequent experience of the primary ProjectCo actors would enable this research to capture a more analytical account of what affected the implementation of a particular HV design solution.

The OGC (2001) list of signed projects was scrutinised for suitable case studies in accordance with the criteria set out in this section. A number of suitable projects were identified. The public sector project managers of the projects were contacted to discuss the possibility of using them as case studies. Subsequently, the use of the following as case studies was agreed:

- King's College London (KCL) Site Rationalisation, and
- University College London Hospitals (UCLH) NHS Trust Gower Street Redevelopment.

The case study research on the KCL was carried out before the research on the UCLH project. This was because the KCL project was less complex and already in its operational phase. The fact that the UCLH project was in its construction phase guaranteed that the research findings relate to the most contemporary practice in PFI development.

4.7. Data Collection

The financial stakes in PFI projects are considerable. As a result, commercial sensitivity was a major issue in the selection of data collection methods. Two data collection methods suitable for this type of research were considered and rejected.

The first data collection method rejected was participant observation. It was unlikely that a researcher would have been able to gain any control over the process studied. In order to use participant observation to pursue the aim of this research, the researcher would have needed to be in a position to have an input in PFI development before the research started.

The second data collection method rejected was pure observation. The method was rejected due to the perceived commercial sensitivity of the $CWLC_P$ driven design solutions and especially the cost data relating to them. There are two reasons for this sensitivity. First, the PFI market is competitive. It was felt that the ProjectCos would have been unwilling to reveal information to the researcher that, if leaked, would have reduced their competitiveness in the market. Second, it was felt that the ProjectCo might have wanted to conceal information from the client and the general public. This was due to the common perception that the ProjectCo should not make too much profit from the provision of a service that has traditionally been provided by the public sector.

The rejection of both participant observation and pure observation led to the decision to use self-reporting as a main source of data in the case studies. The self-reports were obtained as interviews. Other data sources were used to confirm or reject the information revealed or not revealed in the self-reports.

According to Carroll and Johnson (1990), self-reports are good in generating understanding of decisions taken. This is especially the case if they are used as the one data collection method of a case study. The need to use other data collection methods in combination with self-reports arises from remembering, reconstruction and rationalising. *Remembering* relates to the inability or unwillingness of the interviewee to recollect events accurately. *Reconstructing* is a process where, instead of recalling an event, it is reconstructed from remembered fragments using general knowledge. *Rationalising* is a phenomenon where the interviewee tells the interviewer what s/he thinks that the interviewer wants to hear.

4.7.1. Interviews

The main actors in a PFI project are the public sector client and the ProjectCo. The client does not normally have a role that enables it to take decisions on the HV design solution. Instead, it guides the design development by structuring the procurement process and by issuing documentation. The representatives of both KCL and UCLH were interviewed as part of the research. However, the interviews explored the procurement of the case study projects in general, as opposed to $CWLC_P$ minimisation in their development in specific.

The ProjectCo actors that had roles relevant to HV design were interviewed in both case study projects. Unstructured one-to-one interviews were used as the principal data collection method. However, one of the interviews was carried out one-to-two due to the constraints on the time of the interviewees. The use of unstructured interviews was chosen simultaneously with one of the interview data analysis methods – see Section 4.8.4. Unstructured interviews were used because the forces that affected the implementation of $CWLC_P$ driven design solutions in PFI development were not known with great confidence. It was felt that the content of the questions in structured or semi-structured interviews would have affected the importance the interviewees attached to the influence of a specific force on $CWLC_P$.

Nine individual ProjectCo actors were interviewed on the KCL project and 16 on the UCLH project. The interviews explored the forces in PFI development that affected the implementation of $CWLC_P$ driven design solutions. The average length of an interview was around 1 hour 45 minutes with the shortest interview around 45 minutes and the longest around 2 hours 15 minutes. A tape recording was made of each of the interviews.

At the time of commencing the interviews on the UCLH project, the data analysis method had developed further. As a result, sixteen secondary interviews were carried out. Thirteen of the interviews were done in person and three via telephone. The secondary interviews lasted from 5 to 30 minutes. They confirmed that the comments extracted from the initial interviews were representative of the issues that the interviewees thought relevant to implementation of $CWLC_P$ driven design solutions. Some of the interviewees requested slight changes to be made to the wording of the comments extracted.

4.7.2. Documentation

The documentation in PFI projects can be classified into client and ProjectCo issued documentation. The client issued documentation includes the Outline Business Case (OBC), Invitation to Negotiate Documentation (ITND), Full Business Case (FBC), the DBFO contract etc. It was anticipated that once working relationships with the clients of a case study project had been established, it would be possible to gain access to some of the client issued documentation.

The ProjectCo issued documentation includes design solutions, construction specifications, operational method statements (OMSs), contracts between ProjectCo actors etc. It was anticipated that commercial sensitivity would be a major issue in obtaining access to the ProjectCo issued documentation. As a result, it was decided that access to the documentation would not be aggressively sought.

In designing the case study research, it could not be assumed that access to any of the client or ProjectCo issued documentation could be obtained. At the time, it was acknowledged that there were likely to be categories of data that would be impossible to obtain, namely cost data. The only cost data that was anticipated to be potentially available was in the PSC projects. However, it was acknowledged that the PSC projects might not necessarily exist or they might not contain a great level of detail. This had been encountered by, for example, TTF (2000b), NAO (1997) and NAO (1998) in their research. Thus, the research could not be designed to be reliant on the cost data in the PSC projects.

In addition, it was acknowledged that the cost data in ProjectCo issued documentation would be seen as a source of competitive advantage. This was due to the non-existence of good cost data in the public domain. Thus, it was unlikely that it would be possible to obtain $CWLC_P$ estimates. It was felt that it might be possible to obtain capital cost estimates of actual outturn construction costs. However, this information would have been of modest value without any quantification of $CWLC_P$.

As a result, instead of relying on actual or estimated cost data from the public or private sectors, the research was designed to be independent of cost data. CIC (2000) and TTF (2000b) had used a subjective quantification of $CWLC_P$ due to poor access and/or quality of cost data. This method was seen not to add value in this research. Instead, it was decided that indirect measurement of $CWLC_P$ performance would be used. The aspect to be measured was the HV design solution and its deviation from the non-PFI best practice design solution that could be attributed to the desire to achieve $CWLC_P$ savings. It was perceived that the information on the implemented HV design solutions would be readily available. This was because they would be exposed to the general public once the project-facilities had been completed.

In the end, on the KCL project limited access and on the UCLH project full access to client issued documentation was secured. In addition, on the UCLH project the construction specification was obtained on building services works at a stage where it was just about to go to construction. The corresponding specification on the KCL project was sought. However, the only specification that could be obtained was the one that had been produced by the ProjectCo and appended to the design, build and operate

(DBO) contract. It must be noted that it could not have been known at the stage of case study design that access to this documentation would be gained.

4.7.3. Expert Assessment

An expert assessment was used to obtain data to achieve the first research objective. The objective was to highlight $CWLC_P$ driven design solutions implemented. It was felt that due to danger of *rationalising* the existence of $CWLC_P$ driven design solutions identified based on the self-reports required validation. The expert assessment is described in detail as part of the solution analysis – see Section 4.8.1.

4.8. Data Analysis

Tesch (1991) outlines three approaches to analysing qualitative data. These are language based analysis, descriptive or interpretive analysis, and theory building. The language based analysis looks at how language is used in the source data. It also focuses on the meaning that is attached to the use of language. Descriptive or interpretive analysis seeks to formulate a holistic view of the process being studied. This is done from the viewpoint of the people involved in the process. Theory building, as the term indicates, an attempt to develop a theory based on the collected data. This research chose to use the descriptive or interpretative approach to analyse the interview data, as its main purpose was to clarify the future research agenda on PFI.

An analysis framework was compiled for this research. It was to include solution, opportunity, incentive and perception analyses. The solution analysis (SA) was developed to obtain the first research objective. The first stage of the opportunity analysis (OA) was structured to achieve the second research objective. The second stage of the OA and the incentive analysis (IA) and the perception analysis (PA) were devised to attain the third research objective. Together, these four analyses were designed to enable the aim of this research to be realised.

4.8.1. Solution Analysis

The aim of the solution analysis was to identify the $CWLC_P$ driven design solutions that had been implemented in the project-facilities. The data used in the analysis was interviews, public and private sector issued documentation, and expert assessments. Each of the interviewees had been asked to identify the departures in the HV design solutions of the project-facilities that were expected to yield $CWLC_P$ savings. The solutions that the interviewees highlighted were initially labelled as $CWLC_P$ driven design solutions. However, it appeared that a new definition was needed. This was because some of the solutions were implemented mainly for reasons other than $CWLC_P$ minimisation, but would not have been part of the HV solution if the projects had been traditionally procured. Such solutions were defined as *$CWLC_P$ reducing design solutions*.

Subsequently, in order to validate the findings arising from the interview data, the case study projects and their HV design solutions were described to an acknowledged HV design expert. The expert was also provided with the construction specifications of the HV design solutions. The specification on the KCL project was the one appended to the DBO contract and on the UCLH project the one that had been produced just prior to proceeding to installation on site. First, the expert was asked to identify how the HV design solutions varied from those that would have been implemented if the projects had been traditionally procured. Second, the expert was probed to speculate on the reasons for those variations. Third, he was asked if any of the variations would result in $CWLC_P$ savings. Fourth, the expert was asked whether the $CWLC_P$ driven and reducing design solutions that had been identified based on the self-reports but not picked up by the expert would lead to $CWLC_P$ savings. It must be noted that due to the specification used in the assessment of the HV solution in the KCL project, the expert could not have identified the $CWLC_P$ driven or reducing design solutions implemented in detail design development. However, not a single $CWLC_P$ driven or reducing design solution had been identified as having been incorporated in the HV design solution in detail design development based on the self-reports.

4.8.2. Opportunity Analysis

The aim of the opportunity analysis was to uncover the opportunities that the ProjectCo actors had at the various stages of the PFI project to influence the SPS development and, thus, to implement $CWLC_P$ driven design solutions. The analysis was based on the interview data and public sector issued documentation. The opportunity analysis was divided into two stages.

The aim of the first stage was to achieve the second research objective. First, the development processes were captured into simplified process protocol maps. The more complicated mapping technique had been developed by Aouad *et al.* (1998) and subsequently simplified by Winch and Carr (2001).

The simplified process protocol maps of the development processes were compiled based on the Winch and Carr (2001) technique. The only exception was that instead of a standard set of actors the key ProjectCo actors that had a role in influencing the design solution were mapped on the vertical axis. The horizontal axis was based on the phases of the project development process in accordance with the Royal Institute of British Architects (RIBA) (1983) plan of work. The rectangles within the maps were used to represent sub-processes of the project development process. The diamonds within the map were used to signal events in project development. The horizontal lines within the map were used to show flows of information and materials between the sub-processes. The vertical lines on the grid lines were used to indicate flows of information and materials between key actors. The dashed vertical lines between the grid lines were used to highlight a joint sub-process of two or more key actors. The compiled simplified process protocol maps are attached as Appendix I and Appendix V.

A more detailed description of the project development processes was compiled using actor-role matrixes like the ones used by Gruneberg and Ive (2000). The additional role of an operator had to be added to the matrixes. This was because Gruneberg and Ive (2000) had used the matrixes to represent traditional procurement. The matrixes were broken into four parts according to the stages of PFI procurement – see Figure 2.2. A matrix was compiled for each of the key ProjectCo actors. The matrixes were designed to have two columns. The first column represented PFI accommodation service provision and the second a hypothetical traditional accommodation service provision. This enabled the differences between PFI and traditional development processes to be clearly identified and, thus, the second research objective to be achieved. The actors-role matrixes are attached as Appendix II and Appendix VI.

The second stage of the OA sought to identify the ProjectCo actors' opportunities to implement $CWLC_P$ driven design solutions and compare them with the opportunities the private sector actors would have had in a hypothetical traditional development process. These analyses are presented in the OA boxes embedded in Chapters 5 and 6.

4.8.3. Incentive Analysis

The aim of the IA was to identify the incentives that the ProjectCo actors had to implement $CWLC_P$ driven design solutions in the PFI development process. The analysis was based on the interview data and public sector issued documentation. First, the organisational structures of the key ProjectCo actors at different stages of the development processes were drawn. These organisational structures are embedded as figures in Chapters 5 and 6. Subsequently, the ProjectCo actors' incentives to minimise $CWLC_P$ in the development process were identified and contrasted with the incentives that the private sector actors would have had in a hypothetical traditional development process. These analyses are presented in the IA boxes embedded in Chapters 5 and 6.

4.8.4. Perception Analysis

The aim of the PA was to reveal what, in the perceptions (whether rational or irrational) of individual ProjectCo actors, affected the implementation of $CWLC_P$ driven design solutions. This was because the decisions taken to implement such solutions are based on individual perceptions or collections of individual perceptions of PFI development. Studying individual perceptions would generate understanding of the forces in the process that encouraged or discouraged $CWLC_P$ minimisation. The need to study individual perceptions and the existence of a purpose built qualitative data analysis software contributed to the decision to explore the use of cognitive mapping as a data analysis technique.

The development of cognitive mapping out of Kelly's (1955) Personal Construct Theory is usually credited to Eden *et al.* (1979), Eden *et al.* (1983) and Eden (1988). Cognitive mapping is a technique used to create a model of a personal construct system. This model is a cognitive map, which is a representation a person's understanding of a specific problem. According to Eden and Ackerman (1998), cognitive maps capture the values, beliefs and assumptions of an individual in and of the problem domain. The perception of the problem is affected by past experience, expertise gained from other projects, organisational knowledge, human capability etc.

Cognitive mapping involves the researcher and the interviewee drawing the interviewee's perceptions of the problem domain. However, it was felt that this approach was not appropriate for this research. This was because it was perceived to be difficult to have the interviewees commit to this time consuming exercise. Eden and Ackerman (1998) have used the technique mostly in contract research. It is assumed that in such a setting securing the commitment of the interviewees is less of a problem. Thus, it was decided that the mapping would be done based on the tape recordings of the interviews.

Initially, cognitive maps were constructed using the purpose-built software, viz. Decision Explorer. However, it was felt that the in-built analyses of the software did not unlock the forces of the PFI development process that either encouraged or discouraged the implementation of $CWLC_P$ driven design solutions. As a result, it was decided that the interview data would be analysed manually following the principles of cluster analysis, which was one of the in-built analyses. As the theoretical principles of cognitive mapping were no longer strictly adhered to, the technique used to analyse the data was defined as *storyline mapping.*

First, comments that described the problem domain were extracted from each interview. Second, these comments were classified and colour coded as illustrated in Figure 4.3.

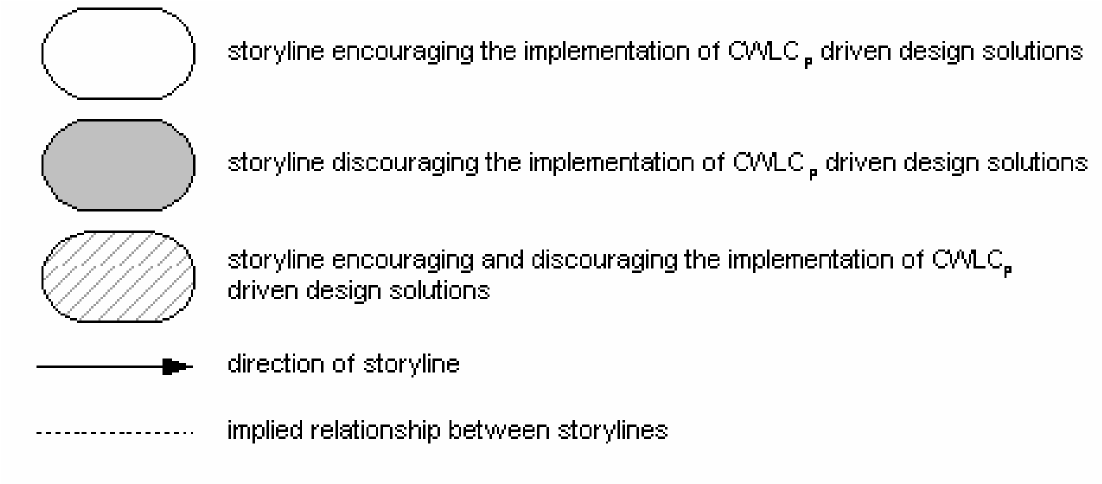

Figure 4.3. Key to storyline maps.

A comment was classified as encouraging if it described:

- an incentive to implement $CWLC_P$ driven design solutions, or
- an opportunity to implement $CWLC_P$ driven design solutions.

A comment was classified as discouraging if it described:

- an alternative incentive to that of implementing $CWLC_P$ driven design solutions, or
- a constraint in the initial opportunity to implement $CWLC_P$ driven design solutions.

A comment was classified as encouraging and discouraging if it described:

- both an incentive to implement CWLCP driven design solutions and an alternative incentive,
- both an opportunity to implement CWLCP driven design solutions and a constraint on that opportunity, or
- an incentive or an opportunity to implement CWLCP driven design solutions dependent on other project actors.

Third, each storyline map was divided into four clusters in accordance with the research sub-questions as illustrated in Figure 4.4 and the comments extracted were allocated into these clusters.

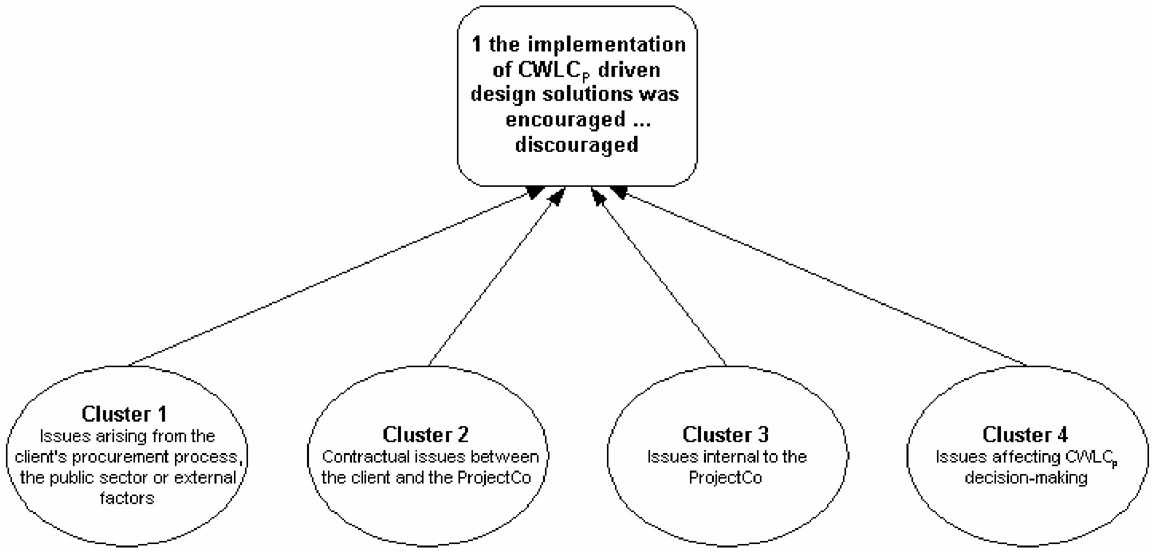

Figure 4.4. The clusters of a storyline map.

As a result, each cluster contained a number of comments. These comments were organised into columns and connected with arrows (see Figure 4.3.) to make up a storyline arising from the interview. The columns were designed to be read from bottom to top, as indicated by the arrows. If two comments in separate storylines were implied as connected, a link (see Figure 4.3.) was drawn between the comments. The storyline maps are attached as Appendix III and Appendix VII.

The content of the storyline maps was summarised in the PA boxes that are embedded in Chapters 5 and 6. The links between the PA boxes and the storyline maps were detailed in matrixes. These matrixes are attached as Appendix IV and Appendix VIII.

It was acknowledged that storyline mapping would include a considerable element of subjectivity. As a result, every attempt was made to be as rigorous and systematic as possible in compiling the maps.

4.9. Concluding Remarks

The aim of this research is *to generate a detailed understanding of how the economic efficiency of an accommodation service PFI project is determined in its development process through CWLC$_P$ minimisation.* The aim was devised to enable public sector clients to procure improved VFM accommodation service PFI projects in the future through enhanced understanding of the ProjectCo actors' behaviour in PFI development.

Due to the limited amount of research in the problem domain and the large number of forces in PFI development potentially affecting the implementation of CWLC$_P$ driven design solutions, the research methodology developed used predominantly qualitative data collection and analysis methods. As a result, the research will mainly serve to inform the future research agenda on PFI.

The chosen research design was that of two case studies. The case studies focused on the effects of PFI development on the HV design solutions in the project-facilities. It was anticipated that the features that affected this particular design aspect affected all those of building design in accommodation service PFI projects.

The main source of data for the case studies was self-reports obtained as interviews. However, additional data as public and private sector issued documentation and expert assessments was obtained. The data was subjected to incentive, opportunity, perception and solutions analyses. These analyses enabled the aim of this research to be realised.

PART D - CASE STUDIES

Chapter 5 - KCL Site Rationalisation Project

5.1. Introduction

This chapter presents the King's College London (KCL) Site Rationalisation project. It focuses specifically on the New Hunt's House redevelopment. The analysis of the project development has four focus areas. First, the chapter identifies the ProjectCo's *incentives* to implement contract whole life cost ($CWLC_P$) driven design solutions in the development process. Second, it examines the ProjectCo's *opportunities* to implement such solutions. Third, the chapter highlights the forces in the development process that in the *perceptions* of the ProjectCo actors either encouraged or discouraged the implementation of $CWLC_P$ driven design solutions. Fourth, it identifies the $CWLC_P$ driven design solution incorporated in the heating and ventilation (HV) design solution of New Hunt's House.

This chapter includes incentive analysis (IA), opportunity analysis (OA), perception analysis (PA) and solution analysis (SA) boxes. The analysis boxes describe the conclusions drawn from the project development process. A simplified process protocol map of the project development process is attached as Appendix I. Actor-role matrixes that highlight the differences between traditional and PFI development processes are attached as Appendix II. The simplified process protocol map and the actor-role matrixes are source material for the incentive and opportunity analyses. Storyline maps that detail the perceptions of individual ProjectCo actors are attached as Appendix III. The links between the PA boxes and the storyline maps are provided in Appendix IV. See section 4.8 for guidance to reading the appendices.

5.2. Background

5.2.1. Introduction of KCL

KCL was established in 1829. Subsequently, in 1836, it became one of the founding colleges of University of London (UoL). In 2002, KCL is the second largest member institution of UoL with around 16,200 students. Originally, KCL established itself on the Strand Campus (see location A in Figure 5.1) in the London Borough of Westminster. The Strand Campus remains its principle location. However, in 2002, KCL also operated out of several other campuses. Its other main campuses are all located within the proximity of the Strand Campus. These campuses are Waterloo, Guy's, St Tomas' and Denmark Hill – see locations E, C, F, and I respectively in Figure 5.1.

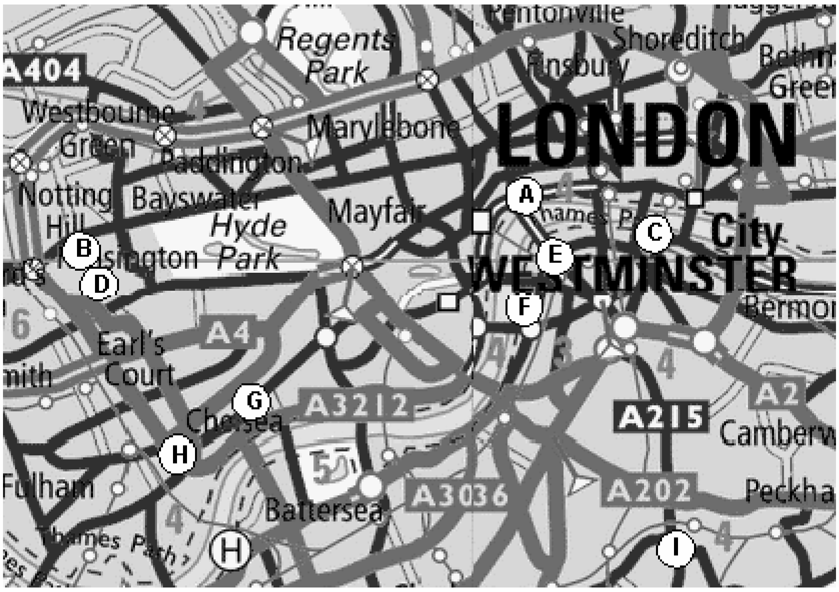

Figure 5.1. KCL's major campuses and other key locations in West and Central London.

5.2.2. History of the Site Rationalisation Project

In 1985, KCL merged with Queen Elizabeth College and Chelsea College. The two universities were both part of UoL. Subsequently, KCL rationalised its overlapping operations that resulted from the merger in order to improve its efficiency. However, the merger left KCL's with dispersed accommodation. KCL obtained accommodation on four sites (see locations B, D, G and H in Figure 5.1) in the Royal Borough of Kensington and Chelsea. After the rationalisation of its operations, KCL continued to occupy three of the sites with one remaining vacant.

The merger placed KCL at a disadvantage with its main competitors in the London higher education market. This was because the other large UoL universities were occupying more integrated accommodation. KCL felt that it could significantly improve the efficiency of its operations and, thus, its competitiveness, if it consolidated all of its accommodation within the proximity of the Strand Campus.

Accordingly, KCL began to pursue a Site Rationalisation project. In the late eighties, it acquired a mostly unoccupied building on the Waterloo Campus. The building, known at the time as Cornwall House, was a listed warehouse that had previously been HM Stationary Office. KCL intended to convert Cornwall House for educational and research purposes. The conversion, combined with rationalising the use of its other accommodation, would enable KCL to transfer its operations from West London into its main campuses. Thus, the Site Rationalisation project would make the three occupied sites surplus to KCL's requirements. Therefore, hereafter, the four sites in the Royal Borough of Kensington and Chelsea are referred to as the *surplus sites*.

However, in the early nineties, a downturn in the London property market prevented the Site Rationalisation project from going forward. This was because KCL had to finance the Cornwall House conversion by receipts from the sale and pre-sales of the surplus sites. KCL was only willing to proceed with the Site Rationalisation project if it could secure the disposal of the surplus sites at a price that reflected its valuation. The depressed property prices did not allow this to happen.

In the early nineties, KCL and the United Medical Dental Schools of Guy's and St Thomas' Hospitals (UMDS) opened discussions on a merger. UMDS was a UoL member institution. The Tomlinson Review on healthcare provision in London, published in 1992, supported the merger. Tomlinson (1992) argued that medical education in London would be more efficient if KCL and UMDS combined their overlapping operations. The review anticipated that KCL and UMDS could achieve particularly significant efficiency savings in rationalising the use of their accommodation. Consequently, Tomlinson (1992) recommended that the Higher Education Funding Council for England (HEFCE) and the NHS should give financial support for the merger.

In late 1992, the two universities agreed to merge. However, it must be noted that the merger did not take place officially until August 1998 because an enabling piece of legislation, the King's College London Act 1997, had to be passed before the merger could take place.

Towards the mid nineties, the London property market began to recover. KCL anticipated that it could obtain an acceptable price for the sale and pre-sales of the surplus sites. KCL intended to use the receipts to finance part of the Site Rationalisation project. Thus, prompted by the recovering property market and the potentially available grant finance from the Central Government, KCL began to work on a more detailed proposal of the Site Rationalisation project.

5.3. Procurement Preparation Stage

5.3.1. Making the Case for Procurement

In the mid nineties, KCL began to assemble an Outline Business Case (OBC) for the Site Rationalisation project. The initial project proposal outlined three distinct construction tasks. First, Cornwall House on the Waterloo Campus was to be converted into 44,000 m^2 of educational and research accommodation for Life and Health Sciences. Second, Hunt's House (see location N in Figure 5.2.) on Guy's Campus in the

London Borough of Southwark was to be demolished and redeveloped. New Hunt's House was to include 20,000 m^2 of educational and research accommodation for Basic Medical Sciences. Third, three small and somewhat run-down buildings (see locations J, K and M in Figure 5.2.) on Guy's Campus were to be refurbished. This case study will hereafter focus on New Hunt's House. This is because it is the only newly built facility in the Site Rationalisation project.

Hunt's House was an old Victorian Building in a fairly bad state of repair. It was unsuitable for modern educational and research activities. In addition, the building was beyond an economic refurbishment to meet KCL's requirements. However, Hunt's House was ideally located on Great Maze Pond for Basic Medical Sciences education and research as it was across the road from Guy's Hospital (see location L in Figure 5.2), which is one of the major hospitals in London. KCL was to transfer its operations from Hunt's House to St Thomas' Campus and, thus, vacate the building as part of the Site Rationalisation project. This relocation was to enable Hunt's House to be demolished and redeveloped as New Hunt's House.

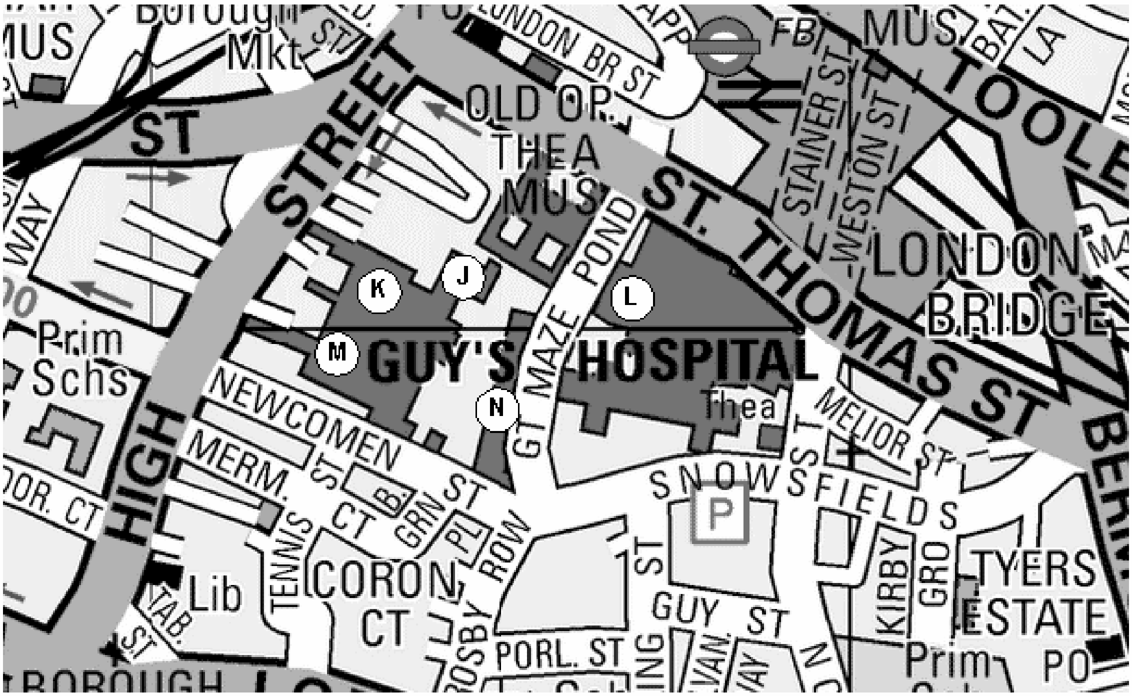

Figure 5.2. Key locations on Guy's Campus.

In May 1995, KCL submitted grant finance applications to HEFCE and the NHS. In July 1995, the two public sector bodies approved KCL's OBC for the Site Rationalisation project and agreed to finance part of it. KCL obtained additional finance for the project from the special trustees of St Thomas' and Guy's hospitals. In total, KCL obtained around £45 million of grant finance for the project. However, KCL was to use the grant finance specifically to integrate the KCL’s and UMDS’ accommodation. Therefore, KCL needed to raise additional finance to relocate from West London. KCL would raise some of this finance from the surplus site disposal.

5.3.2. Procurement Preparation

The financial support of HEFCE and the NHS was conditional upon testing the suitability of the project for PFI procurement. At the time, the prevailing practice was to carry out PFI testing in the market. As a result, KCL reconfigured the project. KCL chose to abandon traditional procurement altogether. Instead, it decided to invite private sector actors to bid for the Site Rationalisation project either as a design, build, finance and operate (DBFO) project or, alternatively, as a design and build (DB) project. KCL preferred to procure a DBFO project as it appeared more suitable for its needs. KCL wanted especially to secure a guaranteed minimum price for the surplus sites. The DBFO project would allow KCL to allocate the property risk and the risk of being able to vacate three of the surplus sites on schedule to a ProjectCo. In addition, the DBFO project would enable KCL to have a single point of contact in the private sector for the entire Site Rationalisation project.

KCL appointed a number of advisers to assist it in procuring the Site Rationalisation project. Namely, it appointed a project management consultant, a financial adviser, an architect, a building service designer and a cost consultant. KCL placed the project management consultant in charge of managing its procurement.

Initially KCL and its procurement team interfaced with the future users of the new accommodation in order to define their needs. This enabled KCL to establish the functional requirements (quality) and the quantity for the accommodation service it needed to procure. It placed a great emphasis on the flexibility of the facilities. This was because it felt that the methods of education and research were likely to change and, as a result, the buildings were likely to require alterations in the future.

KCL’s architect produced an architectural design solution for New Hunt’s House. Hereafter, this design solution is referred to as the *reference design*. The architect developed the reference design only until concept design stage. This was because KCL was to procure the project using either DB or DBFO, as opposed to traditional, procurement and, therefore, the private sector was to take the responsibility for producing the more detailed design solutions. KCL applied for an outline planning permission for New Hunt’s House from Southwark Planning based on the reference design.

Subsequently, KCL began to work on a Public Sector Comparator (PSC) project. KCL used the reference design as a basis for the PSC project. KC produced capital and operational cost estimates for the PSC project. The capital cost estimate was based on the historical capital costs of higher education buildings and the operational cost estimate on the operational costs of KCL's existing facilities. In addition, KCL priced the risks it intended to allocate to a ProjectCo in the DBFO project.

KCL worked to assemble the Invitation to Negotiate Documentation (ITND) for the project. KCL intended, once completed, the ITND to include information on:

- the strategic context of KCL's Site Rationalisation project,
- the bid submission procedure,
- the bid evaluation criteria,
- KCL's existing properties relevant to the project,
- mandatory design requirement, i.e. references to relevant design guidance documents,
- KCL's output-based service requirements, i.e. Facilities Management Output Specification (FMOS), and
- KCL's reference design solution including:
    - spatial requirements,
    - building services engineering strategy report, and
    - capital cost estimate.

The ITND was to enable the private sector to bid for the project either as a DBFO project or as a DB project. The DBFO project would have a 25-year operational period post commissioning. KCL would make a performance related unitary payment (UP) for the accommodation service provision in the operational period. The ITND was to require the ProjectCos bidding for a DBFO project to quote a UP, but also to price the DB and operation components independently. The contractors bidding for the DB contract would be able to submit separate bids for operation of the facilities.

In addition, the ITND was to allow the private sector to bid for only a part of the project. The ITND would allow the DB proposals to include solutions for Cornwall House, New Hunt's House and/or the three buildings on Guy's Campus. The ITND would require the service provision solution (SPS) proposals for the DBFO project to include a solution for Cornwall House and/or the buildings on Guy's Campus, including New Hunt's House.

KCL also intended the ITND to call for proposals for disposal of the surplus sites. KCL would allow the private sector to include any number of the four surplus sites in its proposals. The key issue for KCL was to secure the sale and presales of the surplus sites for a guaranteed minimum of £63 million. The private sector's profit above a threshold set by the £63 million from the development and subsequent sale of the surplus sites would need to be shared with KCL. The ITND would require the private sector proposals to enable KCL to occupy three of the surplus sites during the construction phase of the project. Thus, the sale of the three sites could only take place after commissioning and subsequent relocation.

KCL decided to retain the right to implement the project using either of the two procurement methods and to negotiate solely on the aspects of private sector's proposals that it perceived to be best value for money (VFM) of all the proposals. In addition, KCL chose to reserve the right to exclude any of the surplus sites from the project if it felt that their sale or presale prices did not reflect its valuation.

Of the alternatives project configurations KCL wanted to procure an all-inclusive DBFO project. In such a set-up, it would inject the grant finance into the project and hand over the surplus sites to the ProjectCo executing the project as they became vacant. In return the ProjectCo would convert Cornwall House, redevelop New Hunt's House and refurbish the three buildings on Guy's Campus. The grant finance would meet part of the capital cost of the project. However, the ProjectCo would have to raise two types of additional finance. First, it would need to source bridging finance to enable it to complete the construction phase before the eventual sale of the surplus sites. Second, the ProjectCo would need to obtain project finance to meet the remaining capital cost that could not be met from the grant and bridging finance. The ProjectCo would recover the project finance with interest as part of the UP for the accommodation service provision over the 25-year operational phase. KCL would retain the ownership of the buildings. This was because the ProjectCo would use the project finance to meet only a minor proportion of the capital cost of the project.

KCL intended the ITND to state clearly that the SPS proposals were to be evaluated in relation to a number of *mandatory* and *desirable* criteria. However, KCL did not intend to reveal the detailed bid evaluation methodology. The ProjectCos were to meet mandatory criteria in relation to the following:

- VFM,
- risk transfer,
- design and construction,
- building maintenance,
- performance related payment,
- FM,
- obtaining finance, and
- disposing of the surplus sites.

The ITND was to make the following criteria as desirable:

- demonstration of innovative ideas,
- explanation of management policies and procedures,
- quality assurance proposal,
- dispute resolution proposal,
- realism and practicability,
- ability to meet agreed timescales, and
- track record and quality of key personnel.

5.4. Bidding Stage

5.4.1. Prequalification

In October 1995, KCL issued an Expression of Interest (EoI) notice in the Official Journal of European Communities (OJEC). The project attracted considerable interest because it was one of the first accommodation service PFI projects to enter the market. The number of private sector actors that expressed interest in the project was considerable. KCL provided these actors with the prequalification documentation. This documentation included a Memorandum of Information (MoI) and a prequalification questionnaire (PQ). The MoI provided the interested actors with background information on the project.

European Land and Property Limited (ELPL) was one of the private sector actors that expressed interest in the project. ELPL is a well-known London-based property developer. It was interested in the project primarily because it felt that it could make considerable profits from the development and subsequent sale of the surplus sites.

ELPL established European Land (KC and UMDS PFI) Developments Limited (ELDL) as special purpose vehicle (SPV). ELDL was to bid for the project with the aim of securing the DBFO contract. ELPL was to provide ELDL with strategic direction and the necessary financial resources to develop a SPS proposal. If ELDL were to be successful in the bidding competition and subsequent negotiations with KCL, ELPL was to invest equity in the SPV to enable it to implement the project. In other words, ELPL took the role of an InvestCo in the project.

ELDL appointed Mace Limited to manage the project development. Mace is a project management consultancy with a track record in the PFI market as an InvestCo and as an adviser to clients and ProjectCos. Thus, ELDL obtained the management resource for project development from a specialist consultant instead of the InvestCo. Subsequently, ELDL began to work on the documentation that it was required to submit in order to prequalify to bid for the project.

Opportunity Analysis 5(OA)/1

ELPL used ELDL as a vehicle to bid for the project. ELDL would bring together the expertise required to develop a SPS and, if awarded the contract, to undertake the project. This gave ELDL the opportunity to control the SPS development from its inception. ELPL had the opportunity to fully influence the SPS development through ELDL.

ELDL had the opportunity to take into account simultaneously all the different tasks involved in the implementation of the project over its duration. In addition, ELDL had the authority to decide on the details of the SPS. As a result, ELDL had the opportunity and the authority to implement $CWLC_P$ driven design solutions.

If KCL had acquired the facilities and their operation using traditionally procurement, it would have fragmented the tasks involved in the project into separate contracts and procured them in stages. First, it would have obtained the finance for all of the capital expenditure required for the design and construction tasks included in the project. KCL would have sold the vacant surplus site and entered into pre-sale agreements on the three occupied surplus sites with a property developer. It would have obtained the remaining, including bridging, finance through HEFCE and the NHS. KCL would have been required to pay capital charges on the finance. It would have met them from its annual operating budget which would have been determined based on income from three sources, namely, tuition fees, research grants and formula funding from HEFCE. The formula funding from HEFCE would have been determined based on the volume and the diversity of its educational and research activities. Second, once KCL had secured the finance, it would have appointed designers of its choice to develop design solutions for the buildings. Third, after the detail design solutions had been completed, it would have appointed a contractor to build them to the design solutions. Fourth, once the buildings had been approaching completion, KCL would have appointed operators to provide operational services in the facilities. KCL would have placed several operational service contracts that would have had a relatively narrow scope and short duration. It would have met the cost of the operational services from its annual operating budget.

In traditional accommodation service provision, the private sector actors would not have had the opportunity to take into account all the tasks involved in the service provision over the contract period at the beginning of the project. In addition, the operators would have not been able consider the integration and long-term provision of operational services simultaneously because the services would have been fragmented into several short-term operational service contracts. The designers, the contractor and the operators would have been unable to have an effect on each other’s solutions or obtain feedback from each other on the solutions they themselves had developed. This is because their involvement in the service provision would have been sequential. In conclusion, in a traditional accommodation service provision, the opportunities of the private sector actors to implement $CWLC_P$ driven design solutions would have been limited in comparison to what they were in PFI development.

Incentive Analysis 5(IA)/1

ELPL would profit from the project only if ELDL were awarded the contract at financial close. As a result, the financial resources it had invested in pursuing the project were at risk. If ELDL were not to be awarded the contract, ELPL would have to write off the bid costs it had incurred. ELPL had therefore an incentive to ensure that ELDL would develop a SPS that would enable the project to reach financial close. In addition, ELPL, however, had an incentive to restrict the amount of resources it provided ELDL with in order to limits its own exposure to a failure to secure the contract.

ELDL was at risk in bidding for the project and, thus, had an incentive to secure the contract. KCL would select the ProjectCo with the superior SPS as the preferred bidder (PB). Subsequently, if the PB were to be successful in its negotiations on the project details with KCL, it would be awarded the contract. The best SPS would have to comply with the ITND and offer a solution that was affordable to KCL and superior VFM to the PSC project and other competing bids. The ProjectCo that offered a SPS with the lowest UP was the most likely to be selected the PB, subject to compliance with the ITND. Consequently, ELDL had an incentive to implement $CWLC_P$ driven design solutions. ELDL would be able to appropriate the $CWLC_P$ reductions it had achieved between a lower UP and increased profit from the project. A lower UP would improve the likelihood of ELDL being selected the PB.

ELDL's incentive to minimise $CWLC_P$ was, however, adversely affected for two reasons. First, the fact that KCL's detailed bid evaluation methodology was unknown weakened the incentive. The ProjectCos were also to price their DB and operational solutions for a DBFO project independently. It was conceivable that KCL could pursue combining an inexpensive operational solution that was part of a SPS with an expensive DB solution with an inexpensive DB solution for a DBFO or DB project. In most cases, the implementation of $CWLC_P$ driven design solutions would lower the price of the operational solution and, thus, increase the likelihood of ELDL being invited to negotiate on the details of only part of its SPS. Second, ELPL's desire to restrict the financial resources it provided for SPS development gave ELDL a disincentive to explore potential $CWLC_P$ driven design solutions.

If KCL had procured the service traditionally, it would have obtained a set amount of finance towards the capital expenditure on the buildings through HEFCE and the NHS. It would have supplemented this finance by receipts from the eventual sale of the surplus sites. KCL would have met the cost of providing operational services in the buildings from its annual operating budget. Consequently, KCL's incentive to achieve an optimum balance of capital and operational expenditures in its accommodation service procurement would have been weak. Instead, KCL would have had an incentive to maximise the increase in its annual operating budget resulting from the procurement of the new facilities. KCL's expenditure on operating the buildings would represent only a minor share of its annual operating budget. It is likely that KCL would have been able to achieve an increase in its annual operating budget in excess of the required increases in its expenditure on operating the buildings by not pursuing an optimum balance of capital and operational expenditures and, thus, minimum $CWLC_C$.

In traditional accommodation service procurement, KCL would have procured design solutions from its designers that would have maximised the amount of accommodation it could obtain within its capital expenditure budget. This would have enabled KCL to achieve the maximum increase in its annual operating budget. KCL's designers would have had an incentive to develop the design solutions in accordance with their client's objective. Once the detail design solutions had been completed, KCL would have appointed a contractor to build the facilities to the design solution through a competition. It would have selected the contractor willing to build the facilities with the lowest cost to undertake the works. Consequently, the contractor would have had an incentive to minimise the capital cost of its construction because such minimisation would have increased the likelihood of it being appointed the contractor and enabled it to maximise its profit from the construction contract. Subsequently, through competitions, KCL would have awarded contracts to operators to service the facilities. It would have appointed operators willing to provide the operational services with the lowest costs. Consequently, the operators would have had an incentive to minimise the cost of their service provisions. This would have enabled them to improve their probabilities of being awarded the service contracts and to maximise their profits from the operational service provisions. In conclusion, if KCL had procured the project traditionally, the private sector actors providing the accommodation service would not have had an incentive to minimise $CWLC_P$.

Opportunity Analysis 5(OA)/2

ELDL had the opportunity to choose the other ProjectCo actors. Specifically, it could select the designers, the contractor and the operator for the project. As a result, ELDL could bring together a ProjectCo that was made up of actors that could meet the prequalification requirements to bid for the project. Furthermore, the authority to select the actors enabled ELDL to ensure that they had the capabilities to develop a SPS that would allow it to be selected the PB and, subsequently, to secure the contract. In other words, ELDL had an opportunity to ensure that the actors pursued its objectives (see 5(IA)/1) as they began to develop the design, construction and operation solutions.

In a traditional project, KCL would have sequenced and fragmented the procurement of the design, construction and operational solutions – see 5(OA)/1 and 5(IA)/1. As a result, the private sector actors would not have used a SPV to pursue and undertake the project. Consequently, the private sector actors' opportunities to implement $CWLC_P$ driven design solutions would have been limited. It must be noted that in a traditional accommodation service provision the actors would not have had an incentive to pursue $CWLC_P$ minimisation – see 5(IA)/1.

ELDL invited Anshen Dyer Limited (ADL) to participate in pursuing the project. ADL is a well-known architectural practice with significant involvement in the higher education, healthcare, and PFI markets. ADL was to develop the architectural design solution at risk. ELDL would pay ADL only a proportion of its fees. It would receive its full fees only if the project reached financial close. The organisation of the key project actors prior to prequalification is illustrated in Figure 5.3.

Opportunity Analysis 5(OA)/3

ADL had an opportunity to have an effect on the way that the SPS developed from its initiation. It could influence the development of the construction and operational solutions and receive feedback on its architectural design solution from the other ProjectCo actors.

If KCL had procured the project traditionally it would have appointed an architect directly to develop a detail design solution for the buildings – see 5(OA)/1. Due to the sequential nature of traditional procurement, the architect would have been unable to have an impact on the development of the construction and operational solutions. In addition, it would have only been able to obtain feedback on its design solution from the client. Consequently, the architects' scope to implement $CWLC_P$ driven design solutions in traditional accommodation service provision would have been narrower than it was in PFI provision.

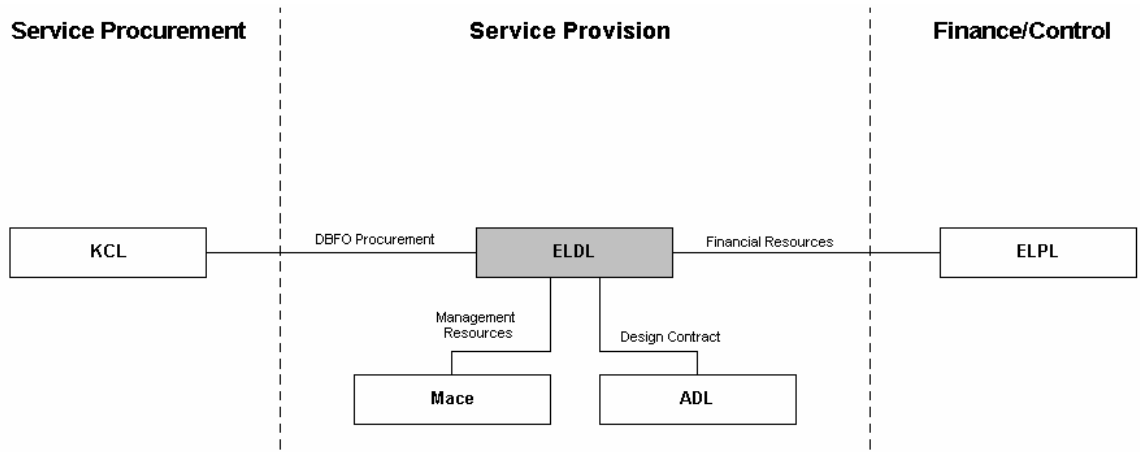

Figure 5.3. Organisation of the key project actors in the bidding stage prior to prequalification.

Incentive Analysis 5(IA)/2
ADL began to work on the project at risk. If ELDL failed to be awarded the contract, ADL would not be compensated for its full fee and, thus, it would not make any profit. As a result, ADL had an incentive to develop a design solution that would enable ELDL to secure the contract. Consequently, it had an incentive to develop the design solution in line with ELDL's objectives – see 5(IA)/1.

If the project had been traditionally procured, KCL would have appointed the architect directly. Thus, it would have had an incentive to pursue KCL's objectives (see 5(IA)/1) in its design development. Consequently, it would have had only a weak incentive to implement $CWLC_P$ driven design solutions.

KCL received a large number of prequalification submissions. ELDL had made one of the submissions. KCL evaluated the ProjectCos that had made submissions in relation to their financial standing, technical capability and previous experience. KCL established that a total of six ProjectCos were willing to undertake a DBFO project and met its minimum prequalification requirements. Consequently, in January 1996, KCL issued the ITND it had completed during the process of prequalification to the six ProjectCos. ELDL was one of the ProjectCos that KCL invited to bid for the project.

The ITND called the SPS to include proposals for the provision of the following *reference services*:

- building and grounds (infrastructure) maintenance,
- utility (electricity, water, gas etc.) management,
- catering,
- car park management,
- postal services,
- security,
- housekeeping (cleaning, pest control etc.),
- furniture storage and management,
- waste disposal,
- signposting,
- grounds (non-infrastructure) maintenance,
- portering, and
- portable appliance testing.

The ITND also invited the ProjectCos to include proposals for the provision of the following *variant services* in their SPSs:

- day nursery,
- indoor sports and recreation management,
- transport and courier services, and
- non residential accommodation management.

5.4.2. Competitive Negotiation

In January 1996, KCL issued the ITND to the six prequalified ProjectCos. The ITND requested the ProjectCos to submit a fully priced SPS proposal in March 1996. However, after examining the ITND, three of the ProjectCos chose not to pursue the project further. In addition, one of the ProjectCos aborted its SPS proposal development half way through the process. Consequently, KCL received only two SPS proposals of which ELDL had submitted one.

KCL felt that ELDL's SPS was the more feasible of the two proposals. ELDL's proposal was based on an all-inclusive DBFO set up for the project. However, KCL felt that the other proposal was more innovative and had more potential. As a result, KCL requested the other ProjectCo to clarify its proposal in relation to a number of issues and, subsequently, resubmit it. After receiving the resubmission, KCL re-evaluated it, but felt that the quality of the SPS was unsatisfactory and the proposal continued to lack feasibility. Thus, KCL had to proceed with ELDL as the only bidder. This was somewhat disappointing because, at the issue of ITND, KCL had anticipated that it would invite three ProjectCos for a second round of negotiations.

Incentive Analysis 5(IA)/3

Once ELDL became the sole remaining bidder it no longer had to be concerned that another ProjectCo would submit a SPS that would be more advantageous to KCL. As a result, the nature of ELDL's $CWLC_P$ minimisation incentive changed. It had an incentive to develop a SPS that KCL's would be just able to procure within its affordability constraint and that would be slightly superior VFM to the PSC project. If ELDL could develop such a solution, it could secure its selection as the PB. In addition, such SPS would maximise the value of the project and, thus, ELDL's revenue from undertaking it. This would maximise the ProjectCo's profit from the PFI project. In other words, ELDL's incentive to implement $CWLC_P$ driven design solutions became more driven by the desire to increase its profit from undertaking the project than by the need to increase the likelihood of it being nominated the PB.

ELDL considered a number of alternative strategies for project development. It decided that it would place DB and operation contracts to undertake the project. However, it chose to proceed to develop the design solution for the project until its scheme design stage. Subsequently, ELDL would procure the DB and operation solutions based on the scheme design solution. ELDL felt that it could procure the construction and operation contracts at a lower cost if the contractor and the operator were not included in the ProjectCo until the design was at a fairly advanced stage. ELDL's intended contractual structure for the project is illustrated in Figure 5.4.

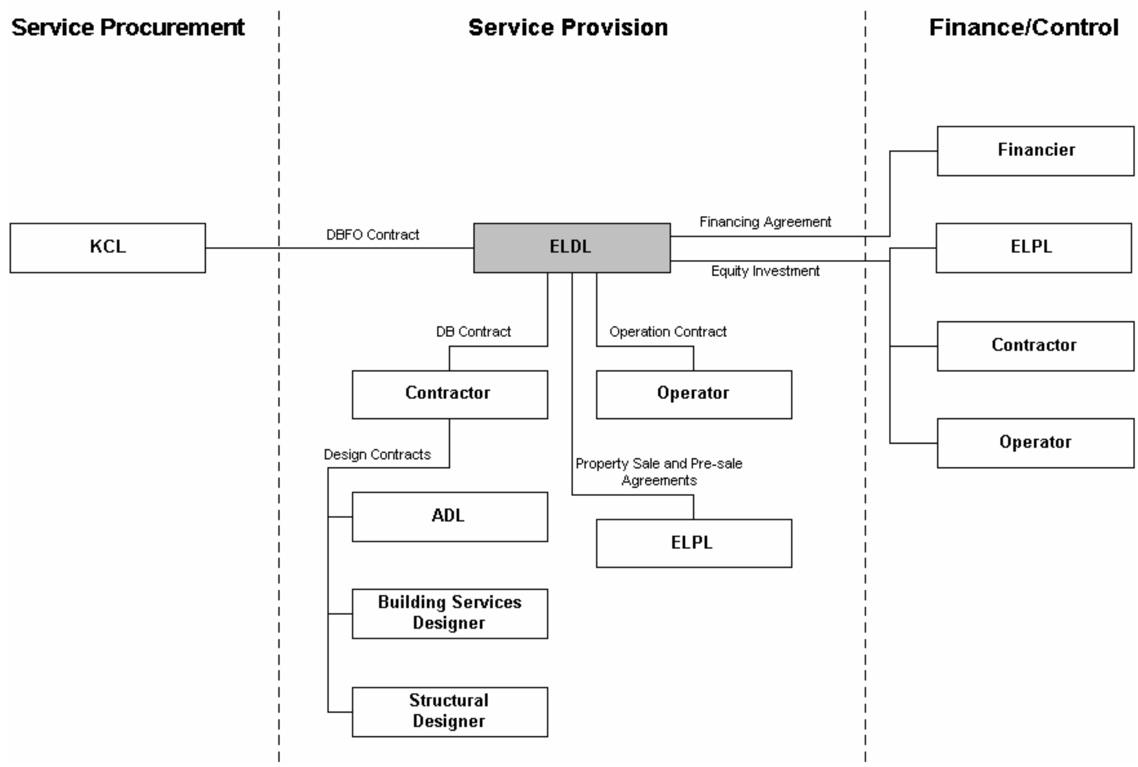

Figure 5.4. ELDL's initial proposal of organisation of the key project actors after contract award.

Perception Analysis 5(PA)/1

ELDL was leading SPS development from inception. It was seen to have an opportunity for $CWLC_P$ minimisation. However, ELDL decided to delay the inclusion of a contractor and an operator in the ProjectCo in order to obtain more competitive prices for DB and operation. This was seen to have an adverse effect on the implementation of $CWLC_P$ driven design solutions. This occurred because the ProjectCo could not benefit from the feedback from a contractor and/or an operator until the scheme design was at an advanced stage.

Once ELDL had become the sole bidder, it began to negotiate the SPS with KCL. It shortly became apparent that KCL had not anticipated the type of SPS proposal that ELDL had submitted. This was because both KCL and ELDL were inexperienced in the use of output specification (OS). This resulted in iterative requirement redefinitions by KCL and SPS resubmission by ELDL to align the SPS with KCL's requirements.

ELDL grew increasingly frustrated as the process of redefinition and resubmission continued. KCL allowed ELDL to approach the heads of the academic departments to be housed in New Hunt's House directly. This was done to enable ELDL to obtain more detailed and accurate information on the intended use of the facilities and accommodated this information into its resubmissions. KCL felt that this improved the quality of the resubmissions. It must be noted that both the KCL and the ProjectCo invested considerable effort in learning the PFI procurement and development processes respectively. This was because the project was one of the very first accommodation service PFI projects to enter the market. Thus, there was very little guidance documentation to support the processes.

In the absence of competition, KCL did not disclose the details of its bid evaluation, namely the methods it used to establish affordability and VFM, to ELDL. After KCL had assessed ELDL's submission or resubmissions, it informed ELDL of the aspects of its SPS that failed the affordability and/or VFM assessments. Occasionally ELDL did not understand why its SPS had failed the assessments. This was because it did not know the details of the assessments. ELDL was not invited to debate the comparative merits of its SPS against the PSC project that KCL has used in its assessments. However, ELDL concluded that the main reason it failed the affordability and/or VFM assessments was that the capital cost of the project, as opposed to the UP for the accommodation service provision, was too high.

Perception Analysis 5(PA)/2
KCL used an OS to procure the project. The ProjectCo actors had difficulties in knowing exactly what the specification called for and how KCL would assess its SPS. The limited understanding of the OS and knowledge of the bid evaluation methodology was perceived to divert attention away from the ProjectCo's pursuit of $CWLC_P$ minimisation. However, some actors acknowledged that the use of OS enabled the ProjectCo to use the best possible solutions to meet KCL's accommodation needs.

Incentive Analysis 5(IA)/4
Once ELDL realised that KCL's affordability constraint was in fact defined in terms of capital cost as opposed to its annual expenditure on the UP, its $CWLC_P$ minimisation incentive changed. Now it had an incentive to implement $CWLC_P$ driven design solutions, subject to being able to price the DB component of the project below KCL's capital cost affordability constraint. This means that ELDL also gained an incentive to minimise the capital cost of the project because capital cost reductions would enable it to make the DB component affordable to KCL. ELDL did not have an incentive to reduce the capital cost lower than the affordability constraint if such reductions led to a greater increase in operational cost and, thus, increased $CWLC_P$.

ELDL passed its objective to ADL. As a result, ADL's incentive to implement $CWLC_P$ driven design solutions also changed.

Perception Analysis 5(PA)/3
KCL was to finance the capital cost of the project partially by public sector grants and the receipts from the surplus sites. This was seen to define a capital cost affordability constraint for the project and, thus, discourage the implementation of $CWLC_P$ driven design solutions that would have involved increased capital expenditure.

Perception Analysis 5(PA)/4
KCL was one of the first accommodation service PFI projects to enter the market. As a result, both public and private sector actors had limited experience of how the procurement method worked. This was seen to divert attention away from the implementation $CWLC_P$ driven design solutions.

5.4.3. Parallel Design Development

As the iterative redefinitions and resubmissions continued, KCL's requirements for New Hunt's House became more apparent. ELDL concluded that the size of the building would need to be increased from 20,000 m^2 to 22,000 m^2. However, if the increase were to be accommodated into the reference design, the building would compromise the quality of its surrounding environment, namely, the Memorial Gardens. As a result, ELDL decided to commence a parallel development of an alternative design solution with the continued development of the reference design. The reason for the parallel design development was that the alternative design did not have an outline planning permission whereas the reference design solution did.

ADL started to work on the alternative design solution in its United States offices. ELDL instructed ADL to develop a concept design solution that would enable it to minimise the capital cost of the building. This was in conflict with the ITND. However, ELDL had learned to understand KCL's objectives in the course of the project development. ELDL felt that in order to be nominated the PB, the project needed to meet KCL's implicit affordability criteria which was defined in terms of capital cost.

ADL designed New Hunt's House to have five upper floors and a single basement floor. The building was to house a considerable amount of research facilities with sensitive medical research equipment. As a result, the building was designed to have a concrete structure to protect the equipment from vibration. ADL laid out the building in the most economic manner. It designed the offices and other non-critical areas in terms of environmental conditions to be on the perimeter of the building. This enabled the building to make extensive use of natural lighting and ventilation. ALD designed the research facilities that were more critical in terms of environmental conditions to be in the interior of the building.

Once completed, ELDL submitted ADL's concept design solution to Southwark Planning. The Planning Authority understood its comparative architectural merits over the reference design solution. Consequently, it swiftly granted a new outline planning permission. At this point ELDL fully abandoned the reference design solution.

In early 1997, once the new design solution had outline planning permission and KCL felt that the project was within a negotiating distance of affordability, it appointed ELDL as the PB.

5.5. Preferred Bidder Stage

5.5.1. Negotiation with the Preferred Bidder

KCL did not have a reserve bidder. It felt that this was an undesirable situation. It feared that the absence of competitive pressure could deteriorate the VFM of the project. Consequently, it decided that it would implement the PSC project, if ELDL's SPS did not meet its affordability and VFM criteria. KCL was continuously refining the PSC project. It enhanced the PSC project with the information it had obtained in the course of its procurement. After making the decisions to treat the PSC project as a genuine procurement alternative, KCL felt more comfortable about negotiating with ELDL without a reserve bidder.

Shortly after the BP nomination, the ProjectCo moved into KCL's premises to continue SPS development. This enabled an excellent relationship to develop between KCL and the ProjectCo actors. Occasionally, for example, ELDL could agree solutions with the end users of the accommodation service, but found it hard to do so with KCL's procurement team.

5.5.2. Scheme Design Development

Once ELDL became the PB, it placed building services and structural design contracts with Troup Bywaters and Anders Limited (TBAL) and Pell Frischmann Consultants Limited (PFCL) respectively. TBAL and PFCL are leading UK building services and structural designers respectively. At the time, both companies were entering the PFI market and have subsequently had significant involvement in PFI projects. TBAL and PFCL became key ProjectCo actors. They began to work for ELDL at risk. In other words, ELDL paid them only a proportion of their fees: TBAL and PFCL would receive their full fees only if the project reached financial close. The organisation of the key project actors at the PB stage is illustrated in Figure 5.5.

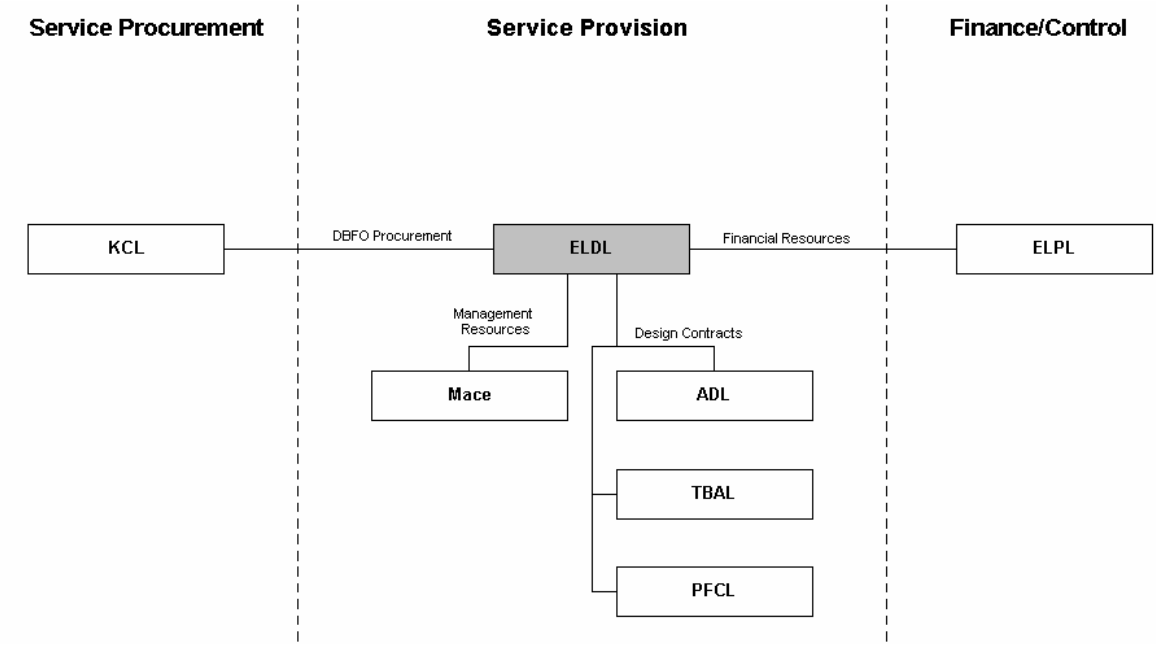

Figure 5.5. The organisation of the key project actors at the PB stage.

Opportunity Analysis 5(OA)/4

TBAL and PFCL had an opportunity to have an effect on the SPS from the early stages of its development. The two actors could give feedback to ADL on its architectural design development and to ELDL on its development of the construction and operational solutions for the project. Furthermore, TBAL and PFCL had an opportunity to obtain feedback on their respective design solutions from ELDL and ADL.

In a traditional project, KCL would have appointed the building services and structural designers directly to produce their respective design solutions – see 5(OA)/1. Due the sequential nature of traditional development, the two designers would have not been able to influence the construction and operational solutions or to obtain advice on their own solutions from the actors developing the construction and operational solutions. However, the two designers would have had an opportunity to interact with KCL and the architect. Nevertheless, the traditional development process would have constrained the opportunity for the two actors to contribute to $CWLC_P$ minimisation more than the PFI development process.

Incentive Analysis 5(IA)/5

TBAL and PFCL began to work on the project at risk. They would only be paid their full fees if ELDL were awarded the DBFO contract. The designers had therefore an incentive to develop building services and structural design solutions that would enable the project to reach financial close. As a result, they had an incentive to pursue ELDL's objectives (see 5(IA)/4) in their design development.

In a traditionally procured project, the building services and structural designers would have worked in a direct appointment for KCL. As a result, they would have had an incentive to develop their design solutions to meet KCL's objectives – see 5(IA)/1. Consequently, the two actors' incentive to implement $CWLC_P$ driven design solutions would have been slightly weaker than it was in the PFI project.

Perception Analysis 5(PA)/5

It was felt that the fact that the designers were working at risk made them pursue ELDL's objectives more rigorously. It was acknowledged that working at risk prior to financial close was the most significant change that PFI had in the designers' role.

ELDL needed to obtain finance in order to meet the capital cost of the project that could not be met by the grant finance and the receipts from the surplus sites. The required additional finance was around £20 million. ELDL intended to obtain some of it as equity investment from the ProjectCo actors and some as debt secured against the project from a financier. As a result, ELDL opened negotiations with a number of potential financiers. At the time, it was not clear on what type of terms an accommodation service PFI project could be financed.

Incentive Analysis 5(IA)/6

ELDL was aware that the project could only be fully financed if the project risks were acceptable to a financier. The key risks of concern to the financier were acknowledged to be the risk of delay in completion, the risk of failure to provide the agreed quality and quantity of accommodation service, and the failure to provide the service within budget. This is because if any of these three risks materialised, ELDL could face difficulties in meeting its loan repayment obligations. As a result, ELDL had an incentive to maximise completion, operational and expenditure certainty in SPS development in order to ensure that it could obtain finance for the project. ELDL passed its objectives onto ADL, TBAL and PFCL. The three designers had an incentive to pursue ELDL's objectives in order to secure financial close and, thus, recover their full fees.

If the project had been traditionally procured, KCL would not have used project finance – see 5(OA)/1. Therefore, the private sector actors would not have been under pressure to maximise completion, operational and expenditure certainty. KCL would have had an incentive to maximise completion certainty but it would have struggled to pass the incentive onto the private sector actors due to the legal difficulties associated with imposing liquidated damages. In addition, KCL would have had an incentive to maximise operational certainty, as it would have been liable for the costs arising from operational failures. However, it is probable that if KCL had allocated additional capital to increasing the capacity of the facilities instead of increasing their operational certainty, it would have been able to obtain an increase in its annual operating budget that would have been greater than the costs anticipated to arise from compromised operation. Thus, in traditional procurement, KCL would have sought to impose a considerably weaker incentive onto the private sector actors to achieve operational certainty than they had as a result of PFI procurement. Furthermore, KCL would have had an incentive to achieve expenditure certainty in relation to both capital and operational costs, as it would have had to meet the additional expenditure. However, in traditionally procured projects, the contractor can often claim additional compensation for cost increases from the client. Thus, KCL would have struggled to pass an equally strong incentive onto the contractor to achieve capital expenditure certainty in a traditionally procured project as it did in the PFI project. In traditional service procurement, KCL would have used a number of short-term operational subcontracts and managed them in-house. It would have been able to maximise its operational expenditure certainty by effective management of the operators. Nevertheless, its success in doing so would have been influenced by the design and construction of the facilities.

Incentive Analysis 5(IA)/7

ELDL had a range of objectives in its SPS development. These objectives were a result of the use of a DBFO contract, KCL's capital cost affordability constraint and the intended contractual structure – see Figure 5.4.

ELDL retained its incentive to implement $CWLC_P$ driven design solutions subject to being able to meet KCL's capital cost affordability constraint – see 5(IA)/4. ELDL had secured its appointment as the PB. However, it had not agreed the price for the DB component of the project or the UP. It needed therefore to persist with capital cost driven $CWLC_P$ minimisation in order to reach financial close and increase the profit the ProjectCo actors would make from the project.

ELDL had an incentive to improve the constructability of the SPS. First, if it could do so, it could reduce the expected duration of the construction period of the facilities. The completion of the facilities and the commencement of the operational service provision would result in KCL beginning to make the UP. Thus, if ELDL could shorten the construction period, it could start to make its loan repayments earlier and, thus, reduce its overall finance cost. ELDL could use this reduction to make the project more affordable and/or to increase the profit from the project for the ProjectCo actors. Second, an improved constructability would increase the completion certainty of the buildings facilitating the financing of the project – see 5(IA)/6. In addition, if the completion of the facilities were to be delayed, ELDL would incur additional costs from rescheduling its loan repayment obligations. Thus, compromised completion certainty would reduce the ProjectCo's anticipated profit from the project.

Furthermore, ELDL had an incentive to improve the operational certainty of the project. First, the UP was to be linked to ELDL's performance in accommodation service provision. Thus, if the operation were to be compromised, ELDL would suffer a UP deduction. As a result, the profit that the ProjectCo actors would make from the project would be reduced. Second, ELDL needed to improve the operational certainty to enable the project to be financed – see 5(IA)/6.

ELDL also had an incentive to maximise its expenditure certainty on the project because it would have to meet any unanticipated increase in capital and operational expenditure in the implementation of the project. As a result, ELDL could face difficulties in meeting its loan repayment obligations. Consequently, increased expenditure certainty would facilitate ELDL to finance the project – see 5(IA)/6. In addition, unanticipated expenditure would reduce the profit that the ProjectCo actors would make from undertaking the project.

In conclusion, ELDL had a range of objectives in developing the SPS. The implementation of $CWLC_P$ driven design solutions was only one of these objectives. It was apparent that ELDL's $CWLC_P$ minimisation objective was considerably weakened by its other objectives.

In a traditionally procured project, KCL would not have acquired the accommodation using a long-term DBFO contract – see 5(IA)/1. Thus, the private sector actors would not have used a SPV to bid for and to undertake the project. Consequently, the private sector actors would have pursued a set of incentives in the design (see 5(IA)/2&4), construction (see 5(IA)/8) and operation contracts (see 5(IA)/8) KCL would have awarded them. As a result, the actors' incentives to implement $CWLC_P$ driven design solutions and to improve the completion, operational and expenditure certainty of the SPS would have been significantly weaker that they were in the PFI project.

TBAL began to develop the HV scheme design solution for New Hunt's House. The design solution was to consist of 1:200 plan and section drawings and generic Room Data Sheets (RDSs). TBAL based the solution on the ITND and ADL's concept design solution. The ITND had referred to a wide range of design guidance documents and made compliance with some of them compulsory. However, TBAL found the design requirements to be unspecific as they were output-based. TBAL invested considerable effort in compiling the RDSs that outlined the environmental condition requirements for all areas in the building. It had to obtain additional information from KCL to achieve this.

TBAL designed the HV solution of New Hunt's House to use natural ventilation, mechanical ventilation and mechanical cooling. TBAL designed the offices on the perimeter of the building to be naturally ventilated and the offices in the interior and the large library area to be mechanically ventilated. It decided to fully air-condition the lecture theatres, seminar rooms, laboratories and specialist areas like the Biological Science Unit (BSU).

TBAL decided to use a Variable Air Volume (VAV) system for air-conditioning. This is because some of the areas, such as the BSU, required environmental conditions to be controlled with great accuracy. The main benefit of the VAV system was that it could provide that high level of accuracy. The HV solution was designed to have air-handling units and ductwork distribution. The cooling effect was to be provided by air-cooled chillers. The heating was to be provided by high temperature hot water from Guy's Hospital converted to low temperature hot water that served the radiator circuit and the heat batteries on the air-handling units. TBAL designed humidification to be provided by a steam generation plant. TBAL decided to include a sophisticated building management control system in the HV solution. This system can be used to monitor and control the environmental conditions in the building with great accuracy.

TBAL focused on energy in its pursuit of CWLCP driven design solutions. This was because the responsibility for utility management, including energy, was to be included in the DBFO contract. As a result, TBAL designed the chillers to have heat recovery bundles.

Solution Analysis 5(SA)/1
The heat recovery bundles on the chillers are a $CWLC_P$ driven design solution, as they will reduce ELDL's expenditure on energy over the DBFO contract period.

PFCL developed a structural scheme design solution that would support the building and enable TBAL to route the building services. PFCL designed the structure in line with the existing guidance documentation referred to in the ITND.

Perceptions Analysis 5(PA)/6
The structural design solution was developed in accordance with the existing design guidance documents. The minimisation of $CWLC_P$ was not perceived to be an issue in structural design. This was because structures will last in excess of 50 years whereas the DBFO contract period was to be 25 years.

ELDL developed the construction solution which it embedded in a specification. As the design solutions became more advanced, the construction specification developed from the output-based document that had been part of the ITND into an output-oriented input specification. In addition, ELDL developed the operational solution. It transformed the FMOS that had been a part of the ITND into a slightly more detailed set of statements on operational service provision. However, the FMOS remained largely an output-based document. ELDL and the designers invested a considerable amount of effort in ensuring that the scheme design solutions and the construction specification were developed in line with the FMOS and *vice versa*. KCL was involved in ensuring that the design solutions, construction specification and the FMOS were in line with the user's requirements.

In scheme design development, the ProjectCo carried out some $CWLC_P$ assessment. However, it established that the information available on *major* maintenance and replacement, especially on the building services components, was mostly of low quality. Consequently, the ProjectCo took the majority of the scheme design decisions based on the ProjectCo actors' past experience, without a formal assessment. However, the ProjectCo's scheme design development was driven mainly by capital, major maintenance and replacement costs. In developing the scheme design solution the ProjectCo rarely took into account the cost of providing operational services, such as cleaning, that ELDL would incur in the operational phase of the project.

Perception Analysis 5/(PA)/7
Some $CWLC_P$ analysis was carried out in SPS development. However, it was felt that the analysis was compromised by the unavailability of good quality cost data. The inconclusive results of the analysis were to discourage the implementation of $CWLC_P$ driven design solutions. It was acknowledged that as a result some of the design decisions had to be taken based on past experience.

Once the ProjectCo had developed the scheme design solution to a fairly advanced state, ELDL submitted an application for detailed planning permission to Southwark Planning. The planning authority swiftly approved the application.

5.5.3. Selection of Contractor and Operator

In March 1997, once ADL's concept design solution had planning permission, ELDL invited contractors and operators to bid respectively for the DB and operation contracts it would place to undertake the project. ELDL would then invite the winning bidders to be part of the ProjectCo. ELDL sought for a fixed-price DB bid for construction and an annual price bid for operation.

Among the pre-selected bidders for the DB contract was Bouygues UK Limited (BUKL) and for the operation contract Ecovert South Limited (ESL). BUKL and ESL are both subsidiaries of a French company, Bouygues SA, which is the largest contractor in Europe. BUKL is a contractor operating exclusively in the UK with involvement in the DB and PFI markets. ESL is a FM company with involvement in the utilities sector and in both traditional and PFI FM service provision. ELDL provided the contractors it invited to bid for the project with the concept design solution that had just been granted outline planning permission and the operators with the FMOS that had been part of the ITND.

Opportunity Analysis 5(OA)/5

BUKL and ESL became involved in the project as ELDL invited them to bid for DB and operation respectively. Initially the two actors were to price only the concept design solution and FMOS independently. As a result, they did not have an opportunity to influence the design, construction and/or operational solutions. Thus, BUKL and ESL did not have an opportunity to implement $CWLC_P$ driven design solutions. However, it must be noted that BUKL and ESL were aware that they would have an opportunity to influence the design, construction and operation solutions, if they were to be invited to join the project.

In traditional procurement, KCL would have awarded separate design, build and operational contracts sequentially – see 5(OA)/1. As a result, the contractor and the operators would have had a very limited opportunity to influence the design solution and each other's solutions or to receive feedback on their own solutions from the other private sector actors. Therefore, their opportunity to minimise $CWLC_P$ would have been as limited in traditional as it was in PFI procurement.

Incentive Analysis 5(IA)/8

BUKL and ESL were invited to bid to become the contractor and the operator in the project respectively. As a result, BUKL had an incentive to minimise the capital cost of its construction and ESL had an incentive to minimise the cost of its operation. This was because such minimisations would improve the likelihood of them being invited to join the project. As a result, BUKL and ESL did not have an incentive to engage in $CWLC_P$ minimisation.

If KCL had used traditional procurement, it would have awarded a construction and a number of operational contracts. As a result, the contractor and the operators would have sought to minimise the cost of undertaking the contracts they were bidding to undertake – see 5(IA)/1. Thus, the actors would not have had an incentive to implement $CWLC_P$ driven design solutions in traditional provision, as was the case in PFI provision.

BUKL and ESL took different approaches in bidding for the project. On the one hand, BUKL bid for the project as a traditional fixed-price DB contract with some additional risks. BUKL's objective was to make a profit out of the design and construction of the facilities. On the other hand, ESL's main objective was to secure a 25-year revenue stream. If it were to be awarded the contract, it would be able to work continuously on improving its operational efficiency and, thus, increasing the profit it would make from the contract over its duration. ESL anticipated that it could secure significant efficiency savings in various aspects of its operational service provision as its understanding of KCL's facilities and their operation improved.

BUKL responded with the most competitive fixed-price DB bid of the contractors ELDL invited to bid for the project. The strength of BUKL's bid arose from its understanding of the risk transfer that was required in the project. It had identified all the risks involved in the design and construction of the facilities and priced them in a matrix format. BUKL's parent company (ParentCo), Bouygues SA, had considerable experience in concession projects around the world. The type of risk transfer used in the KCL Site Rationalisation project is typically used in concession projects. In this respect, BUKL was able to benefit from its ParentCo's expertise. BUKL was also able to benefit from the fact that Bouygues SA would guarantee the DB contract.

Initially, BUKL quoted a price for the DB contract that was several million pounds below the price that was eventually agreed. This was because ELDL had not given BUKL the scheme design solution the ProjectCo had produced while BUKL was bidding for the DB contract. Once given the scheme design solution, it became evident that it did not correspond to what BUKL had priced. BUKL had not been given KCL's criteria on flexibility and adaptability of the facilities. Subsequent, through negotiation, ELDL and KCL agreed a mutually acceptable price for the DB contract.

The pricing of BUKL's and ESL's bids had been integrated. ELDL saw a great benefit in ESL and BUKL being sister companies (SisterCos) willing to invest equity in the project. The two companies offered a single point of contact for design, build, operation and equity finance. This and the fact that Bouygues SA would guarantee both the DB and operation contracts, contributed to ELDL's decision to invite BUKL and ESL to become the contractor and the operator in the ProjectCo.

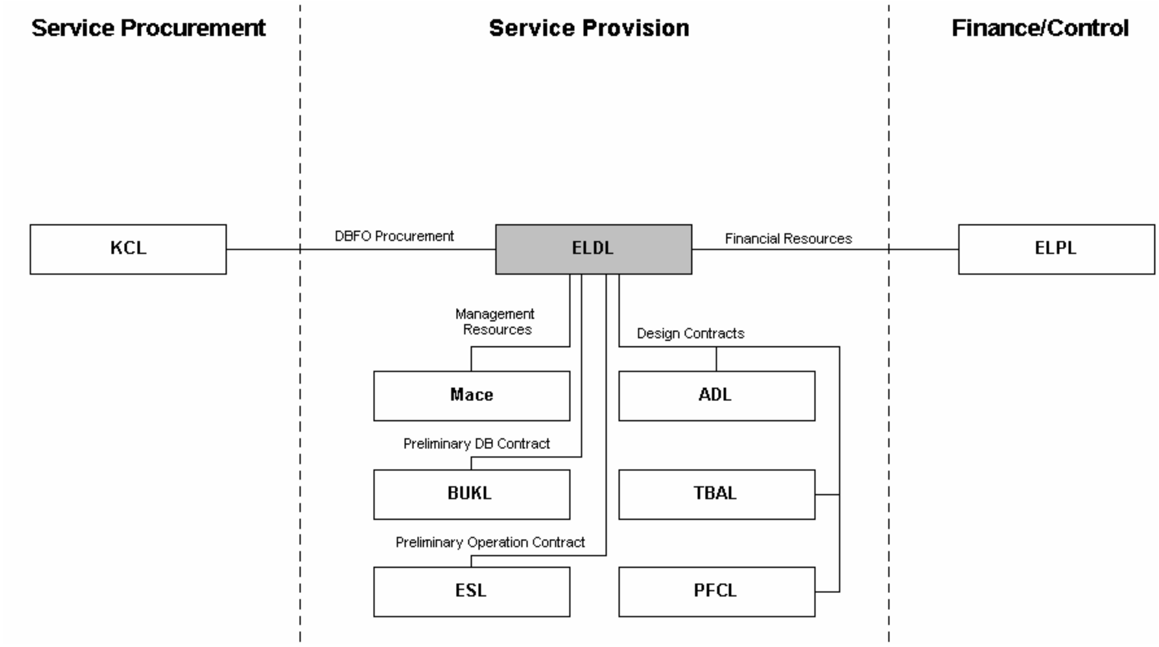

Figure 5.6. The organisation of the key project actors at the PB stage after the inclusion of the contractor and the operator.

ELDL did not permit BUKL and ESL to make direct contact with KCL or the other ProjectCo actors during the bidding process. In August 1997, ELDL signed preliminary DB and operation contracts with BUKL and ESL respectively. Subsequently, the two actors became part of the ProjectCo. The positions of BUKL and ESL in the organisation structure of the project are illustrated in Figure 5.5.

Once included in the ProjectCo, BUKL and ESL begun to work with ELDL and designers on the SPS. They were invited to provide their feedback on the design, construction and operational solutions. However, they did not have the authority to take the decision that would determine the SPS. Until that point, the design, construction and operational solutions had been developed without input from a contractor or an operator. However, the majority of the design decisions were irreversible because the nearly finished scheme design solution had detail planning permission. As a result, BUKL and ESL could have only a limited impact on the scheme design solution.

Opportunity Analysis 5(OA)/6

As BUKL and ESL joined the ProjectCo they gained an opportunity to influence the design, construction and operational solutions developed by the other ProjectCo actors. However, they did not have the authority to impose changes on the solutions. Nevertheless, their opportunity to implement $CWLC_P$ driven design solutions improved. As a result, the opportunity of the two actors to engage in $CWLC_P$ minimisation became greater than it would have been in a traditionally procured project.

Incentive Analysis 5(IA)/9
BUKL and ESL joined the project as the contractor and the operator respectively. BUKL retained is capital cost minimisation incentive because such minimisation would enable it to maximise its profits from undertaking the fixed-price DB contract. ESL kept its operational cost minimisation incentive as operational cost reductions subject to successful service delivery would increase the profit it would make from operation.

However, BUKL and ESL were also to become InvestCos in the project and, therefore, invest equity in ELDL to enable the project to be implemented. As a result, the two actors gained an incentive to implement $CWLC_P$ driven design solutions that would not violate KCL's capital cost affordability constraint. This was because such solutions would facilitate reaching financial close (see 5(IA)/4) and, subsequently, increase their return on equity (ROE) from the project in its operational phase. In addition, BUKL and ESL gained an incentive to improve completion, operational and expenditure certainty in order to enable the project to be financed and not to compromise their ROE or profits from their respective DB and operation contracts in the implementation stage of the project – see 5/(IA)/5. Consequently, the two actor's incentive to minimise $CWLC_P$ became stronger than it would have been in traditional procurement – see 5(IA)/8.

ESL began to work with KCL in order to agree the FMOS and the performance-monitoring programme, including performance indications, that were to be part of the Payment Mechanism (PM). ESL transformed the operational solution that had remained a collection of simple statements into a complex set of documents. This was an iterative process. ESL ensured that the various parts of the FMOS were in line with each other and that they did not call for something that could not be delivered by the design and construction solutions. The late development of the operational solution meant that it had a limited influence on the scheme design and construction solutions.

5.5.4. Value Engineering

KCL needed the approval of HM Treasury in order to award the DBFO contract. The project could only go ahead if KCL and ELDL could negotiate an SPS, which met KCL's capital cost affordability constraint. The two actors proceeded therefore to value engineer the solution in order to secure a mutually acceptable price for the DB component. If KCL could not obtain HM Treasury approval, it would have to re-tender the project. This would result in additional cost to KCL and a delay of 3 to 4 years. ELPL had invested considerable financial resources in developing the SPS, which it was at risk of losing if the project failed to reach financial close. ELPL's exposure increased as the value engineering continued. KCL and ELDL found themselves in a situation where failure was not an option to either party.[1] The need to get HM Treasury approval resulted in considerable delays in reaching financial close. However, during the value engineering, the two actors secured significant reductions in the capital cost of the project.

In the value engineering, KCL and ELDL agreed to exclude the responsibility for energy from the scope of the project. First, KCL agreed to retain the energy price risk as its status as a charity enabled it to get VAT exemption when buying energy. ELDL would have had to pay VAT, so buying energy through ELDL would have not been cost efficient. In addition, ELDL would have been unable to control the market price of energy. It had, therefore, sought to charge a high premium for managing the risk.

Second, KCL agreed that it would also retain the energy consumption risk. KCL uses the facilities, among other things, for energy-consuming laboratory experiments. ELDL would be unable to control the volume of these experiments in the operational period. ELDL had reflected this in its price for energy consumption management. KCL was keen to transfer the energy consumption risk and tried to negotiate a reduction in the price. However, KCL needed to reduce the price of the DB component of the project further in order to make the project affordable. As a result, the responsibility for energy consumption management was removed from the DBFO contract. KCL and ELDL agreed that ELDL would have an obligation to follow *a good housekeeping policy* in relation to energy usage.

As KCL agreed to retain the full responsibility for energy, ELDL removed the energy saving design solutions, such as the heat recovery bundles on the chillers, from the SPS. This reduced the capital cost of the project and, thus, improved its affordability.

Solutions Analysis 5(SA)/2
The energy savings design solutions were initially $CWLC_P$ driven design solutions. However, as the responsibility for the cost of energy consumption was removed from the scope of the DBFO contract this ceased to be the case. As a result, the energy savings design solutions were removed from the HV design solution. The expert assessment identified the HV design solution as being not particularly energy efficient.

Perception Analysis 5(PA)/8
KCL agreed to retain the responsibility for energy. This was seen to have an adverse effect on the energy efficiency of the building. However, some actors acknowledge that the ProjectCo has a moral duty to exceed its contractual obligations to enable KCL to manage its energy consumption as effectively as possible.

[1] This is an example of the hold-up problem commonly described in transaction cost economics – see e.g. Williamson (1985). KCL is holding-up ELDL. It threatens to procure the project using DB procurement unless ELDL lowers its asking price. Nevertheless, the cost of aborting the project is considerable to both KCL and ELDL as they have incurred significant sunk costs in procuring and developing the project respectively.

In addition, KCL decided to exclude the refurbishment of the three small buildings on Guy’s Campus from the scope of the PFI project altogether. This was because KCL felt that the ELDL price for taking responsibility for refurbishing and, subsequently, operating those buildings for 25 years was disproportionately high. In other words, ELDL placed a high price for accepting the risk arising from the uncertainty associated with the current condition of the buildings. The demolition and redevelopment of the buildings would have increased the capital cost of the project further. Therefore, KCL decided to pursue their refurbishment using traditional procurement. This decision reduced the capital cost of KCL’s planned procurement as it retained the risk associated with the condition of the three small buildings on Guy’s Campus. This brought the PFI project closer to affordability.

It was intended that ELDL finance around £20 million of the capital cost of the project with equity and debt finance. It would have recovered the finance with interest as part of the UP. However, in the value engineering, KCL and ELDL had reduced the capital cost of the project to a level where it could be fully financed by the grants and the receipts from the surplus sites. Thus, equity and debt finance were no longer required. However, ELDL still needed to obtain bridging finance in order to make the eventual sale of the surplus sites independent of the construction of the facilities.

Incentive Analysis 5(IA)/10

As a result of value engineering, ELDL no longer had to use project finance to implement the project. Consequently, the ProjectCo actors’ incentive to improve the completion and operational certainty was somewhat weakened and the incentive to improve expenditure certainty was removed. However, the ProjectCo actors retained a fairly strong incentive to improve completion and operational certainty. This was because the DBFO contract was anticipated to have a liquidated damages clause and the UP for the operational service provision was to be performance related. In addition, a delay in completion could result in additional costs from rescheduling the repayment obligations in relation to the bridging finance.

Perception Analysis 5(PA)/9

KCL’s affordability constraint was defined in terms of capital cost. It was perceived that if ELDL could not meet the affordability constraint, the project would not be implemented. This was seen to result in significant pressure to reduce the capital cost of the project and so shift attention away from $CWLC_P$ minimisation. KCL and ELDL were seen to agree a number of solutions that reduced the capital cost but either increased the operational cost of the project and/or decreased its operational certainty.

5.5.5. Project Redefinition

In October 1997, KCL and ELDL decided to redefine the Site Rationalisation project. This was a major change in the way that the project was to be implemented. There were two aspects to the redefinition. First, the project was, from KCL's perspective, divided into two projects. One project would deal with the surplus sites. The other would provide KCL with an accommodation service. Second, KCL was to take the responsibility for obtaining the full, including bridging, finance for the project. Thus, KCL would use a design, build and operate (DBO) contract to procure the accommodation service. KCL established College Facilities Limited (CFL), a SPV that it fully owned, in order to facilitate the financing of the project and to have a single point of contact with the two interdependent projects.

ELPL established European Land (Four Surplus Sites) Limited (4SS) to take the responsibility for and risk associated with developing and eventually selling the surplus sites. The property risk was the key risk that KCL wanted to transfer to the private sector. 4SS' agreement to take the risk was crucial for the Site Rationalisation project going forward. CFL was to enter into pre-sale and sale agreements with 4SS. This case study will not focus on the development of the surplus sites. This is because 4SS undertook the project using DB procurement.

BUKL and ESL established Europland Limited (ELL) with joint ownership. The two actors invested only nominal equity in the SPV. ELL was to enter into a DBO contract with CFL to convert Cornwall House, redevelop Hunt's House and, subsequently, operate the buildings for 25 years. ELL was to place DB and operation contracts with BUKL and ESL respectively to undertake the project. This would involve ELDL novating the designers across to BUKL. The proposed contractual structure for the project is illustrated in Figure 5.7.

BUKL and ESL designed ELL to break even. Thus, ELL's shares will not pay dividend. The only cost that ELL will incur in addition to procuring the DB and operation contracts will arise from maintaining its own existence. BUKL was to have the majority shareholding (99%) over the construction phase of the project. Once all the construction-related issues have been resolved, the majority shareholding will transfer to ESL. BUKL's involvement in the project will therefore reduce considerably. BUKL and ESL agreed this arrangement to reflect their respective responsibilities in undertaking the project.

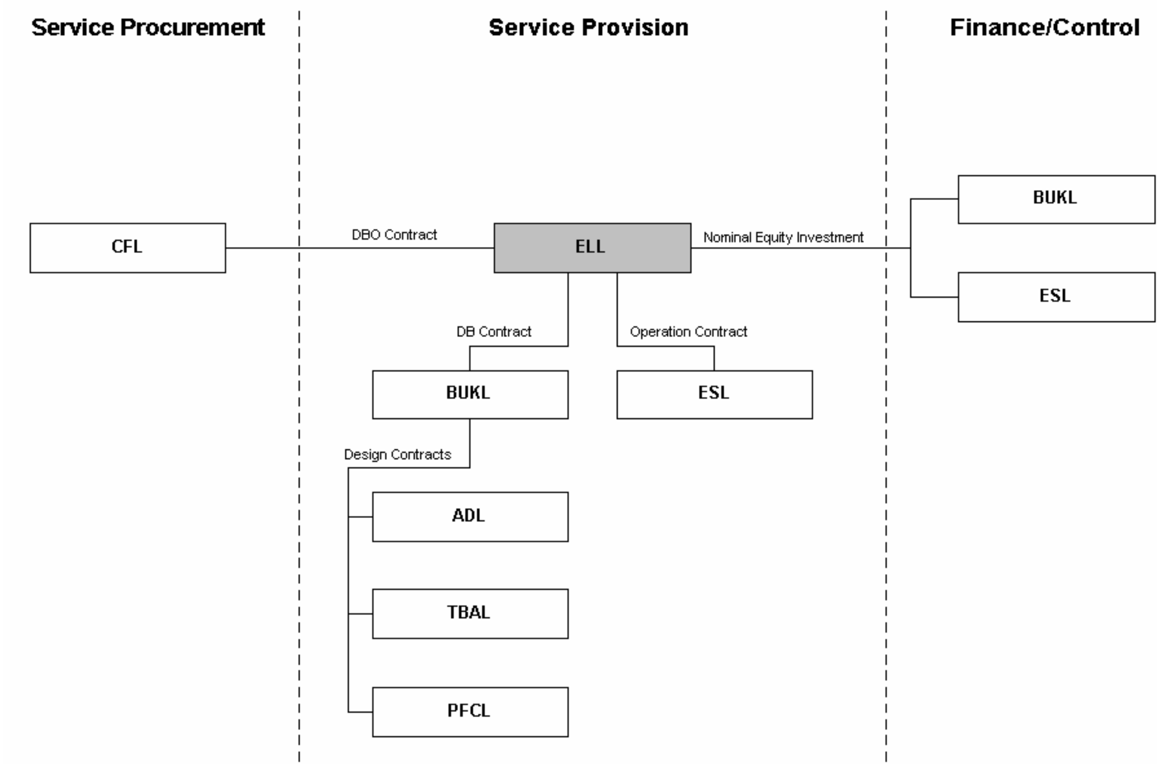

Figure 5.7. Proposed contractual structure of the key project actors after project redefinition.

Incentive Analysis 5(IA)/11
As the contractual structure for the project became apparent the ProjectCo actors' incentives changed. BUKL's $CWLC_P$ minimisation weakened and its capital cost minimisation incentive strengthened. The balance in ESL's incentive shifted from $CWLC_P$ minimisation towards operational cost minimisation. BUKL's and ESL's remaining incentive to implement $CWLC_P$ driven design solutions that resulted in increased costs to the other actor arose from the fact that such solutions would increase the profit from the project to their ParentCo.

Furthermore, ADL, TABL and PFCL were to be novated across to BUKL. As a result, the designers gained an incentive to follow BUKL's objectives in the project.

KCL felt that splitting the project into two had merit. KCL felt more comfortable with a closer relationship to Bouygues SA, which was to guarantee the DBO contract. In the case of ELL default, its contractual obligations would become those of Bouygues SA.

The project required bridging finance in order to make the construction of Cornwall House and New Hunt's House independent of the timing of the revenues from the disposal of the surplus sites. It had become apparent that CFL could obtain the finance at a significantly lower rate than ELL. This was due to KCL's strong covenant, as it would secure the loan. As a result, KCL could improve the VFM of the project if CFL obtained the finance for the period from financial close to the disposal of the surplus sites instead of ELL. KCL had this arrangement approved by HEFCE.

Incentive analysis 5(IA)/12
As a result of removing the responsibility for bringing finance out of the scope of the project, the ProjectCo actors' incentive to increase the completion certainty of the project was again slightly weakened. However, the prospect of liquidated damages meant that the incentive remained strong.

5.5.6. Negotiating the DBO Contract

The main contract to be used in the project was a DBO contract between CFL and ELL. The ProjectCo actors had spent considerable time on negotiating the details of the contract, as it was one of the first contracts of its type to be signed in the UK. The contract would have a number of specifications appended to it, which would capture KCL's requirements and ELL's proposed design, construction and operational solutions.

The DBO contract allocates the responsibility for managing the vast majority of design, construction, and operation risks to ELL. However, there are some risks that the DBO contract allocates to ELL only partially or not at all. The major risk retained by KCL is the responsibility for energy consumption. ELL was allocated only the responsibility to follow a good housekeeping policy in relation to energy usage. In addition, the contract allocates ELL the responsibility for some *force majeure* -type risks, but only up to a predefined maximum. These risks are national strikes, exceptionally adverse weather conditions, Third Party Act, changes of law that affect design and construction, demonstrations against KCL's use of the buildings (e.g. animal rights activists), unexploded bombs in Hunt's House and other adverse events or circumstances (e.g. archaeological discoveries).

KCL and ELL agreed that the DBO contract would allocate ELL the responsibility for providing the accommodation service to the standards described in the specifications appended. The two actors agreed to share the legislation risk and, thus, adjust the UP to reflect the cost implications of changes in legislation.

The agreed contract duration was 20 months for the construction phase of New Hunt's House and 25 years for the operational phase after the completion of the building. However, KCL retained the right to terminate the DBO contract either on its 15th or 20th anniversary. If KCL chooses to exercise this option, it will have to compensate ELL by a sum equalling 67½% of annual UP on the 15th anniversary and by 45% on the 20th.

Incentive Analysis 5(IA)/13
The existence of a termination clause increased the ProjectCo's and, especially, ESL's incentive to improve the operational certainty of the SPS. This was because if ELL's accommodation service provision were to be consistently of the agreed standard, KCL would be less likely to terminate the contract. However, if KCL were to do so, ELL and, consequently, ESL would lose its future revenues from the project.

5.5.7. Negotiating the Construction Aspects of the DBO Contract

Two construction specifications were appended to the DBO contract. These documents are *Client's Requirements* and *ProjectCo's Proposals*. The two documents were both based on the scheme design solution and associated construction specification developed by the ProjectCo actors. Shortly prior to financing close, the documentation was scrutinised and approved by KCL as Client's Requirements. In relation to HV, Client's Requirements outline the approaches that ELL and, thus, BUKL must adopt in providing the engineering services. The document also gives some specific requirements for the systems to be used in New Hunt's House.

As KCL worked on the Client's Requirements, the ProjectCo continued to develop the scheme design solution and associated specifications. At financial close, these more advanced documents were appended to the contract as ProjectCo's Proposals. This meant that KCL contractually approved ProjectCo's Proposals as meeting Client's Requirements. ELL agreed to have a contractual obligation to meet Client's Requirements. However, it would not be obliged to provide the solutions it outlined in ProjectCo's Proposals. The document includes descriptions of the engineering services systems to be used in New Hunt's House, but does not name specific equipment manufacturers. Thus, ProjectCo's Proposals is a more detailed document than Client's Requirements.

The environmental conditions each space in New Hunt's House is required to have are specified in the generic RDSs that are part of both Client's Requirements and ProjectCo's Proposals. ELL will need to meet these environmental conditions throughout the operational phase. TBAL was responsible for specifying the environmental conditions as part of its scheme design development. As a result, both Client's Requirements and ProjectCo's Proposals are likely to describe a HV solution that can deliver the required environmental conditions.

This case study will focus on two types of spaces in New Hunt's House, namely offices and procedure rooms. This is because these two spaces fall into two different categories of the PM – see Section 5.5.9.

There are three types of offices in New Hunt's House, which are internal, external and offices in the BSU. The office space in the BSU is excluded from further analysis, as the net floor area of that space is 18 m^2. In addition, the environmental conditions in the office space are driven by the general requirements for the BSU. All the procedure rooms in New Hunt's House are in the BSU.

ELL will be required to maintain the winter temperature in both internal and external offices at 20ºC with a 2ºC tolerance. In the internal offices the summer temperature must be tempered control. In the external offices the requirement is to maintain temperature within 1ºC of the ambient temperature. The internal offices have a requirement for 6 air changes per hour. The humidity level in the offices does not need to be controlled. ELL needs to maintain these environmental conditions from 8am to 6pm on Mondays to Fridays excluding bank holidays. Outside those hours, ELL needs to maintain the temperature above 16ºC.

The DBO contract requires the temperature for the procedure rooms to be maintained between 19ºC and 23ºC. The requirement for ventilation is 20 air changes per hour and for humidity 55% with a 10% tolerance. ELL needs to maintain these conditions at all times.

It must be noted that ELL was to pass the design and construction obligations from the DBO contract in full to BUKL using a DB contract. As a result, BUKL's contractual obligations in relation to design and construction would become identical to those of ELL.

5.5.8. Negotiating the Operational Aspects of the DBO Contract

The DBO contract was to have the FMOS appended to it. The FMOS contains the relevant performance standards for hard and soft FM services. The hard FM services are divided into building, mechanical and electrical maintenance, and Life Cycle Fund (LCF) management. The soft FM services eventually included in the project are portering, security, waste disposal, cleaning, catering, postal services, furniture management and help-desk services. Thus, in the end, the majority of the reference services and none of the variant services were agreed to be included in the DBO contract. The main reference service excluded from the project was utilities management, including energy management.

KCL and ELL spent considerable time on negotiating a mutually acceptable price for LCF management, which included the responsibility for *major* maintenance and replacement LCF components in order to keep them in the condition defined in the FMOS. *LCF components* were defined to be a set of building components, which require significant major maintenance and replacement expenditure over the life of the contract. KCL and ELL agreed that a proportion of the UP would be directed into the

LCF. ELL intended to include the responsibility for LCF management to ESL's operation contract. Thus, ESL would use the LCF to meet the cost of carrying out the required works.

KCL's procurement team estimated the probable design lives for the LCF components to be used in the buildings. Subsequently, it calculated the cost of their anticipated major maintenance and replacement. The ProjectCo continuously challenged KCL's assessment of the required expenditure. Eventually, KCL and ELL arrived at an expenditure profile that both actors were comfortable with.

KCL and ELL agreed that ESL would review the need and adjust its plans for major maintenance and replacement annually. This would include carrying out a major survey on the condition of the building every five years. ESL would submit the resulting plan for LCF works to KCL. ESL would carry out works in accordance with the plan and the cost would be met from the LCF. If the balance of the LCF were to become negative due to the need to carry out unanticipated major maintenance and/or replacement, ESL would become responsible for meeting the cost of such works.

KCL and ELL agreed that the LCF was to be a separate bank account. KCL and ESL would share the interest on the LCF every six months. At the end of the contract period, ESL would take responsibility for the balance of the LCF, whether positive or negative. If KCL were to terminate the contract prematurely, ESL would be entitled to a third of the balance of the LCF.

Incentive Analysis 5(IA)/14
As the arrangement for the LCF was agreed, ESL gained an incentive to minimise the cost of major maintenance and replacement in the DBO contract period subject to not jeopardising the operational certainty of the building because it would then be entitled to the resulting surplus in the LCF.

The DBO contract requires the HV plant and equipment to have the ability to maintain environmental conditions as outlined in the RDSs. In an emergency, ESL is required to respond within 30 minutes and restore normal or alternative service within 4 hours. Emergencies are situations where health and safety or business operations are affected, distress is being caused to occupants or buildings are being seriously damaged. ESL needs to respond to specific defects in the equipment and installations as part of its normal maintenance routine. Specific defects are not emergencies, but if not rectified, will result in the service being deemed to be underperforming.

The requirement for ventilation, re-circulation and air-conditioning systems is to deliver air at correct quantity, temperature, pressure and humidity as specified in the RDSs. The sound levels and frequencies need to be acceptable. The filters need to be clean and within the operating pressure drop levels. Ducting needs to be kept clean and have no leaks. ELL is also required to carry out Legionella checks at regular intervals. In an emergency, ELL has to respond within 30 minutes and work continuously until the situation is rectified. In such circumstances, infection control procedures need to be followed in relation to biological hazards therefore liaison with departmental managers needs to continue after the situation has been rectified. ELL may attend to specific defects during its normal routine.

It must be noted that ELL intended to fully mirror the operational aspects of the DBO contract on the operational contract it would place with ELS. Thus, ELL's operational obligations would become those of ESL. KCL has the right to have ESL replaced by ELL, if it frequently incurs UP deductions and as a result its service performance is deemed unacceptable.

Incentive Analysis 5(IA)/15
The DBO contract was to have a termination clause in relation to ESL's operation. As a result, ESL's incentive to improve operational certainty was again strengthened. This was because if its operational performance was often compromised, its operation contract would be terminated and it would lose its subsequent revenue and, thus, profit from the project.

5.5.9. Negotiating the Payment Mechanism for the DBO Contract

KCL and ELL agreed that in the construction phase CFL would pay ELL in pre-defined instalments. These instalments would be adjusted in accordance with progress on site in relation to a set of targets. The DBO contract was agreed to have a clause that would impose significant liquidated damages on ELL if it failed to complete construction on programme. ELL used exactly the same terms for payment in the DB contract it would place with BUKL.

Incentive Analysis 5(IA)/16
As the liquidated damages clause was negotiated into the DBO and DB contracts, BUKL's incentive to improve completion certainty crystallised.

KCL and ELL agreed that in the operational period ESL would monitor its own service provision performance. The monitoring service would be part of the help-desk service. If a user of New Hunt's House were to observe unsatisfactory service performance, s/he could inform the help-desk and the information would be recorded. Subsequently, ESL would attend to the problem. Once the problem had been rectified, a corresponding entry would be made.

It was agreed that ESL would report the recorded service performance to CFL every four weeks. CFL would be able to agree or contest ESL's assessment. If the assessment were to be contested, CFL and ESL would use a fast-track dispute resolution procedure that would resolve the issue within a maximum of 19 working days.

KCL and ELL agreed that CFL would make the UP quarterly in advance. Subsequently, ELL would pass the UP in full to ESL. This was because KCL had retained the full responsibility for financing the project and, thus, ELL did not have any finance repayment obligations. The UP was agreed to be performance related and, thus, ELL and, consequently, ESL could incur UP deductions. The deductions could be triggered either by underperformance or unavailability. CFL would adjust the UP according to ESL's reported performance.

KCL and ELL agreed that CFL would adjust the UP for inflation twice a year. The adjustment would be made for the hard services in accordance with the British Maintenance Industry (BMI) Index and for the soft services in relation to Retail Price Index (RPI). In addition, the UP would be benchmarked or market tested in relation to specific operational services. The UP would be market tested only if ELL had incurred UP deductions frequently. Otherwise, the UP would be benchmarked. The benchmarking or market testing will take place after years 7, 13 and 19 of the operational phase. It must be noted that a detailed procedure for carrying out either of these exercises is yet to be established. The new UP is adjusted to be the average of the current payment and the price obtained from the market. However, if the market price falls within 3% of the current price, no adjustment is made.

5.5.9.1. Underperformance

The PM breaks the operational services in New Hunt's House down into eight categories. One of the categories is operations and maintenance of M&E installations. The PM has 24 performance indicators for the service category. Each performance indicator was given a multiplier of 10, 7, 5 or 3 depending on its relative importance to KCL. The assessment observes the number of weeks in a 4-week assessment period that the service has underperformed. The total number of penalty points ELL incurs is calculated using Formula 5.1. If ELL incurs a total of 50 or more penalty points in the assessment period for operations and maintenance of M&E installations, the UP for the period is reduced by 25%. The performance indicators for offices (multiplier 5) and procedure rooms (multiplier 7) are as follows:

- Office environmental condition levels maintained within agreed response times through operation/maintenance of mechanical plant and equipment.
- Special procedure rooms (BSU) environmental condition levels maintained within agreed response times through operation/maintenance of mechanical plant and equipment.

$$PP_{M\&E} = \sum_{p=1}^{p=8} (m_p \times w_p) \tag{5.1}$$

where, $PP_{M\&E}$ is the total number of penalty points incurred for operations and maintenance of M&E installations,
p is the performance indicator,
m_p is the relative importance multiplier of p, and
w_p is the number of weeks of observed underperformance in p in a four week period.

If ESL incurs a UP deduction due to underperformance, but performs according to standards for a considerable period of time following the deduction, it is able to reclaim up to 75% of the deduction.

Incentive Analysis 5(IA)/17
The existence of a reclaim procedure for UP deductions strengthened ESL's incentive to improve operational certainty. This was because it would be able to recover lost revenue and, thus, profit it had lost, if it was able to operate the building to the agreed standards for a period of time following the deduction.

5.5.9.2. Unavailability

A UP deduction can be also be caused by unavailability. This is a state where the facilities simply cannot be used. Unavailability deduction is calculated using Formula 5.2 taking into account the proportion of unavailable floor area, the proportion of unavailable normal working hours in the 4-week period and the relative importance of the facilities in the area where unavailability occurred. The relative importance of the facilities to KCL was expressed as a percentage factor. New Hunt's House was divided into six types of facilities for this purpose. The sum of the percentage factors for these facilities equals one. The percentage factor for offices is 5% whereas for the animal unit, including the procedure rooms, it is 25%. If unavailability were to occur, ELL would be obliged to provide KCL with alternative accommodation at its own cost.

$$UDP = \sum_{f=1}^{f=6} (x_f \times a_f \times h_f) \qquad (5.2.)$$

where, *UDP* is the percentage of unavailability deduction in the UP,

f is the facility type,

x_f is the percentage factor of relative importance of f,

a_f is the percentage of f floor area where unavailability occurred, and

h_f is the percentage of normal working hours that the unavailability in f occurred for.

Incentive Analysis 5(IA)/18

As the details of the mechanism for calculating underperformance and unavailability deductions were revealed, the ProjectCo actors' incentive to improve operational certainty of the building gained different strengths in its different areas. This was because the deductions for the areas would be of different sizes. As a result, the ProjectCo actors' pursuit of their other objectives, such as $CWLC_P$ minimisation, was less influenced by the incentive to improve operational certainty in the office areas than in the areas of the BSU where the procedure rooms were located.

Perception Analysis 5(PA)/10

The UP is performance related. Some actors felt that this lead to increased operational certainty of the SPS. However, others felt that a more detailed analysis of the PM would have led to a design solution that would have provided an even greater level of operational certainty. In addition, some actors felt that the PM had not influenced the design development directly. It was also felt that the PM did not always make it clear what might result in a UP deduction.

5.5.10. Financial Close

The difficult negotiations leading to financial close delayed the project considerably. Nevertheless, KCL would not postpone the operational dates for the two buildings. This was because it needed to have the facilities available for the start of the academic year in September 1999.

The financial close took place in December 1997. The financial close for the 4SS and ELL projects and the signing of all the associated contracts took place simultaneously. The DBO project closed based on the organisational structure devised at project redefinition and illustrated in Figure 5.7. CFL took out a loan against the eventual receipts from the surplus sites and used it to finance the construction of the buildings. This loan was to be repaid once the surplus sites were vacated and bought by 4SS. CFL paid ELDL approximately £10 million for developing the SPS until that point. In effect, this transaction terminated ELDL’s existence. ELL signed the DBO contract on Cornwall House and New Hunt’s House with CFL. The capital value of the project was around £100 million. This included the £10 million, which KCL paid to ELDL. Approximately £40 million of the total capital cost can be attributed to the capital cost of New Hunt’s House. The value of the operational service provision is around £4 million annually for the two buildings for 25 years.

Perception Analysis 5(PA)/11
ELL was awarded a DBO contract with a 25-year operational period. The integration of the responsibilities for design, construction and long-term operation, including LCF management, was seen to enable the ProjectCo to pursue $CWLC_P$ minimisation by providing durable and cost effective solutions for the operational phase.

ELL signed DB and operation contracts with BUKL and ESL respectively. The designers that had worked for ELDL were novated across to and signed contracts with BUKL. At financial close, BUKL also gained the ownership of and responsibility for the design solutions developed until that point in time. In addition, once KCL felt that financial close was imminent, it had hired a demolition contractor to dispose of Hunt’s House. At financial close, the demolition work carried out on Hunt’s House became BUKL’s responsibility and the contractor was novated across to BUKL. As BUKL took responsibility for project management, the involvement of Mace in the project ended.

BUKL and ESL also signed a contract between themselves. The contract stipulated that BUKL would compensate ESL, if it incurred UP deductions due to the quality of design and/or construction.

Opportunity Analysis 5(OA)/7
As the contractual framework was put into place, ESL’s opportunity to implement $CWLC_P$ was reduced. This is because BUKL was responsible for and, thus, had the authority to take the decisions in detail design development and construction. ESL did not have the right to veto the solutions if they met the construction specifications. If ESL wanted to implement $CWLC_P$ driven design solutions that increased capital cost, it would have to compensate BUKL for their implementation. It must be note that BUKL had the opportunity to implement $CWLC_P$ driven design solutions, but did not have the incentive to do so – see 5(IA)/19

Incentive Analysis 5(IA)/19
Once the contracts had been signed, the incentives of the ProjectCo actors crystallised. BUKL had an incentive to minimise the capital cost of the project (see 5(IA)/11) subject to not compromising the completion certainty (see 5(IA)/16) and operational certainty to a degree where it would have to compensate ESL for UP deductions.

ESL had an incentive to minimise operational cost and implement $CWLC_P$ driven design solutions if they reduced operational cost – see 5(IA)/11&14. However, it also had an incentive to improve operational certainty – see 5(IA)/13&15&17&18.

As ADL, TBAL and PFCL were novated across to BUKL, the designers gained an incentive to follow BUKL's objectives.

ELPL is a property developer. It had been interested in the project due to the potential profits to be made from the development of the surplus sites. Consequently, ELPL continued to pursue its interest as an owner of 4SS. However, KCL also appointed ELPL to monitor the construction phase on its behalf. This is because ELPL had a detailed understanding of the design and construction solutions for the project and KCL trusted ELPL.

5.6. Implementation Stage

5.6.1. Detail Design Development

After financial close, Cornwall House conversion and New Hunt's House redevelopment proceeded virtually as two separate projects. The projects had independent design and construction teams and procurement strategies.

BUKL had twenty months to redevelop New Hunt's House. The anticipated time at the issue of ITND had been 32 months. This period of time had decreased due to difficulties in reaching financial close. The design solution for New Hunt's House had yet to proceed to detail design development. The lack of time forced the BUKL to run detail design development and construction in parallel from financial close onwards.

Opportunity Analysis 5(OA)/8
The construction programme for the project was extremely tight. In addition, the scheme design solution had been agreed with KCL and Southwark Planning. Significant design changes would have required the ProjectCo to enter into negotiations the client and the planning authority. This limited the opportunity the ProjectCo had to explore potential $CWLC_P$ driven design solutions. It had to focus on completing the design solution, as a delay would result in liquidated damages.

Perception Analysis 5(PA)/12
The programme for the completion of New Hunt's House was extremely tight. This was perceived to discourage the implementation of $CWLC_P$ driven design solutions as design changes were seen to increase the risk of delay in completion.

BUKL took a strong management role in detail design development. BUKL's brief involvement prior to financial close had allowed it to comment on the scheme design. However, it was not until financial close that BUKL gained the authority to take decisions on the design. Consequently, BUKL committed additional resources to design development. After financial close, the design team resumed work from separate locations.

BUKL began the detail design development with a comprehensive risk assessment. This included the assessment of the risks during construction, at commissioning and in the operational period. The risk assessment formed the basis for the detail design development. The assessment concluded that the detail design solution should be kept simple in order to make commissioning easy, to minimise the risk of UP deductions and to make maintenance cost efficient.

BUKL would have preferred to change the brick that was used in New Hunt's House because it could have sourced a similar brick through its procurement channels from continental Europe for a better price. However, a specific brick had been approved by the planning authority and, thus, could not be changed within the given programme.

The project had a specific design development procedure. The KCL's team approved the detail design as BUKL's and the designers produced it. A specific set of design documents needed to be submitted to KCL for approval after which they became part of ProjectCo's Proposals. The HV design documents that required approval were 1:50 plan and section drawings, final RDSs and plant specifications. BUKL could submit other documents to KCL for comments that would enable the design to progress. However, KCL's approval of those documents would not reduce ELL's obligation to meet the Client's Requirements.

BUKL and ESL worked intensively to align the detail design, construction and operational solutions as well as the FMOS. The specification that had been appended to the DBO contract was not to be the final version of the document. KCL had agreed to review the document to enable ESL take account of the detailed design solution.

In detail design development, BUKL relied on the expertise of its designers but retained the control and responsibility for their decisions. BUKL took the majority of the design decisions based on its previous experience and did not carry out formal WLC assessments before making them. BUKL distributed the detail design solutions completed among the ProjectCo actors, namely ADL, TBAL, PFCL and ESL. They had ten days to raise their concerns on the solution. The actors would discuss the issues raised in the weekly design meetings.

ESL assessed the detail design solution as it was produced. This was crucial, as the design would determine the way that it would provide some of the operational service.

For example, the quality of the air-handling units would affect the amount of minor maintenance, major maintenance and replacement ESL needed to undertake. ESL assessed the design solutions for their robustness in operation. It wanted to ensure that the solutions would be durable for the 25-year operational period because a failure could result in a UP deduction and/or increases in operational costs for which ESL would be liable. As part of its design assessment, ESL highlighted aspects of the design that were subsequently discussed in the weekly meetings. For example, ESL was to be responsible for cleaning and maintaining the internal finishes and therefore it wanted to have washable paint in the public areas of New Hunt's House.

BUKL's objective in detail design development was to minimise the capital cost of the project in order to improve the profit it would make from the project. However, it did not want to disregard ESL: its SisterCo had the responsibility to operate the building for 25 years. BUKL tried to take decisions that would be cost efficient for ESL. It upgraded the design and increased capital expenditure slightly, if ESL could demonstrate significant operational cost savings. ESL was unable to contractually challenge BUKL on design aspects that compromised its operation, but met Client's Requirements. If BUKL and ESL could not reach an agreement on a solution in the design meetings, the issue would be referred to the ELL board. However, this rarely happened. ESL could not get involved in all of the construction details due to the time constraints and the limited resources it had available for the project. ESL would have preferred to examine the design more carefully as it felt that some design solutions had more potential for operational cost savings.

Perception Analysis 5(PA)/13
BUKL and ESL were seen to have a conflict of interest, as they were to make their profits from the DB and operation contracts respectively. This discouraged the implementation of $CWLC_P$ driven design solutions. The fact that BUKL and ESL had the same ParentCo was seen to prevent BUKL from only pursuing capital cost minimisation. However, some actors felt the ESL could not prevent BUKL from implementing solutions that increased operational cost. It was also acknowledged that on subsequent projects BUKL and ESL have learned to pursue $CWLC_P$ minimisation together.

BUKL did not make its capital cost assessment of the detail design solution explicit. The designers were not aware of the cost implications of their design choices even if BUKL had assessed them formally. BUKL relied on ESL to assess the operational cost implications of the design and suggest changes if necessary. ESL carried out formal operational cost assessments on the detail design, but it did not make these explicit either. ESL saw this information as a source of its competitive advantage because at the time good quality WLC information was not readily available. As a result, it was difficult for the designers to understand what type of design solution would be the most preferable for operation. However, as ESL was developing its detailed operational solution, it was confident of the information and tools it used to estimate the operational cost.

Perceptions Analysis 5(PA)/14
The roles for cost analysis in the project were seen to be clear. BUKL was responsible for the capital cost and ESL for the operational cost analysis. The designers were seen to provide BUKL and ESL with information to enable them to analyse capital and operational costs. The two actors did not share their cost analyses with the other ProjectCo actors. This was felt to discourage the implementation of $CWLC_P$ driven design solutions. ESL was comfortable with the tools and information it used to analyse operational cost.

The KCL Site Rationalisation project was BUKL's first project in the UK after its long absence from the market. Therefore, BUKL lacked some knowledge on the planning and building regulation issues. It relied on ADL for this expertise. BUKL would offer products or alternative solutions to ADL's in order to either reduce capital cost or improve quality. ADL assessed the products or solutions and gave advice. The products sourced outside the UK did not necessarily have UK building standard approval. Occasionally, BUKL chose to proceed with certain products against ADL's advice and to challenge authorities.

ADL's role also included the inspection of the production drawings prepared by BUKL and its subcontractors to ensure that everything was properly coordinated. Once ADL approved the drawings, the subcontractors were given permission to proceed on site.

During detail development, ELL held a number of consultation meetings with the future users of the building. KCL had been determined not to issue any variation orders after financial close. However, the pioneering use of an OS led into some misunderstandings and omissions that were discovered in the meetings. After financial close, the users' needs had also changed. If a need for a variation were identified, KCL would assess whether it could function without it. If it could not, it would issue a variation order. In the end, KCL issued around 100 variation orders. BUKL did not see merit in variations and did not actively pursue them. It felt that the project was adequately challenging without the variations.

The user meetings also dealt with the laboratory equipment design that had to be approved by the users of the building, namely heads of the departments to be housed in New Hunt's House. This limited ELL's influence on the solutions. KCL was in a strong position due to its understanding of the equipment. The laboratory equipment had not been subject to any value engineering prior to financial close as medical research was one of the core services to be provided in New Hunt's House.

5.6.2. Construction

The construction of New Hunt's House was unproblematic. BUKL completed the building on programme and KCL occupied New Hunt's House in September 1999 as anticipated.

The KCL's consultants and ELPL monitored BUKL's construction performance in the project. This included assessing whether BUKL was meeting its contractual obligations in relation to quality and whether it was likely to complete the building on programme. The monitoring also formed a basis for CFL's payment ELL, which it passed on to BUKL. In addition to this, ESL overviewed the quality of construction. It wanted to prepare itself for the operational phase by increasing its understanding of the building.

BUKL used the existing procurement channels of Bouygues SA extensively to place contracts with material suppliers and subcontractors outside UK. As a result, the majority of the labour on site was foreign. For example, the building services contractor on New Hunt's House was Sousa Pedout, which was a Franco-Portuguese company no longer active in the UK.

New Hunt's House is generally perceived to be an impressive building. ADL's model of the building is pictured in Figure 5.8. New Hunt's House is not significantly dissimilar to conventionally procured higher education buildings in the UK of the same time period. However, the international involvement in the project contributed to the alternative flavour of the building. First, some of the architectural design was carried out in ADL's offices in the United States where the company has extensive experience in medical research and higher education design. Second, BUKL used its ParentCo's procurement channels across the globe, especially continental Europe, to place contracts with material suppliers and subcontractors.

5.6.3. Commissioning and Operation

New Hunt's House was commissioned in August 1999. KCL issued a snagging list at commissioning. ESL was involved in commissioning in order to ensure that the installations could be used to deliver the standard of performance outlined in the FMOS. At commissioning, BUKL and ESL agreed that ESL would resolve the remaining construction issues on the snagging list. This obligation was accompanied with financial resources. At this point, BUKL's day-to-day involvement in the project ended.

Figure 5.8. New Hunt's House from the West (ADL, 2001).

The operational phase started on the first day of the calendar month after occupation. New Hunt's House was occupied in September 1999. Thus, the operational period will run for 25 years from 1st of October 1999. By September 2001, all of the items on the snagging list had not been fully settled. As a result, ELL had not transferred to ESL's majority (99%) ownership.

Once KCL moved into New Hunt's House and Cornwall House, renamed Franklin-Wilkins Building, it vacated the three surplus sites in West London. Consequently, 4SS purchased them. This enabled CFL to repay the bridging finance it had taken out against the sites.

As New Hunt's House was occupied, the end users raised several issues. They felt that the building did not correspond to the needs that they had communicated to KCL's team and ELDL. This meant that ESL had to check the specifications and see whether the ProjectCo had missed something in design development. If it had, it was classified as *design development* and subsequently rectified. However, if it was a specification failure by KCL's team, it was classified as a potential *variation*. KCL would finance variations if it chose to implement them. Some additional requirements resulted from the downgrading of the specifications in value engineering without informing the users.

The variations that KCL chose to implement made it necessary for KCL and ELL to re-negotiate some of the contractual details. This occurred because additional equipment installed in the building increased the need for minor maintenance, major maintenance and replacement in the contract period.

In the early years of operation, ESL has encountered some difficulties in relation to temperature control in New Hunt's House. In some areas, mainly the naturally ventilated external offices, it has not been able to keep within the temperature parameters during midsummer days. As a result, the specification documents have been subject to a considerable debate. For example, it is not clear what constitutes failure. Does ESL incur a penalty point if a single office is outside the temperature parameters on one given day of a midsummer week? However, by April 2002, ESL had yet to incur a UP deduction for New Hunt's House.

Perception Analysis 5(PA)/15
The relationship between KCL and the ProjectCo actors throughout the project development was seen as a partnership. The nature of the relationship was perceived to enable the actors to agree the implementation of mutually beneficial solutions leading to financial close and, thus, overcome the affordability problem. In the operational phase, the partnership was felt to allow the negotiation of precise interpretations of the controversial aspects of the DBO contract.

Other specification problems have also appeared. For example, the specifications defined the use of the building as from 8am to 6pm on weekdays excluding bank holidays. In reality, New Hunt's House is occupied 7-days a week and 24-hours a day. This increases the use of the building and, therefore, the need to provide operational services. ESL is providing HV to some areas of the building outside the specified hours, which it is not contractually required to do. As a result, ESL will have to replace some of the HV plant sooner than anticipated.

ESL had formed a close working relationship with KCL during the first three years of the operational phase. ESL also provides KCL with operational services that are outside the scope of the DBO contract. ESL invoices KCL directly for such services. An example of this type of service is extra security for a high profile visit.

5.7. Concluding Remarks

KCL Site Rationalisation project was one of the very first accommodation service PFI projects procured in the UK. As a result, the procurement and the development of the project included a considerable amount of learning. KCL used a DBO instead of a DBFO contract to procure the project. Consequently, the KCL Site Rationalisation project is not an example of a true PFI project.

The *solutions analysis* discovered that the HV solution of New Hunt's House did not include a single $CWLC_P$ driven design solution. During scheme design development a solution that would have reduced energy consumption in the building and, thus, $CWLC_P$ was part of the HV solution. However, as KCL subsequently agreed to retain energy risk, the solution was removed.

The *incentive analysis* revealed that the ProjectCo had an incentive to implement $CWLC_P$ driven design solutions in SPS development. However, the incentive was increasingly weakened by other incentives as the project progressed. First, as a result of the project's financing arrangements, KCL's affordability constraint was defined in terms of capital cost instead of its annual expenditure on the UP. This gave the ProjectCo an incentive to minimise $CWLC_P$, subject to being able to meet KCL's affordability constraint. In reality, this translated into a capital cost minimisation incentive. Second, the SPV placed separate DB and operation contracts to undertake the project. This gave the contractor and the operator, once introduced to the project, an incentive to minimise the capital and operational costs independently. Third, the DBO contract had a liquidated damages clause giving the ProjectCo an incentive to improve completion certainty. Fourth, the operation was subject to UP deductions and possible termination, if the service provision was found to be unsatisfactory. This gave the ProjectCo an incentive to improve operational certainty. Fifth, the UP was to be benchmarked or market tested in the operational phase. As a result, the ProjectCo would potentially lose any efficiency gains obtained by implementing $CWLC_P$ driven design solutions after the first round of market testing.

The *opportunity analysis* established that the ProjectCo was able to implement $CWLC_P$ driven design solutions. However, this opportunity was somewhat limited. First, the opportunity was constrained by KCL's capital cost affordability constraint. Second, the contractor and the operator did not become ProjectCo actors until the scheme design solution was nearly completed. As a result, the ProjectCo was unable to benefit from their expertise in the SPS development until the major design decisions had already been taken. Third, as soon as the contractor and the operator were introduced to the project, they began to set themselves up for undertaking the DB and operation contracts respectively that they were going to be awarded at financial close. Fourth, once the contractual framework was put into place, the ProjectCo's opportunity to minimise $CWLC_P$ was further diminished. This was because the majority of $CWLC_P$ driven design solutions would have required the contractor to increase its capital expenditure on the project without being able to access any of the resulting profits in the operational phase.

The *perception analysis* verified the findings of the incentive and opportunity analyses. In addition, it established that the scarcity of good quality cost data and the ProjectCo actors' reluctance to share the available cost data had an adverse effect on the implementation of $CWLC_P$ driven design solutions. Furthermore, it revealed that the lack of previous experience of PFI development was seen to divert attention away from $CWLC_P$ minimisation.

The HV solution of New Hunt's House will not result in $CWLC_P$ reductions as hypothesised. However, New Hunt's House was completed on time. In addition, by March 2002, the operation of the building had yet to be compromised to the extent that would have triggered UP deductions. Therefore, it must be concluded that the ProjectCo's incentives to improve completion and operational certainty of the building were effective. It must also be acknowledged that the procurement and development of the KCL Site Rationalisation project without prior experience of accommodation service PFI projects was a major accomplishment in itself.

Chapter 6 - UCLH Gower Street Redevelopment Project

6.1. Introduction

This chapter explores the University College London Hospitals NHS Trust (UCLH) Gower Street Redevelopment project. The analysis of the project development has four focus areas. First, the chapter examines the *incentives* the ProjectCo had in the project development process to implement contract whole life cost ($CWLC_P$) driven design solutions. Second, it highlights the *opportunities* the ProjectCo had to implement such solutions. Third, the chapter explores the forces in the development process that in the *perceptions* of the ProjectCo actors either encouraged or discouraged the implementation of $CWLC_P$ driven design solutions. Fourth, it identifies the $CWLC_P$ driven design *solutions* incorporated in the heating and ventilation (HV) solution of the new hospital.

This chapter contains incentive analysis (IA), opportunity analysis (OA), perception analysis (PA) and solution analysis (SA) boxes. The analysis boxes present the conclusions drawn from the project development process. A simplified process protocol map that illustrates the project development process is attached as Appendix V. Actor-role matrixes that highlight the differences between traditional and PFI development processes are attached as Appendix VI. The simplified process protocol map and the actor-role matrixes provide supporting material for the incentive and opportunity analyses. Storyline maps that capture the experiences of the individual actors involved in the project are attached as Appendix VII. The relationships between the PA boxes and the storyline maps are detailed in Appendix VIII. See section 4.8 for guidance to reading the appendices.

6.2. Background

6.2.1. Introduction of UCLH

UCLH is one of the largest NHS Trusts in the UK. It provides acute and surgical services locally and specialist services nationally. In the financial year ending March 2002, UCLH's turnover was £312 million. It had around 391,800 outpatient attendances, 31,200 planned admissions and 9,400 accidents and emergency (A&E) admissions. In December 2002, UCLH consists of the following eight specialist hospitals that are all located in either the London Borough of Camden or the City of Westminster:

- University College Hospital (UCH),
- Hospital for Tropical Diseases (HTD),
- Middlesex Hospital (MH),
- Elizabeth Garrett Anderson and Obstetrics Hospital (EGA),
- Eastman Dental Hospital (EDH),
- National Hospital for Neurology and Neurosurgery (NHNN),
- Heart Hospital (HH), and
- Royal London Homeopathic Hospital (RLHH).

UCLH is also one of the best performing hospitals in the UK. In July 2002, the Department of Health (DoH) awarded UCLH a top rating of three stars in its performance assessment. The rating acknowledged a consistently high standard of performance across DoH's assessment indicators. In addition, UCLH is an important centre of medical education and research. Together with the Royal Free and University College Medical School, it has an international reputation as a centre of academic excellence. The medical school is a faculty of University College London (UCL). It has existed in its current form since August 1998 when UCL's University College Medical School (UCMS) merged with the Royal Free Medical School.

6.2.2. Early History of UCLH

The history of UCLH began in 1834 with the establishment of University College Hospital (UCH). However, at the time, UCH was called the North London Hospital. UCL was founded in 1824, but it failed to reach an agreement with Middlesex Hospital (MH) to use its facilities for medical education. This dispute led to the creation of UCH. In 2002, UCH provides A&E services locally and specialist services nationally. UCH, for example, houses the largest bone marrow transplant programme in the UK. UCH is located on Grafton Way, primarily in Cecil Fleming House and the Rosenheim Wing – see locations D and F respectively in Figure 6.1.

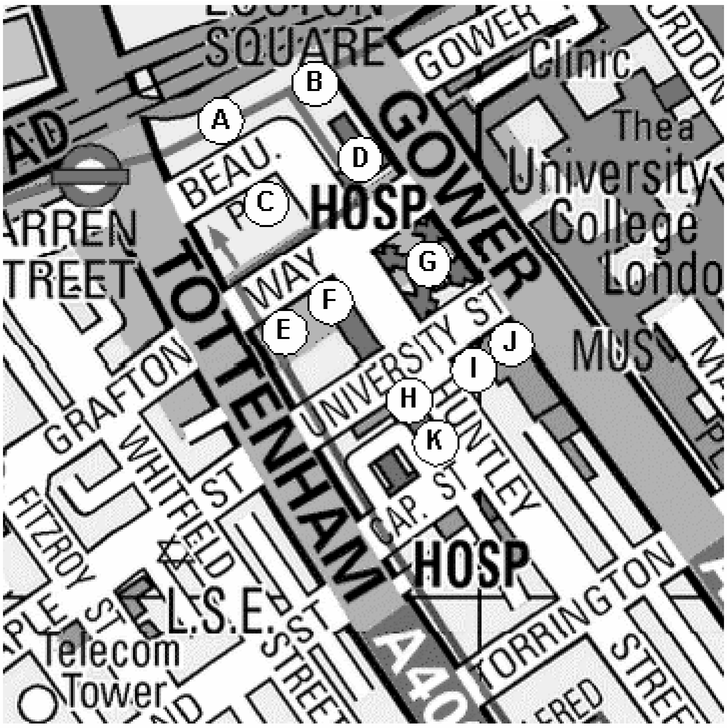

Figure 6.1. UCLH's buildings in the UCH locality.

In 1948, the Hospital for Tropical Diseases (HTD) became part of UCLH. Currently, the HTD is a national centre for the diagnosis and treatment of tropical diseases such as malaria. The hospital is based on Capper Street in the UCH locality – see location K in Figure 6.1.

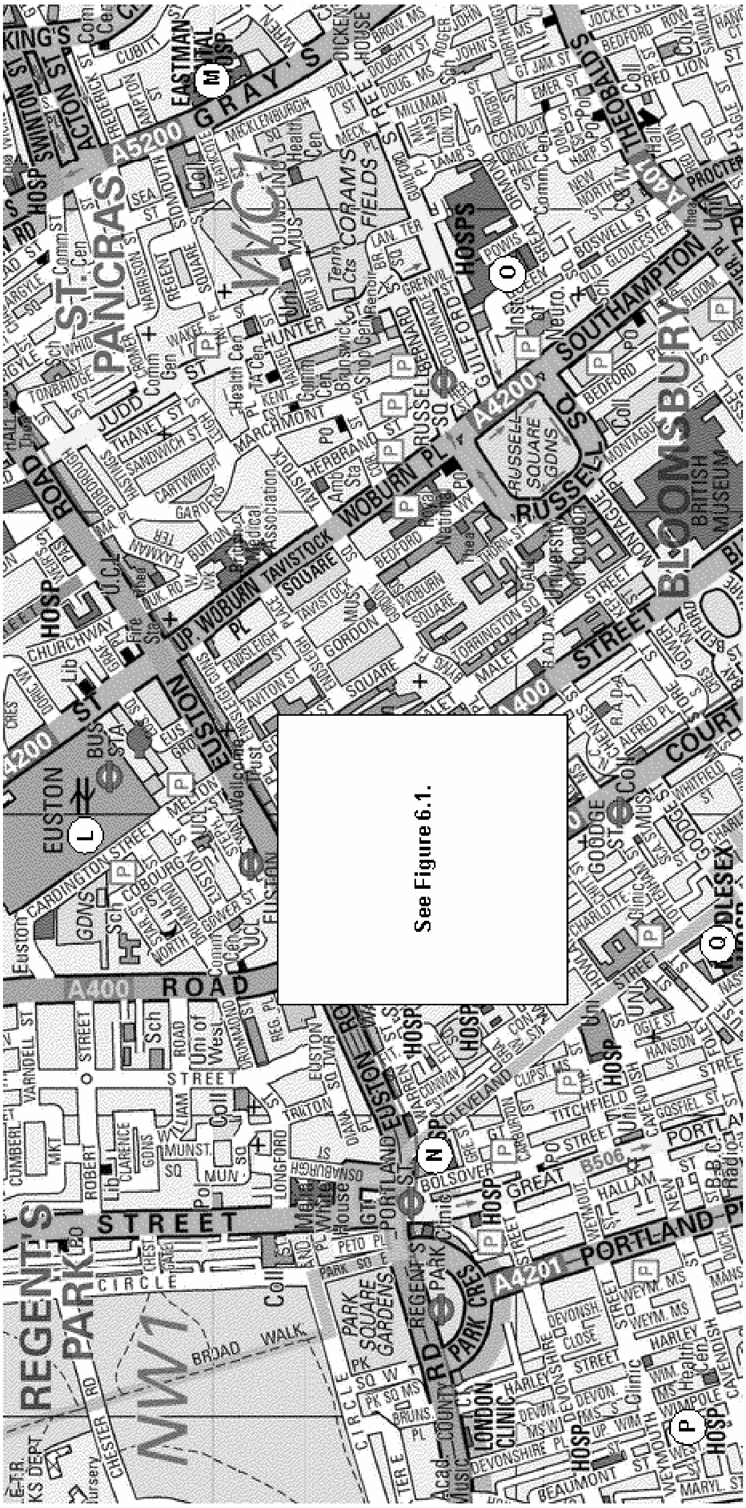

Figure 6.2. Key locations in Central London.

The MH was founded in 1745. Therefore, it is the oldest of UCLH's current hospitals. In 1982, as a result of an NHS reorganisation, MH and UCH began to be managed as a single hospital. Consequently, in 1983, the overlapping activities of the two hospitals were rationalised. At the moment, MH provides surgical, adolescent, and paediatric services. It houses a wide variety of diagnostic and therapeutic facilities and outpatient clinics. MH is situated on Mortimer Street in a number of buildings – see location Q in Figure 6.2.

6.2.3. History of the Redevelopment Project

In the early eighties, UCLH consisted of UCH, HTD, MH and a number of smaller hospitals that in 2002 are part of UCLH's existing hospitals. At the time, all of UCLH's hospitals were housed in old buildings scattered around Central London. UCLH's facilities were compromising its efficiency in healthcare provision. UCLH had to transport clinical staff and patients between hospital buildings in giving and receiving treatment respectively. As a result, it had to duplicate some facilities required for healthcare and support services. In addition, some of the buildings were unsuitable for modern healthcare provision because of their age. It was evident that UCLH needed to improve its facilities.

After the 1983 rationalisation of UCH's and MH's activities, UCLH began to plan for a major upgrade of its facilities. In 1989, it proposed a new hospital to be built above Euston Station – see location L in Figure 6.2. The proposal was approved in principle. However, in August 1993, in the aftermath of the publication of the Tomlinson Review on healthcare provision in London, an updated version of the project proposal was rejected. Tomlinson (1992) recommended that UCLH should retain its A&E services at UCH, integrate UCH and MH, and further deepen its already excellent relationship with UCMS. As a result, UCLH was instructed to explore further alternatives to rationalise and modernise its facilities. Accordingly, it began to compile an Outline Business Case (OBC) for an investment to improve its existing accommodation in line with Tomlinson (1992).

In 1994, during the preparation of the OBC, Elizabeth Garrett Anderson Hospital joined UCLH. The trust integrated the hospital with its existing Obstetrics Hospital. As a result, it formed the Elizabeth Garrett Anderson and Obstetrics Hospital (EGA). The hospital caters for female patients. It houses gynaecology, maternity, neonatal and fetal medicine services. As a result of the expansion, UCLH redefined the scope of its planned rationalisation and modernisation project. In 2000, following the financial close of the PFI project, EGA in its entirety was relocated to the Huntley Street in UCH locality – see location H in Figure 6.1.

6.3. Procurement Preparation Stage

6.3.1. Making the Case for Procurement

In late 1993, UCLH began to assemble the OBC to justify the rationalisation and modernisation of its facilities. Initially, UCLH projected the demand for its healthcare provision. Subsequently, it set out to evaluate eight alternative accommodation strategies that could meet the anticipated demand. UCLH appointed an architect to develop concept design solutions for the accommodation strategies and a cost consultant to estimate the costs of implementing each of the strategies.

The eight accommodation strategies combined newly built, redeveloped and refurbished facilities in alternative ways. The strategies fell into three categories of centralised (3), twin-site (4) and multi-site (1) accommodation. The three alternative centralisation strategies integrated accommodation into UCH, MH and Queen Square (see location O in Figure 6.2) localities respectively. The four possible twin-site strategies combined buildings on two of these three localities in alternative permutations. The multi-site strategy assumed the continued use of UCLH's existing accommodation and, therefore, did not involve the construction of new buildings.

Subsequently, UCLH evaluated the eight accommodation strategies. First, it assessed their comparative financial costs and benefits in terms of net present value (NPV) of the relevant capital and operational cost expenditures and cost savings in healthcare provision. Second, it evaluated the non-financial net benefits each of the strategies would generate. UCLH used a weighted point scoring system adopted from NHS Estates (1994). It used the system to award points to the accommodation strategies in three categories of healthcare provision, education and research. Healthcare provision was given 60% of the total points. Education and research were allocated the remaining points in equal share. UCLH perceived that the point allocation reflected its case for procurement.

Based on the evaluation, UCLH concluded that the centralisation of its accommodation into the UCH locality would yield the most overall benefits. The strategy would deliver only marginal financial benefits in comparison to the next best strategy. However, it would yield substantially more non-financial benefits than the next best strategy. UCLH perceived that the proximity of UCMS in the Cruciform Building on Gower Street (see location G in Figure 6.1) was a major non-financial benefit of the strategy.

The strategy to centralise UCLH's accommodation into the UCH locality was known as the 4Box Solution. This was because its implementation would include construction work on four buildings. First, the Rosenheim Wing would be demolished and replaced by a new hospital that would be built on the vacated site and the adjacent Odeon Car Park – see location E in Figure 6.1. Second, Cecil Fleming House would be refurbished and extended to utilise the open spaces on the site. This would increase the size and the flexibility of the building. Third, the Obstetric Hospital on Huntley Street (see location H in Figure 6.1) would be refurbished. Fourth, the Rockefeller Building on University Street (see location J in Figure 6.1) would also be refurbished. Underground tunnels would be used to connect these four buildings.

In December 1994, UCLH completed the OBC that made the case for the implementation of the 4Box Solution. In September 1995, after a public consultation period, the NHS Executive approved the OBC.

6.3.2. Procurement Preparation

At the time the OBC was approved, it was compulsory for all NHS Trusts to explore the use of PFI as a procurement method. Accordingly, UCLH began to prepare itself for the procurement of a design, build, finance and operate (DBFO) project. It started to assemble the Invitation to Negotiate Documentation (ITND). UCLH intended to develop the documentation to include information on:

- UCLH and its future,
- the bid submission procedure,
- the bid evaluation methodology,
- UCLH's obligations to provide accommodation for UCMS,
- the mandatory design requirements, i.e. references to relevant design guidance documents,
- UCLH's existing properties,
- UCLH's output-based service requirements, i.e. Facilities Management Output Specification (FMOS),
- the Public Sector Comparator (PSC) project and its intended development, and
- the draft contractual terms.

At the time, established models of ITND did not exist. Therefore, UCLH had to invest considerable resources into compiling the documentation.

UCLH intended to develop the ITND to call for the private sector to submit fully priced service provision solution (SPS) proposals. The private sector was to present the price of their solutions as a unitary payment (UP). The solutions would need to deliver a high quality centralised accommodation service adequate for UCLH's anticipated volume and diversity of healthcare provision for a period of 40 years. In addition, the SPSs would need to house UCMS's facilities at MH and deal with the properties that the project would make surplus to UCLH's requirements. The SPSs would need to include a specific set of operational services defined as the *reference services*. However, the

ITND would give the private sector an opportunity to submit variant proposals. The ITND would not specify the sites where the accommodation service was to be provided.

UCLH intended to use the 4Box Solution as its PSC project. This was because at the time the 4Box Solution was its preferred strategy to solve its accommodation needs. UCLH intended to include the design and operational solutions of the 4Box Solution in the ITND as a point of reference. In addition, it intended to produce and include draft operational policies for healthcare provision specific to that solution. These polices would be revolutionary as they would incorporate a shift from treating patients according to departmental specialities to treating them according to their clinical needs and dependencies. At this stage, UCLH anticipated that the new hospital facilities would have 537 acute and 60 low dependency beds.

UCLH intended to develop the ITND to include a bid evaluation methodology that would be used to assess the SPSs for their financial and non-financial costs and benefits. The financial evaluation would consist of value for money (VFM) and affordability assessments. The VFM evaluation of the SPSs would be done in terms of NPV against the PSC project. The affordability evaluation would be carried out in terms of UP against UCLH's annual expenditure constraint. UCLH intended to make its annual affordability constraint explicit in the ITND. In both VFM and affordability evaluations, UCLH would account for the different risk profiles of the SPSs and the PSC project. The non-financial evaluation of the SPSs would be done using the same weighted point scoring system that UCLH had used in the OBC. In addition, UCLH would evaluate the SPSs in relation to their proposed risk allocation to ensure that the project would remain off UCLH's balance sheet.

6.4. Bidding Stage

6.4.1. Prequalification

In October 1995, shortly after the OBC had been approved, UCLH alerted the market of its intention to procure a PFI project by issuing a Prior Information Notice (PIN) in the Official Journal of European Communities (OJEC). Subsequently, in the same month, UCLH initiated the formal procurement process by issuing an Expression of Interest (EoI) notice in the same publication. In November 1995, UCLH held a project launch session for the industry. Over a hundred delegates attended the session.

Subsequently, UCLH organised a prequalification briefing session where the actors interested in the project were provided with a Prequalification Questionnaire (PQ) and a Memorandum of Information (MoI). The PQs were accompanied with guidance documentation on making prequalification submissions. The MoI contained background information on the project. UCLH intended to use a two staged prequalification process.

In the first stage, it would assess the submitted PQs to longlist the ProjectCos that met its minimum prequalification requirements. In the second stage, UCLH would interview the longlisted ProjectCos on the approaches they intended to adopt in their SPSs in order to shortlist the ProjectCos to be prequalified. UCLH would only shortlist ProjectCos that were proposing to develop SPSs that could meet its accommodation needs.

AMEC plc and Building and Property Group Limited (BPGL) were two actors interested in undertaking the project. AMEC plc is a global engineering services company providing design, project delivery and support services. BPGL was a major UK FM service provider involved especially in the commercial, defence and PFI sectors. The two actors set up Health Management Group (HMG) as a bid vehicle (BV) to pursue the project. HMG was based on a joint venture (JV) agreement in which both companies committed to providing resources for and sharing the cost of bidding for the project with the aim of securing the contract. In other words, AMEC plc and BPGL were the InvestCos in the project. AMEC plc and BPGL supplied project management, construction management and FM resources to HMG through labour supply agreements to enable it to bid for the project. As a result, the HMG team that began to work on the project consisted of both AMEC plc and BPGL employees.

Opportunity Analysis 6(OA)/1

AMEC plc and BPGL used HMG to bid for the DBFO project. This was because the two actors needed a vehicle to take the lead role in the bidding process and to bring together all the different skills needed to carry out the tasks involved in the project. This gave HMG the opportunity to influence the SPS from inception. AMEC plc and BPGL had the opportunity to influence the SPS through HMG.

HMG had the opportunity to consider simultaneously all the different tasks involved in the whole duration of the project. The opportunity was accompanied with the authority to take the decisions that would determine the SPS. As a result, HMG had the opportunity and the authority to implement $CWLC_P$ driven design solutions.

If UCLH had procured the project traditionally, it would have fragmented the tasks involved in the project into separate contracts and procured them in stages. First, it would have obtained the finance for the capital expenditure needed to build the new hospital through DoH. UCLH would have needed to pay capital charges on the finance. It would have met them from its annual healthcare provision budget. The budget, provided by DoH, would have been determined by a formula that would have taken into account the volume and the diversity of UCLH’s healthcare provision. Second, once UCLH had secured the finance, it would have appointed designers of its choice to develop a design solution for the hospital. Third, after a detail design solution had been completed, UCLH would have selected a contractor to build the hospital in accordance with the design solution. Fourth, at a state when the hospital had been nearing its completion, UCLH would have selected operators to service the building. UCLH would have awarded a number of service contracts of limited scope and duration. It would have paid for its operational expenditure from its formula funding budget.

As a result of the fragmented and sequential procurement process, the private sector would not have had the opportunity to consider simultaneously all the tasks involved in accommodation service provision over a period of forty years. In addition, the private sector actors would have been unable to take an integrated long-term view of operational service provision, as it would have been fragmented into several short-term contracts. Due to the sequential nature of their involvement, the designers, the contractor and the operators would not have been able to influence each other's solutions or receive feedback from each other on their own solutions. In conclusion, in a traditional development process, the private sector actors' opportunities to implement $CWLC_P$ driven design solutions would have been considerably smaller than they were in the PFI development process.

Incentive Analysis 6(IA)/1

AMEC plc and BPGL would profit from the project only if awarded the contract at financial close. As a result, the resources they invested in pursuing the project were at risk. In other words, if HMG failed to secure the contract, AMEC plc and BPGL would not receive any compensation for the bid costs they had incurred. Therefore, the two actors had an incentive to ensure that HMG would develop a SPS that would enable it to secure the contract. However, AMEC plc and BPGL also had an incentive to limit the resources they supplied to HMG in order to reduce their exposure to its failure to reach financial close.

HMG was bidding for the project at risk. As a result, it had an incentive to secure the project. HMG was aware that UCLH would nominate the ProjectCo with the best SPS as the preferred bidder (PB). If the negotiations on the details of the project between UCLH and the PB had been successful, UCLH would award the contract to the PB. In line with the contemporary PFI market, the best SPS would have to meet UCLH's ITND, be affordable and offer better VFM than the PSC project and the SPSs submitted by other ProjectCos bidding for the project. The ProjectCos were to price their SPSs as a UP. Therefore, the ProjectCo offering a SPS with the lowest UP was likely to be nominated the PB provided that the solution met UCLH's ITND. As a result, HMG had an incentive to implement $CWLC_P$ driven design solutions. This was because such solutions would lower $CWLC_P$. Thus, HMG would be able to appropriate the achieved $CWLC_P$ savings between a lower UP and increased profit from the project. A lower UP would increase the probability of HMG being nominated the PB. However, it must be noted that it is possible that AMEC plc's and BPGL's desire to limit the amount of resources to be used in SPS development gave HMG a disincentive to explore potential $CWLC_P$ driven design solutions.

If UCLH had procured the project traditionally, it would have obtained a set amount of finance towards the capital expenditure on the new hospital through DoH. It would have paid for the operation of its facilities from its formula funding budget. As a result, UCLH would have had only a weak incentive to ensure that it achieved an optimum balance between capital and operational expenditures in its procurement. Instead, it would have had an incentive to achieve the maximum possible increase in its formula funding budget as a result of procuring a new hospital. This is because UCLH's operational expenditure on its facilities would consume only a minor proportion of its formula funding budget. Therefore, it is likely that UCLH would have been able to increase its formula funding budget in excess of the operational expenditure arising from not achieving an optimum balance between capital and operational expenditures.

In a traditional project, UCLH would have instructed its designers to develop a design solution for a hospital that would enable it to obtain the maximum accommodation within its capital expenditure budget and, thus, enable it to maximise its formula funding budget. The designers would have had an incentive to develop the design solution in line with UCLH's objective. Subsequently, through a competition, UCLH would have selected a contractor to build the hospital to the detail design solution. UCLH would have awarded the contract to a contractor willing to build the hospital at the lowest cost. As a result, the contractor would have had an incentive to minimise the capital cost of its construction to improve its chances of being awarded the contract and to maximise its profit from building the hospital. Subsequently, through competitions, UCLH would have selected the operators to service the hospital. It would have awarded the contracts to the operators willing to provide the services with the lowest costs. As a result, the operators would have had an incentive to minimise the cost of their service provisions in order to maximise their chances of securing the contracts and their profits from providing the services. In conclusion, if UCLH had used traditional procurement, none of the ProjectCo actors involved would have had an incentive to implement $CWLC_P$ driven design solutions.

Opportunity Analysis 6(OA)/2
HMG had the opportunity to choose the designers, the contractor and the operator for the project. This enabled it to assemble a ProjectCo that consisted of actors that would meet UCLH's prequalification criteria. In addition, it allowed HMG to ensure that the actors would be capable of developing a SPS that would enable HMG to be appointed the PB and, subsequently, to be awarded the contract. In other words, HMG had an opportunity to ensure that the actors developed the design, construction and operation solutions in line with its objectives (see 6(IA)/1) from inception.

In a traditional project, UCLH would have selected the designers, the contractor and the operators in a fragmented and sequential procurement process – see 6(OA)/1 and 6(IA)/1. Therefore, the private sector actors would not have used an integrated vehicle to bid for and undertake the project. This would have greatly diminished the private sector actors' opportunities to implement $CWLC_P$ driven design solutions. However, it must be noted that in a traditional development process the private sector actors would not have had an incentive to implement such solutions – see 6(IA)/1.

Subsequently, HMG appointed Lewelyn-Davies Limited (LDL) as its architect. The organisational structure of the key project actors in the bidding stage prior to prequalification is illustrated in Figure 6.3. LDL is a design practice involved in architecture and planning both in the UK and internationally. The actor had substantial experience, especially, in the architectural design of hospitals in the UK. Initially, LDL was to prequalify to bid for the project as part of the ProjectCo. Subsequently, it was to develop the architectural design solution for the new hospital. LDL began to work on the project at risk. It was paid its variable cost. The fixed cost and profit elements of its fee were made conditional upon reaching financial close.

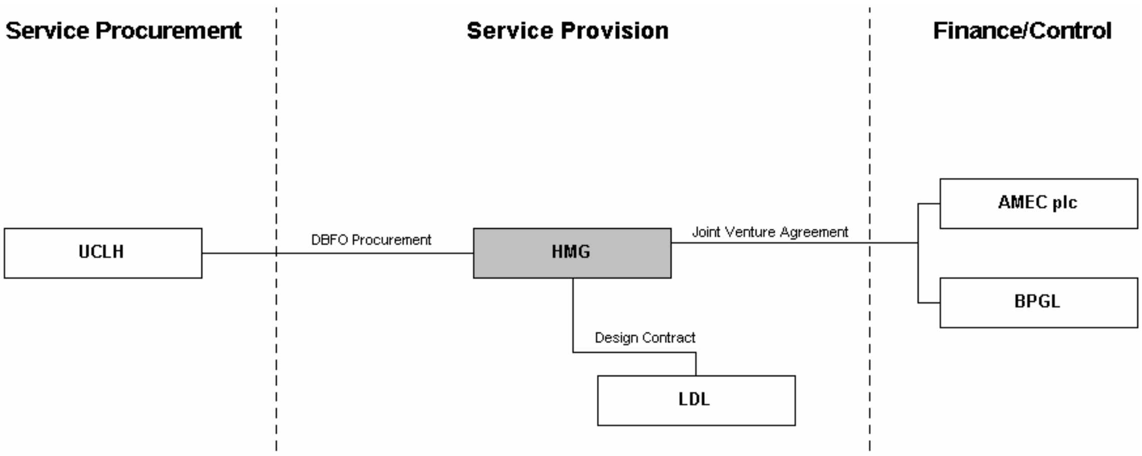

Figure 6.3. Organisation of the key project actors in the bidding stage prior to prequalification.

Opportunity Analysis 6(OA)/3

LDL had the opportunity to influence the SPS from the inception of its development. In other words, it had the opportunity to influence the construction and operational solutions to be part of the SPS and to receive feedback on its own solution from the contractor and the operator.

If UCLH had used traditional procurement, it would have procured the architectural design solution directly from the architect – see 6(OA)/1. As a result of the sequential procurement process, the architect would not have been able to influence the construction and operational solutions or to gain feedback on its solution from the contractor and the operators. As a result, its opportunity to implement $CWLC_P$ driven design solutions in the traditional development process would have been limited in comparison to the PFI development process.

Incentive Analysis 6(IA)/2

LDL began to work on the project at risk. If HMG failed to secure the contract, LDL would not be compensated for the fixed cost of its design development nor would it make any profit. Therefore, LDL had an incentive to produce a design solution that would enable HMG to be awarded the contract. As a result, it had an incentive to pursue HMG's objectives (see 6(IA)/1) in its design development.

If the project had been traditionally procured, the architect would have worked directly for UCLH. Therefore, it would have had an incentive to develop its design solution in line with UCLH's objectives – see 6(IA)/1. As a result, it would have had only a weak incentive to implement $CWLC_P$ driven design solutions.

HMG also appointed J. Henry Schroder & Co Limited (JHSCL) to provide financial advice on the project. JHSCL was to compile the financial model for the project, approach potential financiers in order to establish the terms on which the project could be financed, and eventually negotiate the finance for the project.

In addition, HMG appointed AMEC Developments Limited to explore the possibilities for the disposal of UCLH's existing properties. This was because HMG was to meet a significant proportion of the capital cost of the project from the receipts from those properties.

After studying the MoI, it became apparent to HMG that a single site solution, as opposed to the 4Box Solution, would greatly increase the likelihood of it being awarded the contract. A single site solution would enable it to build a smaller hospital than outlined in the 4Box Solution. The single site solution would, however, still enable UCLH to provide the same volume and diversity of healthcare as the 4Box Solution. The single site solution would have higher capital cost and lower operational cost, but as a result lower $CWLC_P$, than the 4Box Solution. HMG would be able to translate these $CWLC_P$ reductions into a lower UP and, thus, improve the affordability and the VFM of its SPS.

Accordingly, HMG began to search for a suitable single site in close proximity to UCLH's existing accommodation. It identified a suitable site. The site included the site of Cecil Fleming House and St Martin's Site, adjacent to Cecil Fleming house and otherwise defined by Gower Street, Euston Road, Tottenham Court Road and Beaumont

Place. The two major buildings on St Martin's Site were UCLH-occupied 151 Gower Street (see location B in Figure 6.1) and St Martin's House (see location A in Figure 6.1). A single private sector actor owned the buildings on the site. In order to build a single site hospital, HMG needed to buy St Martin's Site. Neither of the buildings on the site would be used in the 4Box Solution. However, HMG could dispose of the Rockefeller Building, Odeon Car Park, the Rosenheim Wing and the Obstetrics Hospital, which would all be used in the 4Box Solution. HMG estimated that the receipts from selling those sites would be greater than the cost of acquiring St Martin's Site. Therefore, HMG could translate the gains from its property strategy into a lower $CWLC_P$. Consequently, HMG negotiated an exclusive option to purchase St Martin's Site. As a result, it abandoned the development of the 4Box Solution.

In December 1995, UCLH received the completed PQs from the ProjectCos. Six of the ProjectCos were prepared to offer a project that included all the reference services. In the first stage of the prequalification, UCLH assessed the PQ submissions using a point scoring system. The system awarded points for the ProjectCos' financial and economical standing, technical capability and experience, PFI experience, resources available for the project, and general approach to the project. UCLH concluded that four of the ProjectCos satisfied its minimum requirements to bid for the project.

In the second stage of the prequalification, in January 1996, UCLH interviewed the remaining four ProjectCos for potential shortlisting to be invited to negotiate. In the interviews, UCLH explored the approaches the ProjectCos intended to take in the development of their SPSs. After the interviews, one of the ProjectCos withdrew from the competition. It had become the PB on another PFI project. Therefore, it did not have the resources to pursue the UCLH project further. Consequently, following the interviews, UCLH shortlisted the three remaining ProjectCos.

In February 1996, while UCLH kept developing the ITND, it issued an Initial Briefing Document (IBD) to the shortlisted ProjectCos. The IBD was a more detailed version of the MoI, but not advanced enough to be used as the ITND. The IBD aimed to familiarise the ProjectCos with UCLH's activities and what was expected of their SPSs. In addition, UCLH invited the ProjectCos to meet its key staff.

In April 1996, as UCLH worked on the ITND, the Eastman Dental Hospital (EDH) and the National Hospital for Neurology and Neurosurgery (NHNN) joined it. In 2002, EDH is focused on providing specialist dental treatment. In addition, together with UCL's Eastman Dental Institute, it is engaged in medical research and education. EDH is located on Gray's Inn Road – see location M in Figure 6.2. NHNN is a leading centre for the diagnosis and treatment of a wide range of diseases of the nervous system, such as epilepsy. Together with UCL's Institute of Neurology, it is a major international centre of research and education. The NHNN is based in Queen Square – see location O in Figure 6.2. As a result of the 1996 expansion, UCLH re-scoped the PFI project it was procuring. The two stand-alone single discipline hospitals, EDH and NHNN, were to remain in their existing locations. However, UCLH included the limited operation of the two hospitals in the PFI project. The examination of the operation of the EDH and the NHNN is not included in the scope of this case study because the project does not include any new construction in relation to the two hospitals.

6.4.2. Competitive Negotiation

In May 1996, UCLH issued the ITND to the three shortlisted ProjectCos. The ITND requested the ProjectCos to submit fully priced SPSs in September 1996. However, shortly after, the procurement process ran into difficulties. One of the ProjectCos dropped out of the competition as it had become over-committed and, thus, lacked the resources to continue pursuing the project. Another ProjectCo collapsed due to an internal conflict. Consequently, UCLH was left with HMG as the only bidder.

It is likely that HMG's explicit intention to use a single site solution in its SPS contributed to the reluctance of the other ProjectCos to commit resources to pursuing the project. Due to HMG's exclusive option to purchase St Martin's Site, the other bidders would have had to develop the 4Box Solution or obtain alternative sites, whereas HMG could use an ideally located site. UCLH clearly preferred the single site solution. This was because it appeared to enable UCLH to make considerable efficiency savings in its healthcare provision as a result of working in integrated state of the art facilities.

Incentive Analysis 6(IA)/3
After all the other ProjectCos withdrew from the bidding process, HMG was no longer subject to competitive pressure. In other words, it did not have to be concerned that another ProjectCo would submit a SPS that would be superior to its proposal. This changed the nature of HMG's incentive. It now had an incentive to develop a SPS that would be just affordable to UCLH and that would offer marginally better VFM to UCLH than the PSC project. This was because such a SPS would secure its appointment as the PB. However, it would also maximise the value of the DBFO contract and, therefore, the ProjectCo's profit from undertaking the project. In conclusion, the balance in HMG's incentive to implement $CWLC_P$ driven design solutions shifted from increasing the probability of bid success towards increasing the profit from the project.

Subsequently, HMG requested AMEC Construction Limited (ACL) and Mathew Hall Limited (MHL) to develop a construction solution for the new hospital in collaboration with LDL. ACL and MHL were both subsidiaries of AMEC plc. ACL was one of the largest construction management and construction companies in the UK. MHL was a leading UK building services contractor. The two companies set up a JV, namely Health Construction Team Joint Venture (HCTJV), to develop the construction solution. HMG invited Building and Property Facilities Management Limited (BPFML) to develop an operational solution for the project. BPFML was a subsidiary of BPGL involved in FM service provision. HCTJV and BPFML began to work on the project at risk. They would only be compensated for their respective development work if HMG secured the contract. The organisational structure of the key project actors in the bidding stage after prequalification is illustrated in Figure 6.4.

Opportunity Analysis 6(OA)/4

HCTJV and BPFML both worked for HMG and were part of the SPS development process from its early stages. As a result, through HMG, the two actors had an opportunity to influence the design solution and each other's construction and operational solutions. This enabled HCTJV and BPFML, together with the other ProjectCo actors, to identify and implement $CWLC_P$ driven design solutions.

If UCLH had procured the project traditionally, it would have awarded separate design, construction and operation contracts in stages – see 6(OA)/1. As a result, the contractor's and operators' opportunity to influence the other aspects of the SPS and, receive feedback on their solutions and, thus, to implement $CWLC_P$ driven design solutions would have been limited.

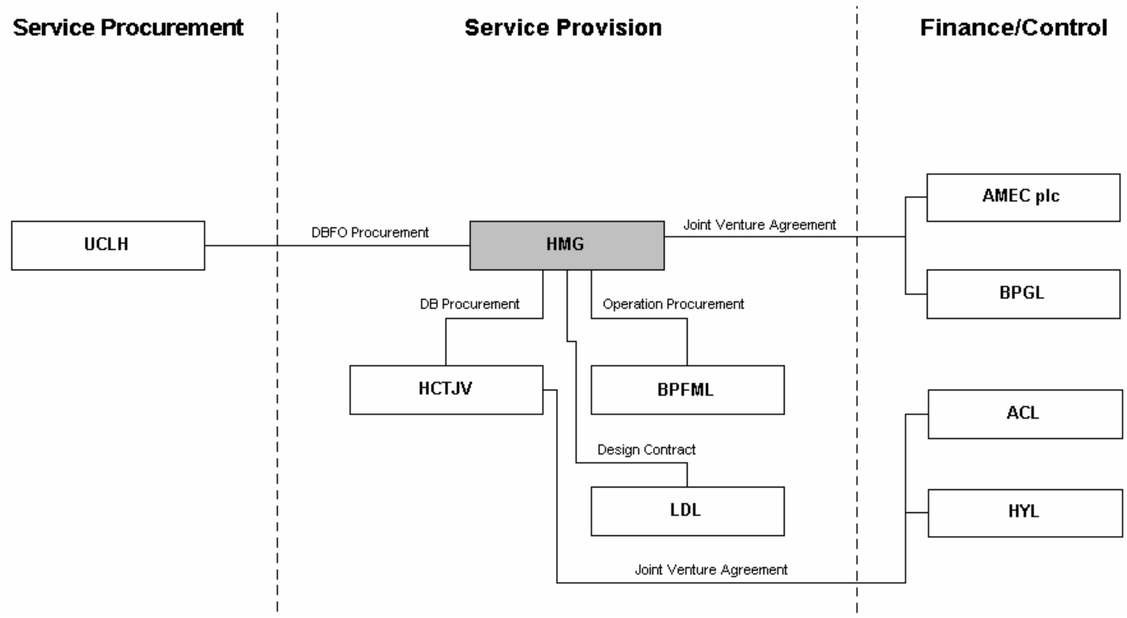

Figure 6.4. Organisation of the key project actors in the bidding stage after prequalification.

Incentive Analysis 6(IA)/4
HCTJV and BPFML needed to invest resources into developing the construction and operational solutions respectively. The two actors carried out the development at risk. Therefore, they had an incentive to develop solutions that would enable HMG to secure the contract – see 6(IA)/1&3.

In a traditional project, UCLH's procurement process would have been fragmented. As a result, the contractor and the operators would have had an incentive to minimise the cost of undertaking the contracts they would have been bidding to secure – see 6(IA)/1. Therefore, neither the contractor nor the operators would have had an incentive to implement $CWLC_P$ driven design solutions.

As the project actors worked on the SPS, the new hospital began to take shape. The single site hospital was to consist of three buildings to be built in two phases. The construction of the single site hospital would require 151 Gower Street and St Martin's House to be demolished in the first phase and Cecil Fleming House in the second phase. The Main Building to be built in the first phase was designed to have a Tower to be built on 151 Gower Street Site and a Podium to be built on the St Martin's House Site. This was because St Martin's House was on a Strategic Viewing Corridor, which restricted the height of the Podium. The Main Building would provide accommodation for the vast majority of UCLH's operations at UCH and MH. However, in the first phase, a small area in the UCLH-leased Maples Building (see location C in Figure 6.1) would also be refurbished. That space would house some of UCLH's administrative staff and it would be linked to the Main Building with a pedestrian bridge. Once the first phase and the associated relocation had been completed, Cecil Fleming House would be demolished and a new building, EGA Wing, would be constructed on the site. The second phase would provide a new home for EGA.

As HMG developed its SPS, UCLH redefined the accommodation needs the project would have to meet. UCLH decided to refurbish HTD, Rosenheim Wing and Rockefeller Nurses Home on Huntley Street (see location I in Figure 6.1) using traditional procurement. Consequently, UCLH would retain HTD in its existing location. It would move pathology from Cecil Fleming House to Rosenheim Wing and UCMS facilities from MH to Rockefeller Nurses Home. UCLH's remaining accommodation needs were to be met by HMG's SPS.

As the SPS development progressed, HMG needed additional advice. At that time, ACL, MHL and BPFML were working with Donald Smith, Seymour and Rooley Limited (DSSRL), a leading UK hospital building services design consultancy, on another PFI hospital project. Through this involvement, HMG invited DSSRL to advise on the building services solution for the new hospital. MHL, especially, was keen to have DSSRL involved as the two companies had considerable experience in working together. In addition, because of its strong association with LDL, HMG invited Clarke, Nicholls & Marcel Limited (CNML), a civil and structural engineering consultancy, to advise on the structural solution of the building. Subsequently, DSSRL and CNML began to work on the project as advisers. They would only be appointed as designers, if HMG became the PB.

Opportunity Analysis 6(OA)/5

DSSRL and CNML had an opportunity to influence the SPS from the inception of its development. Namely, the two actors had an opportunity to influence the architectural, construction and operational solutions. In addition, they had an opportunity to receive feedback on their envisaged design solutions from the other actors.

In a traditionally procured project, UCLH would have procured the building services and structural design solutions directly from the respective designers – see 6(OA)/1. As a result of the sequential procurement process, the buildings services and structural designers would have been unable to influence the construction and operational solutions or to gain feedback on their solutions from the contractor and the operators. It must be noted that the designers would have been able to interact with UCLH and the architect. However, the sequential development process would have limited the opportunity of the two actors to contribute to the implementation of $CWLC_P$ driven design solutions.

Incentive Analysis 6(IA)/5

DSSRL and CNML began to work on the project as advisers. They would only be awarded the contracts to develop the building services and structural design solutions for the hospital if HMG were to become the PB. Therefore, the designers had an incentive to envisage building services and structural design solutions that would enable HMG to be nominated the PB. As a result, they had an incentive to pursue HMG's objectives (see 6(IA)/1&3) in their advisory work.

If the project had been traditionally procured, the building services and structural designers would have worked directly for UCLH. Therefore, they would have had an incentive to develop their design solutions in line with UCLH's objectives – see 6(IA)/1. As a result, they would have had only a weak incentive to implement $CWLC_P$ driven design solutions.

HMG also appointed David Langdon and Everest (DLE) to provide cost advice in the project. DLE was responsible for creating an integrated cost estimate of the various aspects of the SPS. HMG would use the estimate to formulate the final price for its SPS.

In addition, HMG wanted to ensure that the pricing of the construction and operational solutions put forward by HCTJV and BPFML reflected market prices.

Initially, HMG considered a steel structure for the hospital. However, it shortly became apparent that a reinforced concrete flat slab structure had considerable comparative advantages. First, it enabled the building to have a lower floor-to-floor height. This allowed the occupiable space of the hospital to be increased within the planning constraints. Second, the concrete structure allowed for more flexibility in both the routing of the building services and the reconfiguration of the spatial arrangements. This flexibility was essential as the hospital was to be heavily serviced and the future developments in healthcare provision were likely to require at least some spatial reconfiguration within the duration of the contract. Third, the concrete frame was less sensitive to the vibration to which the site was subject to because of the immediate proximity of three London Underground lines.

Perception Analysis 6(PA)/1
The hospital was to have a concrete flat-slab structure. The structural solution was seen to facilitate the implementation of $CWLC_P$ driven design solutions within the HV solution. This was because it allowed holes, up to a certain size, to be penetrated in the structure almost at will.

HMG concluded that the hospital should be fully sealed and comfort cooled. First, the Main Building Tower was to have 17 upper floors. It could not have openable windows due to the risk of patient suicide. Second, the building was facing Euston Road, which is one of the busiest roads in Central London. Therefore, the hospital was to be subject to considerable noise and atmospheric pollution. DSSRL studied the internal noise levels in St Martin’s House and concluded that the most efficient way to deal with noise pollution was to have a sealed building. This would also solve the problem with atmospheric pollution. Third, DSSRL developed a model of the internal temperatures of the new hospital. The model enabled DSSRL to conclude that the use of natural ventilation would result in the hospital having peak internal summertime temperatures outside the required environmental conditions outlined in the ITND.

Once HMG had decided that the hospital would be fully sealed and comfort cooled, it began to consider the type of HV solution to be used. An active chilled beam (ACB) system appeared to offer the most benefits. The main advantage of the system was that it required only a relatively limited amount of ceiling void space to route the services. Therefore, its use would increase the occupiable space in the building further. In addition, HMG compared the ACB system with a full air system in terms of $CWLC_P$. The ACB system appeared to be more cost effective as it had a smaller number of moving parts and, therefore, required less maintenance. The disadvantage of the ACB system was that it could not be used to control environmental conditions as accurately as a full air system. However, the accuracy that could be achieved would be adequate for the vast majority of the areas in the hospital. HMG approached UCLH and negotiated the areas where the system could be used. UCLH and HMG agreed that the ACB system would not be used in areas that required a precise control of the environmental conditions, such as operating theatres and laboratories. Consequently, HMG decided to use a variable air volume (VAV) system in those areas.

Perception Analysis 6(PA)/2

The location of the single site hospital was seen to determine several aspects of the SPS. First, the hospital had to have a specific form. Second, it had to have a concrete structure. Third, the building had to be fully sealed and comfort cooled. These features of the hospital were perceived to limit the scope to implement $CWLC_P$ driven design solutions within the HV solution. The use of an ACB system as part of the HV solution, for example, was seen to result indirectly from the location of the hospital. The ACB system was perceived to reduce $CWLC_P$. However, $CWLC_P$ minimisation was acknowledged not to be the main reason for its use.

Solution Analysis 6(SA)/1

The ACB system has a comparative $CWLC_P$ advantage to a full air system. This is because it has a relatively small number of moving parts and, therefore, it will require less maintenance and replacement. However, it must be acknowledged that its implementation was not solely driven by $CWLC_P$ minimisation. HMG adopted the ACB system partly because it enabled the ceiling void space to be used more efficiently and, therefore, the occupiable space of the building to be increased. Therefore, the ACB system is defined as a *$CWLC_P$ reducing design solution* instead of a $CWLC_P$ driven design solution. The ACB system can be seen as a major innovation. This is because such a system had not been previously used in a UK hospital. The expert assessment confirmed the system as a $CWLC_P$ reducing design solution.

As BPFML developed its operational solution, it was actively involved in the overall SPS development. It responded to questions raised by the actors working on the design and construction solutions. Most of the questions related to the timings and costs of replacing and maintaining building components. BPFML also aimed to influence the design and construction solutions to enable it to improve its operational solution. However, BPFML was unable to significantly influence the solutions. This was due to lack of reliable information on the operational cost implications of potential changes. If BPFML could not clearly demonstrate savings in operation, the other actors were not willing to change their solutions. This led to BPFML becoming more reactive than proactive.

Perception Analysis 6(PA)/3

BPFML was seen to have a significant role in SPS development. BPFML, ACL and MHL had worked together previously on another PFI hospital project. The established relationship was felt to contribute to BPFML's efficient involvement in the development process. BPFML was perceived to influence the SPS. However, some of the actors felt that BPFML lacked the confidence to take the responsibility for design changes and, therefore, to make a significant impact on the SPS. The lack of confidence was seen to be a result of absence of reliable operational costs information. It must be noted that some actors perceived BPFML to be disinterested in other than its operational cost.

As HMG had developed the SPS, it had simultaneously been in active dialogue with Camden Planning. HMG had applied for detail planning permission for the new hospital. In October 1996, the permission was granted, subject to the completed scheme design solution of the hospital satisfying a number of conditions.

Incentive Analysis 6(IA)/6

HMG was under considerable time pressure to develop and submit its SPS. If HMG could not submit its SPS on time, UCLH would not consider it for appointment as the PB. Therefore, HMG had a strong incentive to complete and submit its SPS on time rather than try to incorporate additional $CWLC_P$ driven design solutions into the SPS. This temporarily weakened its incentive to implement $CWLC_P$ driven design solutions.

In October 1996, HMG submitted its SPS to UCLH. The proposal outlined a new hospital that integrated UCLH's accommodation included in the project onto a single site. The new hospital was to have a gross floor area (GFA) of 74,900 m^2 and include 597 NHS beds and 40 private patient beds. The operational proposal outlined solutions for the reference services requested in the ITND and a number of variant services. HMG also accepted the proposed 40-year contract period. At the time, HMG anticipated that the project would reach financial close in July 1997 and the first and second phases of construction would be completed in September 2001 and April 2005 respectively.

HMG proposed to undertake the project by transforming itself at financial close into a special purpose vehicle (SPV) owned jointly by AMEC plc and BPGL. The SPV, to be named Health Management (UCLH) plc (HMU), would enter into a DBFO contract with UCLH. HMU would place a design and build (DB) contract with HCTJV and an operation contract with BPFML to execute the project. HMG's proposed organisational structure for the project is illustrated in Figure 6.5. At the time, HMG left the door open for further equity investors to be added if they would add value to the project. However, new equity investors would only be added on UCLH's approval.

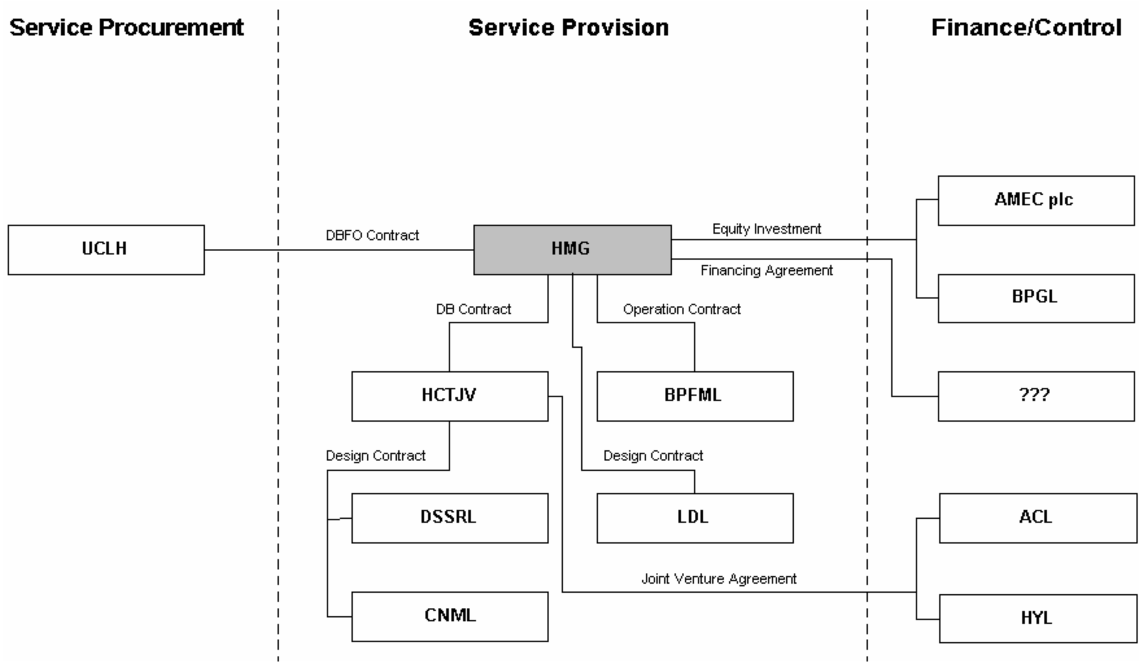

Figure 6.5. HMG's initial proposal of organisation of the key project actors after contract award.

HMG intended to fund the £174 million capital cost of the hospital project partially by the sale of the surplus sites. These gross receipts were estimated at £80.5 million. The remainder of the capital cost would be financed by equity and debt or bond finance. HMG's proposed ratio of equity to debt or bond finance was 1:9. The equity would be provided in equal share by AMEC plc and BPGL. At the time, the provider of the finance was not known. However, JHSCL had opened negotiations with several potential financiers. It estimated that HMG could obtain debt for the project with an interest rate of LIBOR + 1.5% for 32 years. Therefore, HMG proposed a sculpted UP with a 40% reduction in the annual payment after 32 years.

HMG proposed a UP consisting of availability, usage and service components as requested in the ITND. The availability component would be linked to the availability of the facilities. The usage component would be a function of annual inpatient bed days and outpatient, day care patient and A&E attendances. The service component would be linked to HMU's performance in operational service provision.

The HMG default proposal included the provision of all the reference services. The reference services were broken down into property, logistics and operational services. The property services included estate management, security and car parking. The logistics services consisted of non-emergency patient transport, management of supplies, waste management and laundry and linen services. The operational services included catering, sterile services and flexible support services consisting of cleaning, portering, aspects of catering such as food delivery, and non-clinical nursing such as patient washing. HMG assumed that the cost of purchasing energy, sterile equipment and other medical supplies (non-pharmacy items) would be passed through to UCLH. The operational proposal included a considerable staff transfer from UCLH to HMU. HMG anticipated that the staff would be willing to adopt flexible working practices.

In addition, HMG included proposals for variant services to be included in the project. These included residential accommodation services for clinical staff, medical equipment, training and development of NHS staff, creditor payments, payroll and patient services, namely reception and patient records.

HMG anticipated that the project would yield third party revenues from private patient and retail activities. The proposed private patient activity consisted of a 40-bed facility for elective surgery. The retail outlets proposed on the ground floor of the Main Building were a coffee shop, newsagent, florist, gift shop and nursing agency. HMG proposed to direct 40% of third party rent income to UCLH. However, this case study will not examine the interrelationship of the HV of areas used exclusively to generate third party revenues. This is because such areas present only a small proportion of the total GFA of the hospital.

After receiving HMG's SPS, UCLH evaluated the proposal. In relation to financial costs and benefits, UCLH judged that the NPV of procuring the project was higher than the NPV of implementing the PSC project. The key to this judgement was the efficiency savings that UCLH could achieve in healthcare provision by relocating its activities into a single location. The single site hospital would also enable UCLH to develop its healthcare provision based on clinical needs and dependencies further. This would remove the need to have beds dedicated solely for low dependency patients. In addition, UCLH used the weighted point scoring system to evaluate the non-financial costs and benefits of the SPS. It concluded that the implementation of the SPS would yield considerably more benefits than the PSC project. Therefore, UCLH concluded that HMG's SPS was VfM.

UCLH's affordability constraint was defined as its maximum annual expenditure on the UP. The UP for HMG's SPS was higher than UCLH's affordability constraint and the annual equivalent cost of the PSC project. However, the implementation of HMG's proposal would yield efficiency savings in UCLH's healthcare provision. These savings would increase the amount it would have available for the UP. Therefore, UCLH judged the SPS to be affordable. Consequently, in October 1996 UCLH nominated HMG as the PB. Thus, the nomination of PB took place in the same month HMG submitted its SPS.

UCLH had received only one SPS. This caused some anxiety in the project actors. However, UCLH perceived the ProjectCo actors to be reputable companies involved in another more advanced hospital PFI project. In addition, UCLH felt that the PSC project was a genuine alternative to be implemented if it failed to reach financial close on the PFI project. HMG, in turn, was concerned that its selection as the PB had not complied with EU procurement regulations due to limited competition. HMG raised the issue with HM Treasury, which judged that EU procurement regulations had not been breached.

6.5. Preferred Bidder Stage

6.5.1. Resolving Policy Issues

Once appointed the PB, HMG and UCLH began to negotiate the contractual and technical details of the project with the aim of reaching contractual close. HMG had not been completely satisfied with all of the contractual terms UCLH had proposed in the ITND. HMG had highlighted the contractual clauses it wanted to discuss further in its SPS submission.

However, after HMG became the PB, the future of the project began to look increasingly uncertain. There was a genuine prospect that UCLH might have to abandon the PFI project altogether. As a result, the ProjectCo hesitated to commit additional resources to developing the SPS. HMG decided to maintain only a small team working on the project until the uncertainties surrounding it were resolved.

In early 1997, the general election was imminent. The Labour Party was ahead in the opinion polls. At the time, it was not known whether Labour would retain PFI as a public procurement method if it took over in Government. In May 1997, Labour won the election. Somewhat unexpectedly, in July 1997, after a comprehensive review of PFI, the Labour Government committed itself to its use. Almost simultaneously, it gave priority to the implementation of 14 PFI hospital projects with an additional project prioritised in September 1997. These 15 projects are known as the first-wave PFI hospitals. UCLH was not one of the prioritised projects.

In June 1997, the government commissioned the Turnberg Review on healthcare provision in London. In November 1997, Turnberg (1997) gave its full support to the implementation of the UCLH project. Subsequently, the Government began a study of capital investment needs in the NHS. The aim of the investigation was to decide on the hospital projects that should be included in the second wave of PFI hospitals. In April 1998, the Government issued a priority list of 10 PFI hospital projects to be implemented. The UCLH project was on the list.

As a result of the policy reviews, it was not until April 1998 that the project began to regain momentum. Since the nomination of the PB, UCLH had become increasingly comfortable with HMG. This was because HMG had demonstrated considerable commitment to the project during a period of substantial uncertainty.

During the policy reviews, JHSCL had been in active discussions with potential financiers. It had established that Abbey National Treasury Services plc (ANTS), a leading provider of PFI finance, offered the most favourable terms of finance for the project. ANTS was also prepared to provide all of the debt finance needed. ANTS is a subsidiary of Abbey National plc, which is the sixth largest bank in the UK. HMG and ANTS proceeded to agree the terms of finance for the project, subject to due diligence after contractual close. As HMG continued to develop the SPS, it kept ANTS informed to enable it to raise any concerns it might have with the SPS. However, the ProjectCo's prior PFI experience enabled it to anticipate the type of SPS that would be acceptable to a financier.

Opportunity Analysis 6(OA)/6
Shortly after HMG became the PB, ANTS joined the project as the likely financier. ANTS' relatively early involvement gave it an opportunity to ensure that HMG would develop the SPS in line with its objectives – see 6(IA)/7.

In a traditionally procured project, UCLH would have secured the finance for the project through DoH – see 6(IA)/1. Therefore, project finance would not have been used. A financier would not have been an actor in the project development and it would not have had an opportunity to influence the design, construction and operation solutions.

Incentive Analysis 6(IA)/7
ANTS' profit from the project will be the difference of its interest payments for the finance it sources for the project and the interest payments it obtains from HMU for providing the finance. This will be the only source of profit for ANTS from the project. ANTS' profit margin will be very thin. As a result, ANTS had an incentive to ensure that the project risks were minimised so that HMU would always be able to meet its loan repayment obligations. First, ANTS had an incentive to ensure that HMU would maximise the completion certainty of the hospital. If HMU failed to complete the building on time, it would not receive the anticipated UP and, thus, its total revenue to be received from UCLH would be reduced. As a result, HMU would not be able to commence its loan repayment as scheduled. Second, ANTS had an incentive to ensure HMU would maximise the operational certainty of the project. If the operation of the hospital were to be compromised, HMU would not receive the UP in full and, thus, it could face difficulties in loan repayment. Third, ANTS has an incentive to ensure that

HMU would maximise its expenditure certainty in the project. This is because HMU's unanticipated expenditure increases in the implementation stage could jeopardise its ability to make loan repayments. As a result, ANTS had an incentive to discourage the implementation of $CWLC_P$ driven design solutions. This is because it would not receive any of the profits that result from $CWLC_P$ reductions and the implementation of $CWLC_P$ driven design solutions could decrease completion, operational and/or expenditure certainty.

If UCLH had used traditional procurement, project finance would not have been used – see 6(OA)/1. Therefore, a financier would not have imposed the pressure to maximise completion, operational and expenditure certainty on the private sector actors. UCLH would have had an incentive to maximise completion certainty. However, it would not have been able to pass the incentive onto the private sector actors effectively because of the legal difficulties in recovering liquidated damages. UCLH would also have had an incentive to maximise operational certainty. This is because UCLH would have met cost increases arising from the compromised operation from its formula funding budget. However, it is likely that by allocating additional capital to increase the capacity of the hospital instead of its operational certainty, UCLH would have been able to increase its future formula funding budget in excess of the anticipated costs of the compromised operation. Therefore, the incentive to maximise the operational certainty that UCLH would have passed onto the private sector actors would have been considerably weaker in a traditional project than it was in the PFI project. In addition, UCLH would have had an incentive to maximise its capital and operational expenditure certainty on its accommodation. However, in traditional procurement, it would not have been able to effectively pass the incentive to achieve capital expenditure certainty onto the contractor. This is because, in traditionally procured projects, the contractor is typically able to increase the contract value by claiming compensation for additional work. In a traditional project, UCLH would have managed its various short-term operation contracts. It would have had an incentive to maximise operational expenditure certainty on its facilities by effective management of its subcontractors. However, its ability to do so would have been limited by constraints arising from design and construction.

Perception Analysis 6(PA)/4

ANTS was perceived to strongly support the pursuit of completion, operational and expenditure certainty in SPS development. It was felt that ANTS wanted to ensure that HMU could always meet its loan repayment obligations on time and in full. ANTS was seen to want the SPS to be based on proven design solutions without unnecessary innovations that could compromise completion, operational and/or expenditure certainty. This was seen to affect the behaviour of the ProjectCo throughout SPS development. However, some of the private sector actors felt that exploring innovations were an integral part of the service they provided.

In April 1998, once the policy issues had been resolved, HMG instructed LDL to develop an architectural scheme design solution for the hospital. LDL continued to work on the project at risk. In addition, HCTJV appointed DSSRL and CNML to produce the scheme designs of the building services and structural solutions respectively. The two design consultants began to work for HCTJV at risk. They were compensated only for their variable design costs with the fixed cost and profit elements of their fees deferred until financial close.

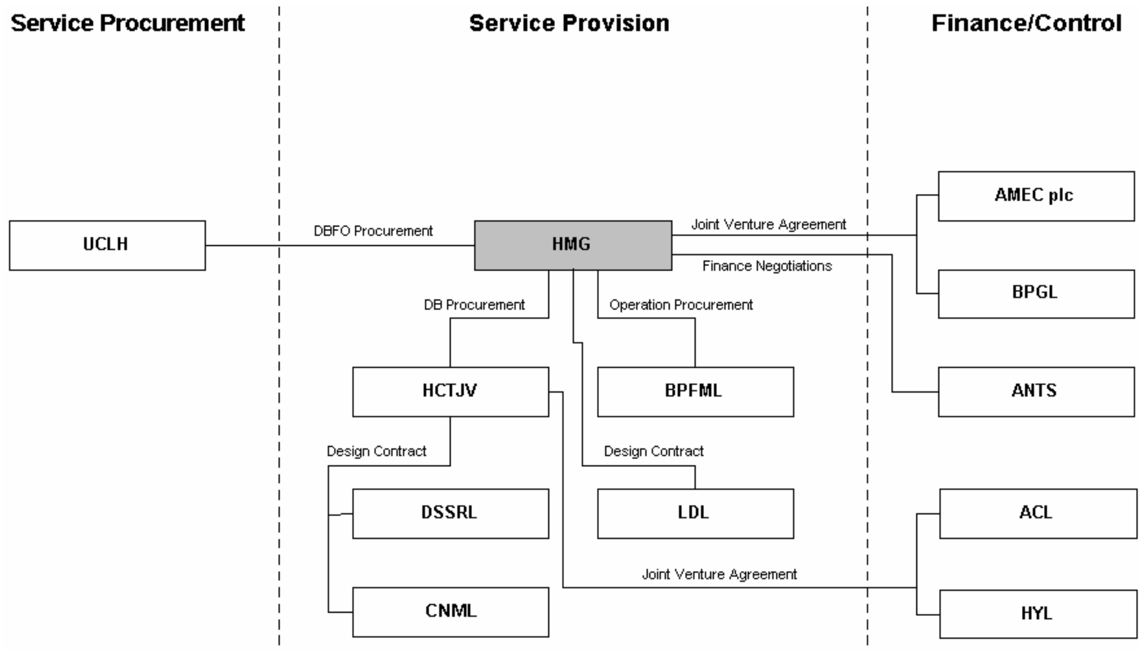

Figure 6.6. The organisation of the key project actors in the early stages of the PB stage.

Incentive Analysis 6(IA)/8
In the PB stage, DSSRL and CNML began to work in direct appointment for HCTJV as opposed to as advisers for HMG. The two actors were working at risk. This slightly changed their incentives. The two actors had an incentive to produce design solutions that would enable HCTJV to secure the DB contract. This, in turn, would require HMG to secure the DBFO contract from UCLH – see 6(IA)/1&3 and obtain finance from ANTS – see 6(IA)/7. Therefore, the two designers had an incentive to implement $CWLC_P$ driven design solutions within the resulting constraints. As the designers worked at risk, their incentive to implement such solutions was stronger than it had been in the bidding stage.

HMG gave LDL management responsibility in scheme design development. LDL was to ensure that the building services and structural designs were produced as scheduled and were compatible with the architectural design. HCTJV and BPFML were responsible for assessing the overall design solution for its suitability for construction and operation respectively.

Incentive Analysis 6(IA)/9

HMG had an incentive to develop the SPS to satisfy a number of objectives. These objectives arose from the nature of the DBFO contract and the intended contractual structure – see Figure 6.5.

HMG retained its incentive to implement $CWLC_P$ driven design solutions – see 6(IA)/1&3. HMG had been nominated the PB, but it had not agreed the UP with UCLH. As a result, HMG's incentive to reduce $CWLC_P$ arose from two sources. First, $CWLC_P$ reductions prior to agreeing the UP would enable HMG to reduce the UP and, thus, facilitate reaching financial close and/or increase the profit the ProjectCo would make from the project. Second, once HMG and UCLH had agreed the UP, the reductions in $CWLC_P$ would increase the ProjectCo's profit from the project.

HMG also had an incentive to improve the constructability of the SPS. On the one hand, improved constructability would enable HMG to reduce the intended duration of the construction period of the hospital. HMU would only begin to receive the UP after the building had been commissioned and become operational. Therefore, a reduction in the length of the construction period would enable HMU to achieve two things. First, it could begin its loan repayments earlier and, thus, decrease the overall cost of finance. Second, HMU could increase the duration of the operational period and, thus, the total revenue from the project. HMU would be able to translate the gains from reducing the construction period to a lower UP and/or to increased profit for the ProjectCo from the project. On the other hand, improved constructability would allow HMU to improve the completion certainty of the hospital. This was essential in order to be able to finance the project – see 6(IA)/7. Furthermore, a delay would reduce HMU's total revenue from the project and result in additional costs from rescheduling its loan repayment obligations. Thus, a delay in completion would reduce the profit that the ProjectCo anticipated to make from the project.

In addition, HMG had an incentive to improve the operational certainty of the SPS. This was because the UP was to be performance related. HMU would incur UP deductions if its service provision were to be compromised. If HMU would not receive the UP in full, it might not be able to meet its loan repayment obligations. Therefore, unless HMG improved the operational certainty of the SPS to a level acceptable to ANTS, it would be unwilling to finance the project – see 6(IA)/7. In addition, UP deductions would compromise the ProjectCo's anticipated profit from the project.

Furthermore, in SPS development, HMG had an incentive to maximise HMU's expenditure certainty on the project. This was because HMU could become liable for unanticipated capital and/or operational expenditure increases in the execution of the project. These additional expenditures would compromise its anticipated dividend payments to AMEC plc and BPGL and could compromise its ability to make loan repayments to ANTS. As a result, an acceptable level of expenditure certainty was one of ANTS' preconditions for financing the project – see 6(IA)/7.

AMEC plc and BPGL would have their equity investment tied up in the project for a considerable period of time. Therefore, the two actors would not be able to use the resources in their core business operations. As a result, they had an incentive to limit their equity investment in HMU. This gave HMG an incentive not to increase the capital cost of the hospital. This was the case even if HMG could use additional equity investment to finance $CWLC_P$ driven design solutions that would increase HMU's profit and, thus, its dividend payments to AMEC plc and BPGL. In other words, HMG had an incentive to ensure that HMU would deliver a target rate of return on equity (ROE) to the two InvestCos rather than the maximum rate of ROE.

In conclusion, HMG had a number a number of objectives in SPS development. $CWLC_P$ minimisation was just one of these objectives. It is likely that the other objectives directed attention away from the implementation of $CWLC_P$ driven design solutions.

In a traditional project, UCLH would not have used a long-term DBFO contract – see 6(IA)/1. Therefore, the private sector actors would not have used a vehicle to pursue and to implement the project. As a result, the private sector actors' incentives to minimise $CWLC_P$ and improve the completion, operational and expenditure certainty of UCLH's accommodation would have been considerably weaker in the traditional development process than they were in the PFI development process. Instead, the actors would have pursued a different set of incentives in the design (see 6(IA)/2&8), construction (see 6(IA)/4) and operation contracts (see 6(IA)/4) UCLH would have awarded them.

Incentive Analysis 6(IA)/10

At financial close, HMU was to award HCTJV a fixed-price DB contract to design and construct the hospital. As a result, HCTJV had an incentive to begin to ensure that it would maximise and not compromise its profit from undertaking the contract. HCTJV would maximise its profit by minimising the capital cost of design and construction. However, HCTJV could also compromise its profit. First, it could fail to complete the building on time and, thus, become liable for liquidated damages. Second, HCTJV could become liable for UP deductions and the cost of rectifying their cause if they had resulted from the quality of its construction. Third, it could become liable for increased operational costs it they proved to result from the quality of its construction. As a result, HCTJV had an incentive to maximise the completion, operational and operational expenditure certainty of the hospital.

In addition, HCTJV had an incentive to ensure that its design and construction would not compromise HMU's profit and, thus, its ability to pay dividends over the duration of the contract. This was because AMEC plc, its ParentCo acting as InvestCo, was to own half of HMU. Therefore, half of HMU's compromised profits would have to be absorbed by AMEC plc. This reinforced HCTJV's incentives to improve the completion and operational certainty of the hospital.

It must be noted that HCTJV needed to pursue HMG's objectives – see 6(IA)/1&3&9. This is because it needed to ensure that HMG would be able to secure the DBFO contract and the finance for the project in order for HCTJV to be awarded the DB contract. Therefore, HCTJV retained an incentive to implement $CWLC_P$ driven design solutions. However, the incentive was weakened by its other objectives, which arose from the prospect of being awarded a fixed-price DB contract at financial close.

If UCLH had used traditional procurement, it would have procured the construction based on a detail design solution. As a result, the contractor would have had a capital cost minimisation incentive, as it would have maximised its profit from construction through such minimisation. However, its incentives to pursue completion, operational and operational expenditure certainty would have been weaker than they were in the PFI project. First, in a traditionally procured project, the contractor could have escaped some of the liquidated damages for a delay due to legal difficulties in demonstrating them. Second, the contractor would have been responsible for its construction quality only for the warranty period. This period would have been significantly shorter than the duration of the DBFO contract for which its ParentCo will be responsible for the hospital. Third, the contractor would have been responsible for increased operational expenditure only if it was caused by a fault included in the warranty of the building or a latent defect.

Incentive Analysis 6(IA)/11
HMU was to award an operation contract to BPFML at financial close. BPFML's profit from operating the hospital would be the difference of its payment from HMU and the cost of providing the operational services. As a result, BPFML had an incentive to minimise its operational cost in order to maximise its profit. However, BPFML also has an incentive not to compromise operational certainty. First, it could incur payment deductions due to poor performance or non-delivery of its services. Second, its service provision could cause HMU to incur unavailability deductions and it could become liable for compensation. BPFML's ParentCo, BPGL, will own half of HMU. Therefore,

BPFML had an incentive not to compromise HMU's profitability by its operation. This is because BPG would have to absorb 50% of the reductions in HMU's anticipated profit.

In addition, BPFML had an incentive to ensure that the project could reach financial close by pursuing HMG's objectives – see 6(IA)/1&3&9. BPFML would only be awarded the operation contract if HMG could secure the DBFO contract and the finance for the project. Therefore, it retained its incentive to implement $CWLC_P$ driven design solutions. However, it is possible that BPFML's $CWLC_P$ minimisation incentive was compromised by its other objectives.

If UCLH had used traditional procurement, it would have awarded a number of operation contracts of limited scope and duration at a stage when construction would have been nearing completion. The operators would have had an incentive to minimise the cost of their service provisions in order to increase their profits from the contracts. However, the operators would have had a weaker incentive to invest in cost efficient operation. This is because the recovery periods for the investments would have been considerably shorter than they were in the PFI contract. In addition, the operation contracts would have not been subject to UP deductions as they were in the PFI project. As a result, the operators would have had weaker incentives to improve operational certainty.

UCLH had developed operational policies for the 4Box Solution, but not for the single site hospital. Instead, it relied on the ProjectCo's previous experience on hospitals. Throughout scheme design development, UCLH was in active dialogue with the ProjectCo in order to communicate the clinical functionality requirements of its intended healthcare provision. Clinical functionality would determine the layout of the hospital and, therefore, how the building was to be serviced. UCLH sought to ensure that the SPS would enable it to treat its patients according to their needs and dependencies.

Incentive Analysis 6(IA)/12

HMG had an incentive to ensure that the clinical functionality of the SPS would at least meet UCLH's minimum requirements and preferably exceed them. If the SPS could not satisfy the minimum requirements, the project could not reach financial close. If HMG could improve the clinical functionality beyond the minimum requirements, it could also improve the efficiency of UCLH's healthcare provision. UCLH was likely to use the efficiency savings achieved towards the UP. This would relax UCLH's affordability constraint. As a result, HMG would be able to increase the value of the DBFO contract and, therefore, the profit the ProjectCo would make from the project.

If UCLH had procured the project traditionally, it would have instructed its designers to develop a detail design solution that met its clinical functionality requirements.

Subsequently, it would have instructed a contractor to build the hospital to the design solution. As a result, the designers and the contractor would have had only a weak incentive to improve the clinical functionality of the hospital beyond the minimum requirements. This weak incentive would have arisen from the opportunity to enhance reputation.

The designers developed the HV scheme design solutions in conjunction with an Activity Data Base (ADB). The ADB was to consist of 1:200 plan drawings and room data sheets (RDSs) of each of the approximately 2,500 rooms of the hospital. However, the design of some of the rooms was to be standardised across the hospital. In relation to HV, the RDSs specified the environmental conditions each of the rooms would need to have. DSSRL obtained the required environmental conditions from NHS Estates. The tolerances were defaults for NHS hospitals. Consequently, DSSRL designed the HV solution with the aim of delivering the specific environmental conditions outlined in the ADB.

Hospital design is governed by guidance documents issued by various public sector bodies. Therefore, DSSRL needed to design a HV solution that would comply with the relevant Health Building Notes (HBNs), Health Technical Memoranda (HTMs), British Standards, CIBSE Guidance, Building Regulations, and Disability Discrimination Act etc. In addition, the HV solution needed to satisfy the demands of various external third parties such as Infection Control and Camden Planning. The output specification (OS) made the compliance of the HV solution with specific guidance documents a mandatory requirement. If the HV solution was to be unsatisfactory the external third parties, it could not be implemented. As a result, DSSRL was fairly constrained in its scheme design development.

Opportunity Analysis 6(OA)/7
HMG had an opportunity to propose any given HV solution subject to meeting the OS, UCLH's clinical functionality requirements and constraints imposed by external third parties. However, the OS made compliance with various standards and design guidance documents compulsory. If the SPS was to be non-compliant, the project could not reach financial close. This limited the ProjectCo's opportunity to implement $CWLC_P$ driven design solutions within the HV solution. Therefore, in comparison to traditional development process, the PFI development process gave the private sector actors only a slightly improved opportunity to minimise $CWLC_P$.

Perception Analysis 6(PA)/5
UCLH used an OS to procure the project. The compliance requirements in the OS were perceived to be technical and very prescriptive and, therefore, to significantly limit the scope to implement $CWLC_P$ driven design solutions. It was acknowledged that the standards and guidance documents could be challenged, but the outcome of such

challenges would be uncertain. It was felt that the strict requirements on HV diverted attention away from implementing $CWLC_P$ driven design solutions within the HV solution to implementing them in other less complex areas of the SPS.

As DSSRL worked on the HV solution, it was conscious that HMU would incur UP deductions, if a space in the hospital did not meet its specified environmental conditions. At the time, UCLH and HMG were also negotiating the details of the payment mechanism (PM). However, the detailed clauses that related to specific areas of the building had a limited impact on the scheme design. Instead, DSSRL sought to improve the operational certainly of the HV solution as a whole. DSSRL designed the HV plant to serve the building as a whole rather than a specific piece of plant to serve a specific area. Therefore, if a single piece of plant failed, the failure would merely reduce the overall HV capacity and would not necessarily cause unavailability in any one area. DSSRL designed the HV plant to have a considerable amount of excess capacity. Therefore, several pieces of plant will have to fail simultaneously for unavailability to occur. In addition, DSSRL designed the HV solution to have a diversified distribution. Therefore, if the distribution network were to fail, the failure would not necessarily cause unavailability. If the failure were to cause unavailability, it could be limited to a relatively small area.

DSSRL and HCTJV developed a design for corridor modules to be used in building services distribution. The modules will enable the distribution to be installed with relative ease and, therefore, improve constructability and, thus, decrease the likelihood of unanticipated problems in installation. In addition, the corridor modules will provide excellent access for carrying out maintenance in the operational period.

Solution Analysis 6(SA)/2

The corridor modules used in routing HV distribution will reduce $CWLC_P$. This is because they will facilitate a cost efficient maintenance of the distribution. However, it must be noted that the modules were adopted primarily to reduce the duration of construction and to improve completion certainty. Therefore, the corridor modules are a $CWLC_P$ reducing, as opposed to $CWLC_P$ driven, design solution. The expert assessment confirmed that the corridor modules would reduce $CWLC_P$.

During the scheme design development, LDL worked closely with Camden Planning. It wanted to ensure that its design solution met the conditions of the detail planning permission. In August 1998, HMG received the approval to build the new single site hospital.

6.5.3. Life Cycle Fund Development

HMG had estimated $CWLC_P$ and, thus, priced its SPS primarily using HCTJV's capital cost and BPFML's £/m^2 operational cost estimates. As HMG developed the SPS further, it needed to estimate $CWLC_P$ more accurately and reliably to improve HMU's expenditure certainty. Accordingly, HMG adopted a structured approach in its estimation. It decided to follow a British Standard on the durability of building components.

HMG scrutinised the scheme design solution. It identified close to a hundred different primary building component types based on the expectation that expenditure on these types of components would present a significant proportion of $CWLC_P$. HMG isolated the components from the SPS. A substantial number of the components were part of the HV solution. Subsequently, HMG created a life cycle fund (LCF). The fund was to be used to meet the cost of major maintenance and replacement of the primary building components. Hereafter, these components are referred to as the *LCF components*. It must be noted that HMG did not intend to use the LCF for minor maintenance of the components. Instead, BPFML would carry out the task as part of its operation. Therefore, BPFML was also responsible for estimating the cost of minor maintenance as it priced its operation contract.

Subsequently, HMG set out to rationalise the selection of LCF components it would use in the SPS. It sought to use component types that would minimise the $CWLC_P$ of each component. However, in the selection, HMG only took into account a component's *major* maintenance, replacement and capital costs.

Initially, HMG attempted to obtain whole life cost (WLC) data on the LCF components. However, the availability of the data in the market was limited. In addition, HMG perceived that the quality of the data that it could obtain was inadequate to govern LCF component selection. Therefore, HMG invited the ProjectCo actors to participate in workshops where the LCF was to be developed. Initially, the actors estimated the $CWLC_P$ of each LCF component. The actors possessed WLC data in variable quantity and quality. DSSRL provided most of the data on the HV components. It had produced maintenance management systems in the past. Therefore, it possessed some useful data. However, the vast majority of the information used in LCF component selection was extracted from the past experience of the individuals involved.

HMG held a series of workshops where the actors debated the possible $CWLC_P$ profiles of LCF components. For example, in the case of a chiller, the workshop participants identified the main types of chillers on the market. Subsequently, the actors used their past experience to estimate the costs and timings of major maintenance and replacement associated with each chiller type. The life expectancy of each chiller type was revealed in this process. The actors estimated the costs of major maintenance and replacement as percentages of the components' capital cost, which they extracted from HCTJV's capital cost estimate. The actors debated the accuracy of their estimates. DLE captured the discussions into a formal LCF model. Subsequently, the actors refined the model in the following workshop with information they had obtained in the meantime.

Perception Analysis 6(PA)/6
The availability of quality WLC data in the market was seen to be very limited at the time of SPS development. It was felt that reliance on the data in SPS development would be a significant risk. The non-existence of data on new materials and components was seen to be an additional problem. The quality of the WLC data generated in the LCF workshops was perceived to be of superior quality to the data available in the market. Nevertheless, the lack of good quality data in significant quantities was seen to discourage the implementation of $CWLC_P$ driven design solutions. In 2002, it was acknowledged that the quality and availability of WLC data had improved as the PFI market had matured.

Eventually, after a series of workshops, the actors arrived at a consensus on the $CWLC_P$ profile of each chiller type. Subsequently, they compared the profiles of alternative chiller types. The actors used actual costs in the comparison. In other words, they did not use discounted cash flow techniques. In addition, the actors used current prices and did not take inflation into account. This was because the UP was expected to vary in line with the Retail Price Index (RPI), which was also felt to reflect the changes in major maintenance and replacement costs. The actors selected the chiller type with the lowest non-discounted $CWLC_P$ of the alternatives. As HCTJV would request quotes for the chosen component types from the market, a more accurate estimate of the $CWLC_P$ of the LCF components would emerge. HMG would use this information to estimate $CWLC_P$ and, subsequently, price the project more accurately.

Incentive Analysis 6(IA)/13
The ProjectCo actors did not use discounted cash flow techniques in LCF component selection. As a result, future savings appeared higher in LCF development than they would have if they had been discounted. This strengthened the ProjectCo actors' perceived incentive to implement $CWLC_P$ driven design solutions.

Perception Analysis 6(PA)/7
The experience of $CWLC_P$ modelling was perceived to be limited. This was seen to have prevented the development of a $CWLC_P$ model that would have guided SPS development from inception. However, some actors felt that the cost interrelationships in the SPS were understood and that the main problem was the lack of data to populate the model. Furthermore, some actors were of the opinion that other actors understood $CWLC_P$ minimisation and its importance but did not pursue it. This was seen to be due to the slow pace of change in individuals' attitudes.

Solution Analysis 6(SA)/3
The LCF component selection achieved in the project will reduce $CWLC_P$. However, the selection was partially driven by the desire to improve the certainty of HMU's LCF expenditure in the operational period. Therefore, the LCF component selection is not a $CWLC_P$ driven design solution, but a $CWLC_P$ reducing design solution. The expert assessment validated the LCF component selection as $CWLC_P$ reducing design solution.

Initially, HMG intended to include LCF management as part of BPFML's operation contract. However, ANTS insisted that HMU should retain LCF management. This was because such an arrangement would leave the LCF unaffected by an operator default and, therefore, reduce the overall project risk. As a result, HMG designed the LCF to be controlled jointly by HMU and ANTS. The two actors will release funds based on BPFML's recommendations. HMG and ANTS agreed that BPFML will report on the condition of the hospital every six months. This will enable HMU to anticipate its LCF expenditure more accurately. In other words, the reports will allow HMU to decide whether to postpone or move forward major maintenance and replacement of the LCF components. However, HMU will have an opportunity to commission independent surveys on the building if it is uncomfortable with BPFML's recommendations. HMG budgeted a small contingency in the LCF to meet the cost of such surveys.

Perception Analysis 6(PA)/8
HMU was to retain the responsibility for LCF management. The arrangement was perceived to facilitate the implementation of $CWLC_P$ driven design solutions. This was because HMU had the authority to instruct HCTJV and BPFML to change their solutions if $CWLC_P$ savings involving LCF components could be identified.

HMU will use the UP to meet five distinct liabilities. First, it will make loan repayments with interest to ANTS. Second, it will compensate BPFML for the operation of the hospital. Third, HMU will meet the cost of maintaining its own existence, which will be a minor cost in comparison to its other liabilities. Fourth, it will transfer some of the UP to the LCF. Fifth, it will pay dividends to AMEC plc and BPGL.

The initial LCF expenditure profile had peaks and troughs. HMG attempted to smooth the expenditure profile. First, it did not want the LCF expenditure to affect HMU in meeting its other liabilities from the UP in any one year. Second, HMG wanted to minimise the excess funds in the LCF as they could yield higher interest if invested in HMU shareholders' core business operations. Third, HMG did not want to disrupt UCLH's healthcare provision by major maintenance and replacement. Consequently, the ProjectCo scheduled LCF expenditure to be spread evenly around the time the work was expected to be required. The ProjectCo actors debated whether the selection of different types of components could be used to smooth the demands on the LCF. However, the earlier selection of LCF components prevailed.

Incentive Analysis 6(IA)/14
HMU has an incentive to minimise its expenditure on the LCF components in the operational period. This is because it will be entitled to any surplus in the LCF at the end of the contract period. Thus, it had an incentive to select a set of LCF components to be used that will minimise LCF expenditure. This would enable it to maximise its profit and, thus, pay the maximum dividends. However, HMU will also have an incentive to ensure that the major maintenance and replacement of LCF components will not compromise operational and/or operational expenditure certainty of the project. This is because compromised operation and/or increased operational expenditure will reduce the amount of profit it will make from the project. As a result, HMU has an incentive to allocate sufficient funds to the LCF to carry out major maintenance and replacement.

HMU will also have an incentive to have a small surplus in the LCF for unanticipated events. This is because such events could lead to compromised operational certainty. However, HMU also has an incentive to minimise the excess funds in the LCF. This is because the LCF will only yield a market rate of interest. AMEC plc and BPGL are able to invest their dividends in their core business operations, which are likely to yield a higher rate of return than the LCF.

6.5.4. Restructuring the Project

HMG felt that the risks in the construction phase of the project would be substantial. The sourcing of building services technicians in the London labour market was seen as a particularly high risk. This was because the labour market could change significantly in the construction period. Therefore, HMG was keen to have another contractor involved in the project. ANTS strongly supported the inclusion of an additional contractor, as it would reduce the project risks. Consequently, HMG began to look for a contractor interested in participating in the project.

HMG identified Balfour Beatty Construction Limited (BBCL) and Haden Young Limited (HYL) as potential candidates. BBCL is a construction contractor operating in the UK and internationally. HYL is a predominantly UK building services contractor. BBCL and HYL had considerable PFI experience. In addition, they had worked with ACL and MHL on other projects in the past. HMG felt that the strengths of the two companies complemented those of ACL and MHL. Consequently, in September 1998, BBCL and HYL joined the project. Furthermore, Balfour Beatty Capital Projects Limited (BBCPL) became a joint venture partner in HMG with the intention of investing equity in HMU. BBCPL is an InvestCo that specialises in bidding for and investing equity in PFI projects. BBCPL, BBCL and HYL are all subsidiaries of Balfour Beatty plc, which is a leading UK and international engineering contractor.

Incentive Analysis 6(IA)/15
BBCPL joined the project as an InvestCo to take up a similar role to those held by AMEC plc and BPGL. Therefore, it had the same incentives in the project as the two actors – see 6(IA)/1&9.

ACL, MHL, BBCL and HYL formed Building Contractor Joint Venture (BCJV), which replaced HCTJV. The contractors agreed to share the profit or loss made by BCJV. The general contractors and building services contractors would receive 30% and 20% shares respectively. BCJV was created to be an integrated joint venture. It did not employ anyone directly. Instead, it had labour supply agreements with the four contractors. The contractors would second staff to BCJV in roughly the same share that its profit and loss was to be distributed. However, each of the contractors would have an equal vote in BCJV's decision-making, which would have to be unanimous.

Incentive Analysis 6(IA)/16
As BBCL and HYL joined the project, they formed BCJV together with ACL and MHL to replace HCTJV. As a result, BCJV, including BBCL and HYL, adopted HCTJV's incentives in SPS development – see 6(IA)/10.

Opportunity Analysis 6(OA)/8
The SPS was fairly advanced at the time BBCPL, BBCL and HYL joined the project. As a result, the three actors had only a limited opportunity to influence the SPS. However, it must be noted that the SPS development had proceeded in line with the objectives of AMEC plc, BPGL and HCTJV. The actors had the same incentives as the actors that joined the project.

BCJV decided to use work package procurement to build the hospital. This was because such an approach enabled it to use its core competence of construction management most effectively. It would subcontract the vast majority of the construction of the hospital as work packages. These subcontracts would include the responsibility for production design. However, BCJV chose to produce the building services production design and carry out the building services installations in-house. This was because it had superior access to experienced building services designers and technicians through its labour supply agreements with MHL and HYL.

Incentive Analysis 6(IA)/17
BCJV will use mainly work package procurement to build the hospital. It will maximise the profit it will make from the project by minimising the cost of designing and constructing the hospital. As a result, BCJV has an incentive to minimise the capital cost of each of the work packages. However, it also retains its incentives to minimise $CWLC_P$ and not to compromise completion, operational and operational expenditure certainty – see 6(IA)/10.

During scheme design development, AMEC plc restructured. It created AMEC Project Investments Limited (APIL) as an InvestCo subsidiary specialised in bidding for and investing equity in PFI projects. Therefore, APIL would invest equity into HMU instead of AMEC plc. In addition, AMEC plc created AMEC Capital Projects Limited (ACPL) as a company specialised in construction and construction management. ACL and MHL became divisions of ACPL.

Incentive Analysis 6(IA)/18
ACPL replaced ACL and MHL in the project. As a result, ACL adopted their incentives in SPS development – see 6(IA)/10&17. APIL replaced AMEC plc and, thus, took over the pursuit of its objectives in the project – see 6(IA)/ 1&9.

At the time, ANTS insisted that all design and construction risks should be packaged into the DB contract HMU would place with BCJV. As a result, HMG novated LDL to BCJV. Consequently, BCJV took the responsibility for the architectural design. The organisation of the key project actors after the inclusion of additional contractors, AMEC plc restructuring and LDL novation is illustrated in Figure 6.7. The organisation of the actors was to be mirrored in the contractual framework for the project.

Incentive Analysis 6(IA)/19
LDL's incentives changed, as it was novated across from HMG to BCJV. Now, LDL had an incentive to pursue BCJV's objectives (see 6(IA)/10&17) in its design development instead of HMG's – see 6(IA)/1&9&12&14. As a result, LDL's incentive to implement $CWLC_P$ driven design solutions was weakened.

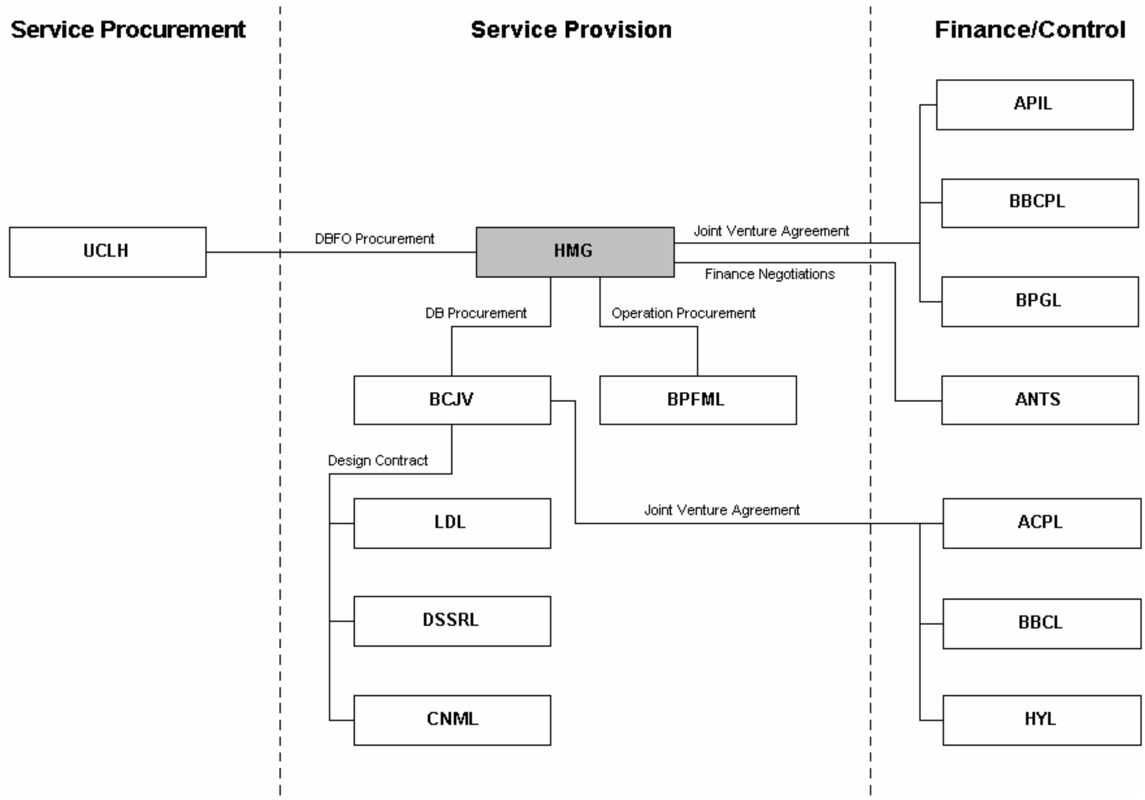

Figure 6.7. The organisation of the key project actors in the PB stage in late 1998.

Perception Analysis 6(PA)/9
It was perceived that if LDL had worked for HCTJV/BCJV from inception, it would have pursued capital cost minimisation in its design development. At the time of LDL's novation, the major design decisions that were to determine $CWLC_P$ were perceived to have been taken. HMG was perceived to have placed an emphasis on $CWLC_P$ in developing the DB and operation contracts. Therefore, it was felt that HMG no longer needed to control LDL directly. The late novation of LDL was seen to have contributed to $CWLC_P$ minimisation.

6.5.5. Negotiating the DBFO Contract

At the time UCLH drafted the initial contractual terms, the understanding of PFI contracts was limited. Therefore, as the project progressed, UCLH and HMG spent a considerable amount of time developing the overall contractual documentation that could be used to award the contract. The main contract to be used in the project was a DBFO contract between UCLH and HMU. The initial draft of the contract had been part of the ITND. However, because the PFI market had matured, it required some renegotiation. In addition, UCLH and HMG needed to agree the various specifications to be appended to the contract. These specifications would encapsulate HMG's SPS and UCLH's requirements. BCJV and BPFML were also involved in the negotiations. This was because HMU was to pass the vast majority of the project risks to BCJV and BPFML using DB and operation contracts.

The DBFO contract allocates the vast majority of the risks related to designing, building, financing and operating the hospital to HMU. However, there are some exceptions. First, UCLH and HMG agreed a small minority of the risks, namely *force majeure* –type risks, to be shared. A national strike is an example of this type of risk. HMU will be liable for this category of risk to a predetermined maximum. Second, UCLH agreed to retain the liability for design and construction risks that materialise due to its omission. A delay in completion caused by UCLH's failure to approve the clinical functionality of the design is an example of this type of risk.

UCLH and HMG agreed that the party that requested a variation after financial close would meet the cost of its implementation. This, however, would exclude variations issued due to the introduction of legislation that was hospital specific, discriminatory or enabled VAT reductions to be obtained through the NHS. In these three cases, UCLH and HMG would adjust the UP to reflect the cost implications of the necessary variations. HMU would take the responsibility for all other variations that had to be made due to the introduction of new legislation.

The duration of the DBFO contract will be 40 years. However, UCLH will have the right to terminate the contract prior to its completion date if HMU's service provision is deemed unacceptable.

Incentive Analysis 6(IA)/20
The DBFO contract was to have a termination clause. As a result, the ProjectCo's incentive to improve completion and operational certainty was strengthened. This was because if the completion or the operation of the hospital were to be significantly compromised, the ProjectCo would lose its future revenues and, thus, its profits from the project.

6.5.6. Negotiating the Design and Construction Aspects of the DBFO Contract

The DBFO contract was developed to have two construction specifications appended to it. These are *Client's Requirements* and *ProjectCo's Proposals*. In relation to HV, Client's Requirements, produced by UCLH, is a slightly more detailed version of the OS. In effect, Client's Requirements is a collection of references to design guidance documents that the HV solution will have to comply with. It also refers to the ADB and makes compliance with it compulsory. Client's Requirements does not specify a HV solution for the hospital. However, it must be noted that the precise control of environmental conditions specified in the ADB for some areas of the hospital can only be achieved with certain types of HV systems.

The ProjectCo produced ProjectCo's Proposals. The document specifies the HV solution at its scheme design stage. It describes the HV solution the building will have. In other words, the document states that a VAV system will be used in the critical areas and an ACB system in the remaining areas of the building. The document also identifies the locations for the HV plant and the routing of the HV distribution. However, ProjectCo's Proposals does not name specific types of components to be used. The document also refers to the ADB. It commits HMU to maintaining the environmental conditions in the building as outlined in the document.

The DBFO contract requires HMU to implement a HV solution that will meet Client's Requirements. The contract accepts the HV solution in ProjectCo's Proposals as a compliant solution. However, the contract does not oblige HMU to implement the specific HV solution in ProjectCo's Proposals. It allows HMU to alter the solution as long as it meets Client's Requirements.

The two construction specifications make explicit the aspects of the hospital that will be included in the project. UCLH will be responsible for procuring, installing and operating all the core medical equipment, such as X-ray machines. Similarly, HMU will be responsible for the entire building including non-core medical equipment like X-ray viewing boxes. However, in some specific cases, non-core medical equipment will be obtained from UCLH's existing facilities. In such cases, the equipment will be transferred to HMU's ownership to be installed in the new hospital and subsequently operated.

This case study examines the HV of three types of area in the hospital. These are operating theatres, inpatient wards and offices. These specific areas were selected because they fall into the three different categories of the PM – see Section 6.5.9.2.

The Main Building will have a total of 12 operating theatres of four different types. The Main Building will have cardiac (3), laser (2), normal (5) and ultra clean (2) operating theatres. The total GFA of the theatres will be 601 m^2. All the theatres will be located on the 3^{rd} floor of the Podium. Client's Requirements makes it compulsory for the operating theatres to comply with all the relevant design guidance. The environmental conditions the theatres are required to have are outlined in the ADB. These requirements are summarised in Table 6.1. It must be noted that the hospital will have two additional operating theatres in the EGA Wing.

Table 6.1. Environmental condition requirements for operating theatres.

	Temperature	Ventilation Extraction/Supply	Pressurised	Filtration	Humidity
Cardiac	Controllable 15–25°C	as HTM 2025	Yes	min 80% DSE	40–60% RH
Laser	Controllable 16–24°C	as HTM 2025	Yes	min 80% DSE	40–60% RH
Normal	Controllable 16–24°C	as HTM 2025	Yes	min 80% DSE	40–60% RH
Ultra Clean	Controllable 15–25°C	as HTM 2025	Yes	min 90% DSE	40–60% RH

The vast majority of the inpatient wards in the hospital will be in the Main Building Tower. It will have a total GFA of 7 444 m^2 of inpatient wards. The inpatient wards have a standardised design, which consists of ward area, shower area and toilets. The required temperature for the inpatient wards is a minimum of 21°C in winter and a maximum of 25°C in summer. The filtration required is a minimum of 80% DSE. The ADB does not specify additional environmental requirements for the inpatient wards.

The office space in the newly built hospital will be limited and scattered. The vast majority of the office space in the hospital will be in the Maples Building. However, that office space will be refurbished and, consequently, it will not be used as an example in this case study. The largest concentration of offices in the newly built hospital will be on the 3rd floor of the EGA Wing. The total GFA of that office space will be 134 m^2. The area will consist of 9 offices and 2 corridors. The minimum winter temperature required in the area is 20 °C. The minimum winter temperature is the only environmental condition requirement specified for the office space.

6.5.7. Negotiating the Operational Aspects of the DBFO Contract

The DBFO contract was designed to have a FMOS and Operational Method Statements (OMSs) appended to it. The FMOS, produced by UCLH, is an output-based specification of the operational services. The contract allocates HMU the responsibility to operate the hospital to the standard set in the FMOS. The OMSs, produced by BPFML, outline a possible approach to operating the hospital to the standard specified in the FMOS. However, HMU will not be obliged to provide the services as described in the OMSs. This is because methods of operation are likely to evolve during the construction period. HMU is not obliged to provide UCLH with OMSs until March 2005.

The operation will have three distinct phases. In the first phase, HMU will operate UCLH existing facilities to be replaced by the new hospital. In the second phase, it will service the Main Building, the Maples Building and UCLH's existing facilities to be replaced by the EGA Wing. In the third phase, HMU will provide the operational services in the Main Building, the Maples Building and the EGA Wing. In addition, in the first and second phases HMU will operate EDH and NHNN with the possibility of extending the operation to include the third phase subject to successful negotiations with UCLH. The durations of the three phases are 5, 3 and 32 years respectively. The first phase of operation will commence not more than six months after financial close, the second on the operational date of the Main Building and the third on the operational date of the EGA wing. The operation of the Main Building, the Maples Building and the EGA Wing will include the provision of all the reference services. The operation of UCLH's existing facilities is not within the scope of this case study.

The DBFO contract requires each element of the hospital to be in at least *Condition B* at the end of the contract period. NHS Estates (2001a), for example, defines a categorisation for the conditions of building components in NHS buildings. Condition B is one of these categories. A building component can be classified as being in Condition B only if it is fully operational and has a remaining life expectancy that is in line with its age. UCLH will be allowed to withhold around 6.25% of the annual UP after the end of the contract period and hospital ownership transfer until it has ensured that the hospital is in Condition B.

Incentive Analysis 6(IA)/21
The DBFO contract enables UCLH to withhold payment at the end of the contact period. This reinforced the HMU and BPFML incentives to ensure operational certainty of the hospital throughout the contract period. This was because if the hospital was not to be in its anticipated condition at ownership transfer, the cost of rectifying the situation would be met from HMU's outstanding UP. As a result, HMU's and BPFML's revenues and, thus, profits from the project would be reduced.

The DBFO contract includes a transfer of around 500 of UCLH's non-clinical support service staff. The staff will be transferred to BPFML to which HMU will award an operation contract at financial close. The staff transfer will take place as the first phase of operation begins.

Initially, UCLH was to retain full energy price and consumption risks. HMU was to have only the responsibilities to procure energy and monitor energy consumption. However, some of the first wave hospital contracts had included energy risk transfers. UCLH felt that the VFM of the project could be improved if it transferred some of the energy risk to HMU.

Subsequently, UCLH and HMG began to negotiate the transfer of additional energy risk. HMU will not be able to control the market price of energy. Therefore, HMG was reluctant to agree the transfer of any energy price risk. UCLH accepted this and agreed to retain it. UCLH's healthcare provision will largely determine the energy consumption in the hospital. HMU will not easily be able to influence UCLH's healthcare provision.

Therefore, HMG was unwilling to have any energy consumption risk allocated to HMU. However, through negotiation, UCLH and HMG agreed the energy consumption risk to be shared. HMG accepted that HMU would take the responsibility for energy consumption above the standard of 130 GJ/100m^3 per annum. UCLH will meet the cost of energy consumption below the standard. UCLH and HMG agreed the standard after examining the scheme design solution and various NHS Estates guidance documents on energy consumption, which eventually became NHS Estates (2001b). In addition, UCLH and HMG negotiated an incentive for HMU to reduce energy consumption. The two parties agreed that HMU would receive 10% of any savings arising from below standard energy consumption.

However, HMU will take the responsibility for the cost of above standard energy consumption only if it can be demonstrated to result from the design, construction or operation of the building. HMU will then have to compensate UCLH for the additional energy cost. HMU will also have the right to rectify the cause of the problem at its expense to prevent itself from incurring further liabilities. Subsequently, HMU will pass the responsibility to the appropriate actor – see Figure 6.8. If the excess consumption results from healthcare provision, UCLH will be responsible for the cost.

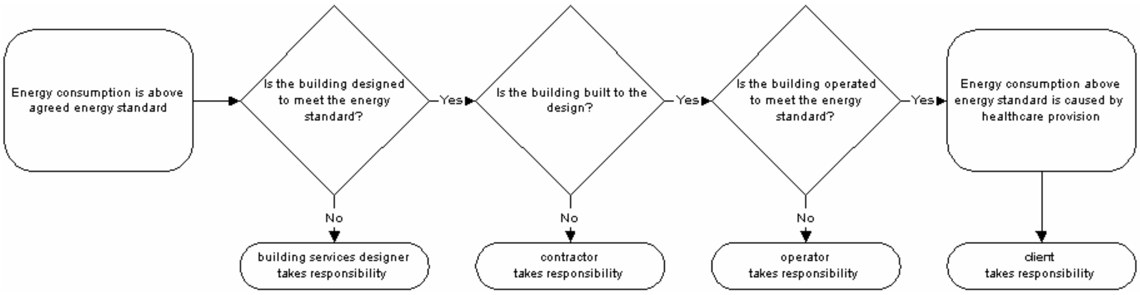

Figure 6.8. Allocation of liability for energy consumption above energy standard.

Incentive Analysis 6(IA)/22
As a result of the energy risk transfer, HMG had two incentives in relation to energy consumption. First, it had an incentive to ensure that consumption in the hospital would not exceed the energy standard. This is because HMU would become liable for the cost of excess consumption. Second, HMG had an incentive to reduce energy consumption below the standard as long as HMU could recover the additional capital expenditure required to do so as additional revenue from UCLH. However, this incentive was relatively weak. This is because HMU would receive only 10% of savings in energy consumption below the standard.

If UCLH had used traditional procurement, it would have used an energy standard to define a consumption target for the hospital. UCLH would have instructed its designers to develop a solution that would not consume energy in excess of the target. The designers would have had an incentive to ensure that the target would not be exceeded. This is because they could become liable for excess consumption if it proved to arise from their design solutions. However, the designers would not have had an incentive to reduce energy consumption below the target. Subsequently, UCLH would have instructed a contractor to build the hospital to the design solution. After that, UCLH would have given its operators an incentive to operate the building energy efficiently. However, due to the length of their operation contracts, they would have only a weak incentive to finance improvements in energy efficiency.

Perception Analysis 6(PA)/10

The agreed energy consumption standard was perceived not to be the most ambitious. However, it was seen to impose a responsible approach to energy usage. The financial penalties for exceeding the standard were seen to make the private sector actors aware of the importance of ensuring that the standard would not be exceeded. However, it must be noted that the vast majority of the private sector actors were unaware of the potential for additional revenues from energy efficiency.

As a result of the renegotiated energy risk transfer, HMG’s team upgraded the scheme design to be more energy efficient. DSSRL estimated the likely energy consumption. It instructed LDL on what was required of the architectural design solution for the building to be energy efficient. The DSSRL and LDL incorporated design features including energy efficient lighting, heat recovery on major HV plant, variable speed motors on major drives, free cooling and night purging. In addition, the cladding was designed to have the minimum possible leakage and to have solar control glazing and shielding. However, these design features increased $CWLC_P$ and, thus, the UP.

Solution Analysis 6(SA)/4

Each of the design solutions incorporated in the SPS to improve the energy efficiency will reduce UCLH’s expenditure on its accommodation. The solutions will increase $CWLC_P$, but they may also increase HMU’s revenue from the project and, thus, offset the increase in $CWLC_P$. These solutions are defined as *energy saving design solutions*. However, it must be noted that their implementation was driven by the desire to ensure that energy consumption would not exceed the energy standard and, thus, that HMU would not incur additional liabilities. It must be noted that their implementation was not driven by the desire to increase HMU’s revenue from the project by improving the energy efficiency of the hospital. The expert assessment identified that the use of variable speed motors would improve the energy efficiency significantly.

6.5.8. Negotiating Funding and Finance of the DBFO Contract

The DBFO contract will be funded from three distinct sources. These are: the UP to be met from UCLH's annual budget, the one off payments to be met from the receipts from UCLH's sale of properties to be made surplus by the project, and HMU's profits from third party activity. UCLH retained the risk of having adequate funds in its annual budget to make the UP to HMU.

Initially, UCLH was to transfer a considerable number of properties to HMU as part of the project. These properties will be surplus to UCLH's requirements when it has relocated to the Main Building, the Maples Building and the EGA Wing. HMG and UCLH spent a considerable amount of time on negotiating a mutually acceptable price for the property transfer. However, in the late nineties, property prices in London rose rapidly. Therefore, UCLH felt that the value of the properties would increase considerably during the construction phase. HMG disagreed with UCLH's projection of the anticipated property price increase. As a result, the two parties failed to reach an agreement. Eventually, in early 1999, the two parties agreed that UCLH would retain the property risk. It will sell the properties once they are vacated and pay a total of £83 million to HMU in instalments on specific dates of the contract period. At this point, the involvement of AMEC Developments Limited in the project ended.

The third party revenues in the project will arise from private patient and retail activity in the hospital. UCLH and HMG agreed that UCLH and HMU would get a 40% and a 60% share respectively of the rent income from these activities. HMU's 60% share will be used to fund the project directly. Naturally, UCLH will be able to use its share towards the UP and, therefore, fund the project indirectly.

UCLH and HMG negotiated the DBFO contract to allocate HMU the full responsibility for financing the project. In other words, HMU took the responsibility for obtaining a loan to finance the project until the completion date. Subsequently, it will have the responsibility of being able to repay the loan with interest.

At the time of negotiating the finance risk allocation, both UCLH and HMG anticipated that the project would be refinanced shortly after operational date. Therefore, the two actors agreed that HMU would direct a 10% share of any refinancing gain to UCLH.

6.5.9. Negotiating the Payment Mechanism for the DBFO Contract

6.5.9.1. Unitary Payment

UCLH and HMG agreed that UCLH would pay HMU the UP quarterly in advance. The UP will consist of an availability payment (AP) and a service payment (SP). The initial AP will be made on the completion date and the initial SP on the operational date. Subsequently, the UP will be made on the first date of the quarterly payment period. Thus, UCLH will not begin to pay HMU the UP until the hospital has been commissioned.

The annual UP will be around £32 million with the AP and the SP being around £22 million and £10 million respectively. UCLH and HMU agreed the UP based on March 1997 prices. UCLH will adjust each quarterly UP according to the RPI.

HMU will report its availability and service performance in the operational period at the end of each contract month. In addition, it will summarise its performance quarterly. In the summary report, HMU will calculate deductions that arise from unavailability and shortcomings, variations and non-provision in operation. Subsequently, UCLH will make the payment proposed by HMU. If UCLH disagrees with the proposed UP, the issue is resolved using a fast track dispute resolution procedure. The procedure will enable the dispute to be resolved within a maximum of 31 days. In the meantime, HMU will retain the disputed payment. If the issue is resolved favourably to UCLH, the following quarterly UP will be adjusted accordingly.

6.5.9.2. Availability Payment

The AP will be payable from the completion date. For example, the AP for the Main Building will be payable from the date that it is completed. It must be noted that UCLH and HMU have not agreed the consequences of early completion on the UP.

The AP will be linked to the availability of all the areas in the hospital. In the case of HV, availability will be related to the compliance with the environmental condition requirements outlined in the ADB. A space will be deemed unavailable if its temperature is more than 5°C above or 4°C below the specified tolerances. However, an area will not be classified as unavailable if the ambient temperature is above 29°C or below –4°C. In relation to humidity, filtration, extraction and supply, HMU will need to stay within the specified tolerances at all times.

In the event of unavailability, HMU will incur an unavailability deduction. HMU will be liable for the deduction if it arose from delaying LCF expenditure against BPFML’s advice. If this is not the case, HMU will be able to receive compensation from either BCJV or BPFML. If unavailability occurred due to failings in specification, design or construction, BCJV will be liable. In the case of design failures, BCJV will be able to seek compensation from the relevant designer. If the unavailability arose as a result of a shortcoming in operation, BPFML will be liable.

It must be noted that unavailability will be allowed to occur in the first 90 days after the completion date without resulting in deductions. This period is known as the *settling in period*. In addition, the unavailability deductions will not apply if unavailability was caused by UCLH's omission, maintenance and/or replacement in accordance with the annual programme, or work carried out due to the introduction of new legislation.

The PM divides the building into three spatial categories. The classification of a space affects the magnitude of the unavailability deductions and the time HMU will be allowed to rectify the cause of the unavailability without incurring deductions. This period of time is known as the *grace period*. Category A space includes areas such as operating theatres and laboratories. Category A space is the highest risk space, carries the heaviest unavailability deductions and has a grace period of 2 hours. Category B space consists of areas such as impatient wards. The grace period for category B space is 5 hours. Category C space includes areas such as offices and storage rooms and has a grace period of 10 hours. In negotiating the PM, UCLH and HMU agreed to review the division of the hospital into the three spatial categories in the operational period.

In the event of unavailability, HMU will need to provide UCLH with alternative accommodation. UCLH will need to approve the accommodation. HMU will also be liable for reasonable cost increases in UCLH's healthcare provision, namely, the costs arising from relocation. The unavailability deductions will cease to apply when HMU has rectified the cause of unavailability.

An unavailability period will begin when an *Unavailability Notice* is made. UCLH will be able to make the notice through BPFML's helpdesk. If BPFML identifies the unavailability, it will need to notify UCLH. If UCLH's Unavailability Notice is deemed true, an unavailability period will begin, initially with a grace period.

Once BPFML has rectified the cause of the unavailability, it will submit a *Cure Notice* to UCLH. Subsequently, within an hour, UCLH and BPFML will inspect the area where unavailability had occurred. The Cure Notice ends the unavailability period. However, the Cure Notice will become invalid if the area is deemed unavailable in the inspection or if the unavailability reoccurs within 6 hours.

The unavailability deductions will be calculated using formulae 6.1 and 6.2. The magnitude of the AP deductions will be determined by the type of space affected, the floor area affected, the duration of unavailability and whether alternative accommodation was used or not.

$$UD_t = AP_t \times p_t \tag{6.1}$$

where, UD_t is the unavailability deduction for the payment period t,
AP_t is the availability payment for the payment period t, and
p_t is the unavailability deduction percentage for the payment period t.

$$p_t = \sum_{i=1}^{n} \left(\frac{(a_i \times w \times d_i \times r_i)}{A_t \times D_t} \right) \tag{6.2}$$

where, i is the unavailability incident,
n is the total number of incidents of unavailability,
a_i is the total area of unavailability for incident i,
w is the weight (A=10, B=5 or C=1) of the spatial category where incident i occurred,
r is 1 if alternative accommodation is used and 0.5 if the area of unavailability is still used,
d_i is the duration of unavailability (excluding grace period) for incident i,
A_t is the total floor area of the spatial category affected by unavailability incident i, and
D_t is the total duration of the payment period t.

Incentive Analysis 6(IA)/23
The AP formula was finalised leading to financial close. It enforced the ProjectCo's incentive to improve operational certainty of the hospital – see 6(IA)/9. However, it must be noted that the AP formula created incentives of different strengths for the three spatial categories in the hospital. The incentive to increase the operational certainty of category A space is the strongest and of category C space the weakest. In other words, the ProjectCo's incentive to implement $CWLC_P$ driven design solutions is the most influenced by the incentive to improve operational certainty of category A space and the least affected by the incentive to improve operational certainty of category C space.

Once the details of AP became more apparent, HMG considered the use of natural ventilation in some of the category C space of the EGA Wing that was not subject to noise and atmospheric pollution from Euston Road. However, HMG established that the $CWLC_P$ savings that could be obtained by using natural ventilation in those areas were limited. HMG also concluded that the use of a mixture of HV systems would increase the complexity of the HV solution. This in turn could compromise operational certainty. Consequently, HMG retained the ACB system in the category C space of the EGA Wing.

6.5.9.3. Service Payment

The SP will be payable from the operational date. For example, the SP for the Main Building will be payable from the date that BPFML begins to provide operational services in the building. The vast majority of the SP will be linked to BPFML's operational performance in accordance with the FMOS. However, the SP will also be slightly influenced by the volume of service provision. Namely, the payment related to catering, linen, laundry and waste management will be affected by volume. This is because the cost of providing those services will be largely determined by their quantity. For example, the cost of catering will be a function of the number of meals provided.

The SP will be determined by the extent that BPFML meets the performance indicators for each operational service. It must be noted that there are no performance indicators for HV as it is covered under the AP. BPFML will be given a percentage score on its performance against each indicator. If the percentage is less than a hundred, HMU will incur a SP deduction of the appropriate magnitude. However, UCLH and HMU have yet to agree the exact performance measurement methodology for operation. These are to be agreed, at latest, three months prior to the operational date. If the two parties fail to agree the performance measurement methodology by that time, it will be determined using the fast track disputes resolution procedure.

In the operational period, the price of HMU and, thus, all BPFML soft operational service provision will be benchmarked and/or market tested. UCLH will take the decision on whether the services will be benchmarked or market tested. The exercises will take place two years after the completion of the EGA Wing and every five years thereafter.

BPFML's SP may be benchmarked for price against equivalent provision in the NHS. The benchmarking will be done by HMU one soft operational service, such as cleaning, at a time. UCLH and HMU have not yet agreed the precise method for benchmarking. After benchmarking, the relevant proportion of the SP will be adjusted in relation to the operational service benchmarks using Formula 6.3 if the benchmark price is within 15% of the current price and using Formula 6.4 if it is outside that range.

$$N_x = C_x \pm \left(\frac{B_x - C_x}{2} \right) \qquad (6.3)$$

where, N_x is the new price of soft operational service x,
C_x is the current price of soft operational service x, and
B_x is the benchmark price for soft operational service x.

$$N_x = C_x \pm \left(\frac{7.5 \times C_x}{100} \right) \qquad (6.4)$$

UCLH may also market test the price of BPFML's soft operational service provision in the contract period. UCLH will request a price for a specific soft operational service, such as cleaning, from a list of pre-selected potential service providers. BPFML will have to re-bid for the service as part of market testing. The new price of the service will be the price that a provider in the market is willing to accept for providing it. This may result in a part of BPFML's operation being taken over by an outside subcontractor willing to provide the soft service at a lower cost. It must be noted that the exact methodology for market testing is yet to be agreed.

Incentive Analysis 6(IA)/24
The price of BPFML's soft operational service provision will be benchmarked and market tested in the contract period. The prospect of benchmarking did not affect the ProjectCo's incentive to implement $CWLC_P$ driven design solutions. However, the prospect of market testing significantly weakened the ProjectCo's incentive to implement $CWLC_P$ driven design solutions. This is because, at market testing, the potential service providers would be aware of the $CWLC_P$ driven design solutions incorporated in the hospital. Thus, they would be able to price their bids accordingly. This would force BPFML to lower its SP and, consequently, HMU its UP. As a result, HMU would lose the efficiency savings generated through $CWLC_P$ minimisation. In conclusion, the ProjectCo had an incentive to implement $CWLC_P$ driven design solutions only if the additional capital expenditure required could be recovered before the first round of market testing.

Perception Analysis 6(PA)/11
BPFML was seen to be unwilling to finance $CWLC_P$ driven design solutions. This was perceived to result form the prospect of market testing soft operational services. BPFML would be able to capture operational cost savings from increased capital expenditure only until the first round of market testing.

Perception Analysis 6(PA)/12
The prospect of UP deductions was seen to influence design solution as a whole. However, it was felt that the more specific details of the PM, such as spatial categorisation, were not taken into account in design development.

6.5.10. Negotiating the DB Contract

HMG and BCJV negotiated a fixed-price DB contract to be used between HMU and BCJV. The contract covers the design and construction of the hospital. The risk allocation in the DB contract mirrored the design and construction risks the DBFO contract would allocate to HMU.

The DB contract was based on Contractor's Proposals. The document specifies the design and construction solutions of the hospital. The document is a slightly more detailed version of ProjectCo's Proposals. A key difference between the two documents is that Contractor's Proposals include a schedule of design lives for LCF components. HMG specified the design lives in order to impose a minimum standard for the LCF components to be used, and thus its LCF component selection – see Section 6.5.3. BCJV will be obliged to design, procure and install the LCF components to achieve their specified design lives. If the LCF components have been maintained appropriately but need to be replaced earlier than anticipated, BCJV will be liable unless it can demonstrate that it designed, procured, and installed the components to meet their design lives. However, in the case of failure in design and/or specification, BCJV may be able to pass the liability to its designers and/or suppliers.

Incentive Analysis 6(IA)/25
BCJV had an incentive to minimise the capital cost of undertaking the DB contract subject to meeting a number of other objectives – see 6(IA)/10&17&20&23. The inclusion of design lives into the DB contract imposed an additional constraint on its capital cost minimisation. This is because BCJV could become liable if the LCF components did not meet their design lives.

Perception Analysis 6(PA)/13
The design lives were seen to have a major influence in design development. They were perceived to oblige BCJV to use LCF components that would reduce $CWLC_P$.

HMG and BCJV negotiated the DB contract to have a liquidated damages clause. The penalties for a delay in the completion date will be around £50,000 per day and, therefore, considerable. The amount of liquidated damages was designed to meet HMU's finance repayment with interest for the delay period. HMG and BCJV agreed the construction programme to be tight, but not overly optimistic. This was because the two actors were aware that the design and construction solutions would have to pass a due diligence assessment prior to financial close. In other words, HMG would have to convince ANTS that it was extremely unlikely that the start of the UP stream from UCLH to HMU would be delayed.

Incentive Analysis 6(IA)/26
As anticipated (see 6(IA)/10), the DB contract contained a liquidated damages clause. This reinforced BCJV's incentive to improve the completion certainly of the hospital as a delay would reduce its profit from the project.

Perception Analysis 6(PA)/14
The potential liquidated damages were perceived to be substantial. Even a short delay was seen to diminish BCJV's anticipated profit from the project. Therefore, it was felt that completion certainty had to be emphasised in SPS development.

The DB contract was to have an 18-month defects liability period after the completion date. Subsequently, BCJV's involvement in the projects will reduce considerably. After the initial defects liability period, BCJV will be liable only for latent defects. In other words, BCJV will be liable only for defects that could not have been detected in the initial 18-month period.

Perception Analysis 6(PA)/15
The DB contract includes only a short defects liability period. However, BCJV was perceived to be aware that its SisterCos, APIL and BBCPL, would be involved in the project for the whole duration of the DBFO contract and that they would have to meet two thirds of any additional expenditures arising from the quality of its construction.

The DB contract also made BCJV responsible for ensuring that the design and construction solutions would not cause the energy consumption in the hospital to exceed the energy standard specified in the DBFO contract. If the standard were to be exceeded, BCJV would become liable for the excess consumption and/or the cost of rectifying its cause – see Section 6.5.7.

Incentive Analysis 6(IA)/27
The DB contract transferred some energy consumption risk to BCJV. As a result, it had an incentive to ensure that the energy consumption in the hospital would not exceed the energy standard. This is because BCJV could incur additional costs due to excess consumption and, thus, its profit from the project could be reduced.

HMG and BCJV agreed a payment profile for the period from financial close to completion date. HMU would pay BCJV monthly. The payment would vary according to the milestones BCJV had achieved in the previous contract month. The two actors agreed the milestones to be representative of actual capital cost expenditure in design and construction. In other words, the milestones were placement of orders, start points and/or end points of activities. Typically, five to ten milestones will be achieved in each month. At the end of each month, HMU will verify and pay BCJV accordingly.

6.5.11. Negotiating the Operation Contract

HMG and BPFML negotiated the operation contract to include the provision of all the reference services included in the DBFO contract. The exception, however, was the responsibility for *major* maintenance and replacement of LCF components, which HMU was to retain. The operation contract was based on the FMOS. In addition, the OMSs were appended to the contract. The OMSs described BPFML's intended methods of provision for each reference service. The OMSs were required for the contract to pass the due diligence assessment prior to financial close. However, the specific OMSs appended to the contract will not be binding to BPFML.

Incentive Analysis 6(IA)/28
BPFML will be responsible for *minor* maintenance of LCF components. Around 20% of the SP will be dedicated to the task. BPFML will have an incentive not to compromise the task. This is because it may become liable for unavailability deductions if the LCF components are not in Condition B because of shortcomings in *minor* maintenance. The deductions can be potentially more than ten times BPFML's payment for undertaking the task.

BPFML will be responsible for procuring and managing the *minor* maintenance of LCF components below the value of £250 per item as part of its estate management service. Above that value, HMU will procure the *major* maintenance and replacement including its management. If BPFML wants to carry out the work, it will have to bid for it in competition with other building maintenance contractors.

BPFML will also be responsible for monitoring the amount of energy consumed in the hospital and reporting it to HMU and UCLH. HMG passed the incentive, embedded in the DBFO contract, to reduce energy consumption below the energy standard in BPFML's operation contract. BPFML will receive 10% of the savings in energy consumption below the standard.

Incentive Analysis 6(IA)/29
BPFML had an incentive to reduce energy consumption in the hospital. This is because it will be entitled to a 10% share of the energy savings in consumption below the energy standard. However, BPFML's incentive to implement energy saving design solutions was weak. This was because the additional capital expenditure required for the implementation of energy saving design solutions would have to be offset by 10% of the achieved energy savings.

Opportunity Analysis 6(OA)/9
BCJV was in charge of design development. As a result, BPFML had only a limited opportunity to implement energy saving design solutions. BPFML would have to finance such solutions in order to convince BCJV to incorporate them into the design solution. BPFML was an operator and, thus, had limited assets. Therefore, its ability to raise finance for energy saving design solutions was limited.

HMU will pay BPFML for operation according to exactly the same criteria that UCLH will pay HMU for the provision of operational services – see Section 6.5.3.9. HMU will pass the SP it receives from UCLH directly to BPFML.

6.5.12. Negotiating the Financing Agreement

HMG and ANTS negotiated the terms of the debt finance for the project subject to a due diligence assessment prior to financial close. HMU needed the debt finance to meet the costs the ProjectCo had incurred and would incur in developing the SPS until financial close and the costs it would incur in making the project fully operational. It must be noted that around 10% of the cost would be met by equity investment from APIL, BBCPL and BPGL in equal share.

HMG and ANTS agreed a schedule for releasing the finance to HMU. This schedule was mirrored in HMU's payment to BCJV for the design and construction of the hospital – see Section 6.5.10. In addition, ANTS and HMG agreed a repayment schedule for the finance. The schedule took into account the one off payments from UCLH following the surplus site sales. These payments would be £83 million in total. HMU would pass the payments directly to ANTS.

The agreed loan period was 32 years. The interest rate for the finance was LIBOR + 1% for the majority of the loan period. Towards the end of the loan period, the interest would rise to LIBOR + 1.3% to reflect the ageing of the building and the resulting increase in the risk of unavailability. However, at the time of negotiating the finance, both HMG and ANTS anticipated that HMU would refinance the project shortly after the operational date.

6.5.13. Value Engineering

Some of the first wave PFI hospital projects had reached financial close while the UCLH project had remained at PB stage. The contractual terms of the projects had been different from the ones that UCLH had proposed in the ITND. UCLH felt that the VFM of the project could be improved if some of the contractual mechanisms used in the first wave projects were introduced to the contract. As UCLH and HMG had negotiated additional risks, such as energy, to be transferred to HMU, $CWLC_P$ and, thus, the UP had increased.

The project eventually reached a stage where the UP was unaffordable to UCLH. Consequently, UCLH and HMG began to value engineer the SPS. However, the value engineering became capital cost driven. There are three reasons for this. First, the project actors felt that reducing the capital cost of the hospital would solve the affordability problem most effectively. Second, at the time, PFI was attracting bad publicity. This was especially due to the high capital costs of PFI buildings. Third, UCLH understood capital cost better than $CWLC_P$. As a result, UCLH decided to assess the pricing of HMG's SPS in terms of capital cost. Accordingly, UCLH advised its cost consultant to scrutinise HMG's $CWLC_P$ estimate one building element at a time. HMG had to justify its design solutions to UCLH if their capital prices exceeded the market prices for solutions with similar functionalities.

Incentive Analysis 6(IA)/30
UCLH's decision to assess capital prices weakened the ProjectCo's incentive to implement $CWLC_P$ driven design solutions. This was because UCLH was likely to request solutions that were higher in capital price than market prices of solutions with comparable functionalities to be removed from the SPS.

Opportunity Analysis 6(OA)/10
UCLH's capital pricing assessment significantly limited the ProjectCo's' opportunity to implement $CWLC_P$ driven design solutions. The private sector actors did not have an opportunity to include solutions to the SPS that were more expensive in capital price than solutions with similar functionalities in the market.

Perception Analysis 6(PA)/16
The capital price driven assessment was seen to discourage the implementation of $CWLC_P$ driven design solutions. It was felt to reflect unfavourably on $CWLC_P$ driven design solutions involving increased capital expenditure with the aim of recovering it as efficiency savings in the operational period.

Initially, the hospital had been designed to have three full basement levels. In value engineering, HMG considerably reduced the size of the third basement level. This was because particularly high capital cost savings could be achieved by having to do less piling to protect the third basement level from vibration. The resulting reduction in capital cost was translated into a UP reduction. This brought the project closer to affordability.

However, HMG's proposed UP remained unaffordable. If the SPS could not be value engineered to affordability, the project would not be implemented. Instead, UCLH would implement the PSC project[2]. As a result, the two actors worked together to identify solutions that would reduce $CWLC_P$ and, thus, could be translated into improved affordability. First, UCLH and HMG examined the underlying assumptions of

[2] This is another example of the hold-up problem – see e.g. Williamson (1985). UCLH is holding-up HMG. It threatens to abort the project unless HMG lowers its asking price. However, the cost of aborting the project is considerable to both UCLH and the ProjectCo as they have incurred significant sunk costs in the procurement and development processes respectively.

the LCF. Based on its estates management experience, UCLH felt that HMG's anticipated LCF expenditure requirements were extremely pessimistic. As a result, HMG rationalised its LCF expenditure expectations. Second, HMG sought to reduce the duration of the construction period further, as this would reduce the cost of finance and increase its revenues from the project. Third, HMG persuaded ANTS to extend the loan period from 32 to 40 years, which reduced the annual loan repayment. Fourth, the project actors reassessed and, subsequently, lowered their profit requirements for the project. All of these measures reduced $CWLC_P$ and, thus, the UP, making the project affordable to UCLH.

Perception Analysis 6(PA)/17
UCLH could not procure a project it could not afford. This was perceived to place the private sector actors under considerable pressure to lower the UP and, thus, $CWLC_P$. This was felt to encourage the implementation of $CWLC_P$ driven design solutions. The pressure was seen to result in both technical and financial solutions that reduced $CWLC_P$ and, thus, made the project affordable.

Perception Analysis 6(PA)/18
The UCLH project was one of the first building based PFI projects. As a result, the SPS development was seen to entail a considerable amount of learning. It was felt that this directed attention away from the implementation of $CWLC_P$ driven design solutions.

6.5.14. Final Project Evaluation

In early 1999, HMG had developed the SPS and the contractual documentation to the stage required for financial close. It submitted its fully priced SPS, including scheme design and operational solutions, to UCLH. At the time, the capital cost of the project was around £225 million. This translated into a UP of £32 million. The AP and SP were around £22 and £10 million respectively. The hospital had a GFA of 72,500 m^2. The Main Building Tower had 17 upper and 2/3 basement floors, whereas the Main Building Podium had 4/5 upper and 2/3 basement floors. The EGA Wing had 5 upper and 2 basement floors. LDL's model of the single site hospital is pictured in figures 6.9 and 6.10. The design documentation in the SPS included 1:200 plan and section drawings, a complete set of RDSs, and engineering systems specifications. In addition, HMG's team had produced 1:50 example plan drawings of some of the key areas, such as operating theatres. The operational documentation in the SPS consisted of provisional OMSs for the reference services.

After receiving the SPS, UCLH began a final evaluation of the project. In the meantime, UCLH had upgraded the PSC project. It now included facilities, with a total GFA of 79,062 m^2, which would enable UCLH to provide an equivalent output of healthcare to

HMG's SPS. UCLH had increased the size of the new building on the site of the demolished Rosenheim Wing and adjacent Odeon Car Park. The PSC project provided 41 more beds than HMG's solution. The need for the additional beds arose from the inefficiencies in working in four buildings. The PSC consisted of a project brief, 1:500 plan and section drawings, a building services strategy report and estimates of capital and operational costs.

Figure 6.9. Main Building Tower and Podium from the Northwest (UCLH, 2002).

UCLH included a Conventionally Funded Option (CFO) project in the final evaluation. It did so because HM Treasury argued that the PSC project was not an appropriate comparator for HMG's SPS. The CFO project had identical design, construction and operation solutions to HMG's SPS. The difference was that the CFO project would be publicly financed and procured as separate DB and operation contracts. Therefore, by default, its implementation would produce the same non-financial benefits as HMG's SPS.

UCLH evaluated the non-financial benefits of HMG's SPS and the PSC project using the weighted point scoring system. It concluded that HMG's SPS would generate significantly more non-financial benefits than the PSC project, as would the CFO project.

In the financial evaluation, UCLH considered the VFM of the three solutions and the affordability of HMG's SPS. UCLH evaluated the VFM in terms of NPV. It established that HMG's SPS had the highest NPV of the three alternatives. There were two key factors in arriving at the specific NPVs. These were the valuation of the relative risks involved in the alternative solutions and the anticipated healthcare provision efficiency resulting from each of the solutions. Consequently, UCLH concluded that the implementation of HMG's SPS would be VFM.

Figure 6.10. EGA Wing, Main Building Tower and Podium from the North (UCLH, 2002).

In addition, UCLH judged that the UP for HMG's SPS would be affordable. The single site hospital would enable UCLH to rationalise its healthcare provision. UCLH anticipated that this would yield annual efficiency savings of around £12 million. These anticipated savings were a key factor in UCLH's judgement that it could afford the project.

UCLH had re-scoped the project during its development. As a result, the project will not fully meet its accommodation needs. Therefore, simultaneously to procuring the PFI project, UCLH had pursued the Rosenheim Wing refurbishment and Odeon Car Park development using traditional procurement. UCLH estimated the total capital cost of these two projects to be around £40 million. The refurbished Rosenheim Wing would house a cancer unit, additional beds and offices. The Odeon Car Park Building would house pathology, medical school accommodation and parking facilities.

In May 1999, UCLH completed the Full Business Case (FBC). The document described the final evaluation of HMG's SPS and made the case for implementing the project. In January 2000, the NHS Executive approved the FBC and gave UCLH the authority to award the DBFO contract.

6.5.15. Due Diligence Assessment

Once HMG had submitted its SPS to UCLH for final evaluation and approval, it shifted its focus onto enabling finance deployment. At the time, HMG was around £8 million at risk. Therefore, it decided not to proceed with detail design development prior to financial close. As UCLH commenced its final evaluation, ANTS commissioned the due diligence assessment of the SPS. The aim of the assessment was to identify all the project risks and ensure that there was a strategy for managing and mitigating them prior to financial close.

ANTS appointed Currie & Brown Limited (CBL) to carry out the technical aspects of the due diligence assessment. In addition, ANTS appointed legal advisers to undertake a similar assessment on the contractual documentation. CBL is a leading technical consultancy in the UK with an especially high profile role in advising financiers on PFI projects. CBL scrutinised the SPS in order to ensure that ANTS would not be exposed to any project risks. It sought to establish that:

- The DBFO contract between UCLH and HMU contained only risks that HMU could pass on to its subcontractors or manage itself.
- HMU's DB and operation contracts would transfer all the desired risks to BCJV and BPFML respectively.
- HMU, BCJV and BPFML would have access to all the resources required to implement the project.
- ProjectCo's Proposals and Contractor's Proposals met Client's Requirements.
- BCJV's construction programme was achievable.
- The payment and, thus, finance deployment milestones in the DB contract were truly reflective of capital cost expenditure.
- BPFML's provisional OMSs could meet the FMOS.
- HMG had priced all aspects of the project correctly.
- HMU would be able to meet the performance standards specified in the PM without incurring deductions.
- In the event of unavailability, HMU would be able to limit the affected area and, subsequently, swiftly rectify the cause of unavailability.

Opportunity Analysis 6(OA)/11
CBL undertook a due diligence assessment before the implementation of the SPS. As a result, it had an opportunity to request changes in the SPS. Thus, it also had an opportunity to identify $CWLC_P$ driven design solutions and request them to be implemented. However, it did not have an incentive to do so – see 6(IA)/31.

If UCLH had procured the project traditionally, it would have used sequential and fragmented procurement – see 6(OA)/1 and 6(IA)/1. In addition, it would not have used project finance. As a result, none of the project actors would have had an opportunity to assess the design, construction and operation solutions of the hospital simultaneously prior to their implementation.

Incentive Analysis 6(IA)/31

CBL worked for ANTS. Therefore, it had an incentive to ensure that the SPS would meet ANTS' objectives – see 6(IA)/7. It must be noted that, as a result, CBL did not have an incentive to identify possible $CWLC_P$ driven design solutions in the course of the due diligence assessment. This is because ANTS would not be able to benefit from such solutions. However, it had an incentive to identify and suggest possible improvements in completion, operational and expenditure certainty.

If UCLH had used traditional procurement, project finance would not have been used and, thus, a due diligence assessment would not have been required – see 6(IA)/1. As a result, none of the actors involved in the development of a traditional project would have had an incentive to ensure that the completion, operational and expenditure certainty of the hospital were at a level that was required to pass the due diligence assessment in the PFI development process.

HMG tried to facilitate reaching financial close by providing CBL with as much information as possible. HMG commissioned WS Atkins Consultants Limited (WSACL) to carry out an availability, reliability and maintainability (ARM) assessment of the building services solution. WSACL is a leading UK engineering consultancy with significant involvement in PFI projects. The ARM assessment confirmed the validity of the ProjectCo's design principles. However, it also highlighted some areas where HMU might be vulnerable to unavailability deductions. As a result, DSSRL further diversified the building services distribution. However, HMG deemed that the vast majority of the changes suggested by the ARM assessment were unaffordable.

Perception Analysis 6(PA)/19

The ARM assessment was felt to demonstrate effective risk management. The assessment proposed a number of design changes that could have further improved operational certainty. However, it was perceived that the vast majority of the improvements that could be achieved did not justify the additional capital expenditure required.

In addition, HMG obtained $CWLC_P$ data from similar PFI projects that the ProjectCo actors were involved in. HMG used the data to demonstrate that its anticipated LCF expenditure was realistic. HMG proved that the ratio of LCF to capital cost expenditure in the project was similar to the ratio on other PFI projects that had reached financial close.

CBL raised a number of issues in the course of the due diligence assessment. However, HMG had already highlighted these issues as potentially problematic. CBL requested HMG to provide further evidence of effective risk management in relation to these issues. Once CBL felt that the project risks were acceptable, it advised ANTS that the project was ready to proceed to financial close.

Perception Analysis 6(PA)/20
It was perceived that HMG's strong emphasis on risk identification, quantification, mitigation and management made it easier for ANTS to deploy the finance. The emphasis was seen to affect all the ProjectCo actors' behaviour.

6.5.16. Financial Close

In July 2000, 57 months after the EoI notice, the project finally reached financial close. The signing of all the contracts took place simultaneously. UCLH signed a DBFO contract with HMU. The project remained off UCLH's balance sheet. HMG had established HMU in anticipation of financial close in May 1999. HMU was owned in equal share by APIL, BBCPL and BPGL. The three InvestCos injected around £22.5 million of equity in total into HMU. Some of that equity was used to meet the costs the ProjectCo had incurred in SPS development. This included paying the designers the outstanding elements of their fees, compensating BCJV and BPFML for the development of the construction and operation solutions respectively and reimbursing APIL, BBCPL and BPGL for the management resources they had provided to HMG. Subsequently, HMG's staff were seconded to HMU and the BV ceased to exist. In addition, the involvement of JHSCL, DLE and WSACL in the project ended.

HMU signed a DB contract with BCJV and an operation contract with BPFML. BCJV reappointed the designers with fixed-price design contracts. The contract values were determined as percentages of the DB contract value. The contractual structure of the key project actors at financial close is shown in Figure 6.11.

HMU and ANTS signed the financing agreement. ANTS retained CBL as its technical adviser to monitor detail design development and construction. CBL's task in detail design development was to ensure that the variations in the SPS proposed by either UCLH or HMU would not increase project risks. In addition, CBL was to monitor the BCJV's progress in construction against the preset milestones. This was to ensure that ANTS deployed the finance appropriately and that the completion date would be reached on schedule and, thus, finance repayment would commence as anticipated.

Incentive Analysis 6(IA)/32
CBL will work for ANTS in the construction period. Therefore, it will have an incentive to ensure that ANTS' objectives (see 6(IA)/7) will materialise in detail design development and construction.

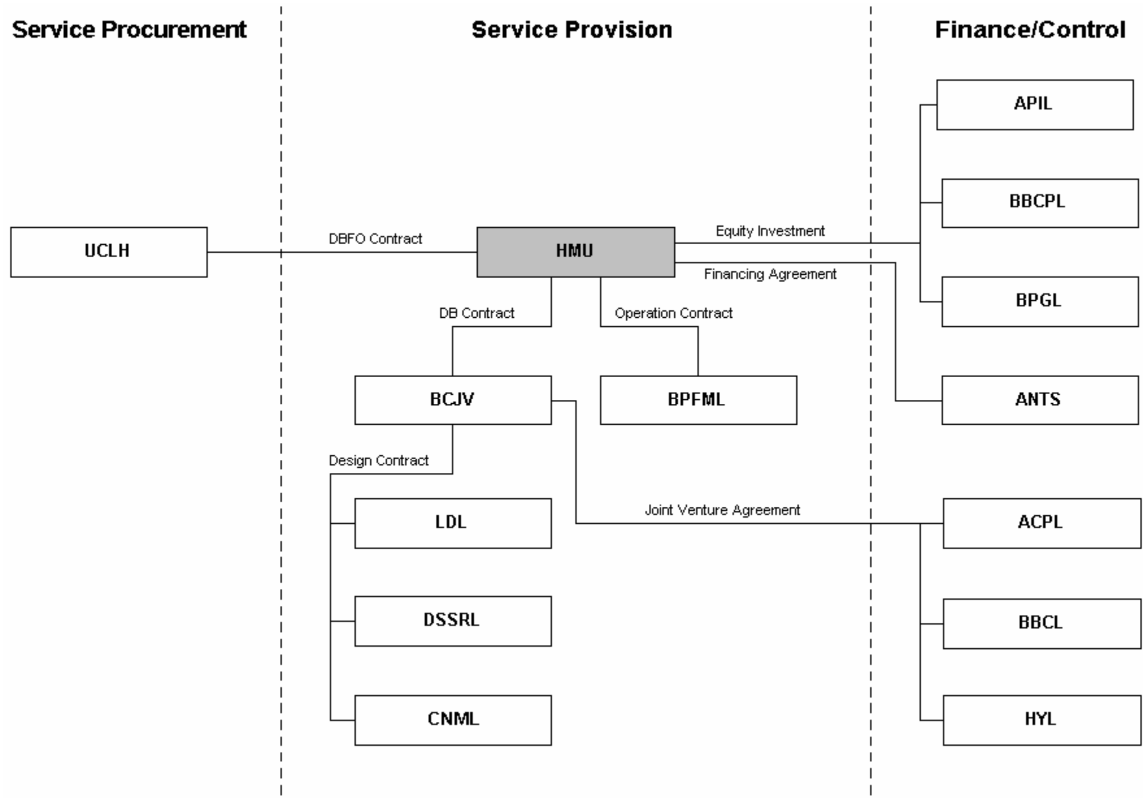

Figure 6.11. The contractual structure of the key project actors at financial close.

Opportunity Analysis 6(OA)/12
CBL will have the authority to reject changes in the design solution that depart from Contractor's Proposals. As a result, it will have an opportunity to prevent the implementation of some $CWLC_P$ driven design solutions.

It must be noted that UCLH and ANTS signed additional contracts to protect themselves. ANTS entered into a contingent DB contract with BCJV, which was guaranteed by AMEC plc and Balfour Beatty plc. In addition, UCLH entered into a contingent DBFO contract with ANTS. These contracts would come into force only if HMU went into liquidation and/or the DBFO was terminated prematurely.

Perception Analysis 6(PA)/21
It took the project 57 months to proceed from EoI notice to financial close. This was seen to have a negative effect on the project. HMG was perceived to struggle to maintain momentum in SPS development. However, it was also acknowledged that the delay in reaching financial close enabled the ProjectCo to develop the SPS further than it would have done otherwise, and that it gave the ProjectCo an improved opportunity to explore $CWLC_P$ driven design solutions.

6.6. Implementation Stage

6.6.1. Detail Design Development

In the period leading to financial close, HMU had temporarily suspended design development. This was because the ProjectCo was reluctant to increase its exposure by developing the design further than was necessary to achieve contract award. However, at financial close, the project and, thus, the involvement of LDL, DSSRL and CNML in the project was secured. Consequently, the designers committed additional resources and proceeded with detail design development.

Incentive Analysis 6(IA)/33
At financial close, BCJV reappointed LDL, DSSRL and CNML to their respective roles. Thus, the three actors were no longer working at risk. However, they were appointed on fixed-price design contracts. As a result, they have an incentive to develop the detail design solutions to meet BCJV's objectives (see 6(IA)/10&17&20&23&25) as effectively as possible. This is because they will have to meet the cost of redesign, which will reduce the profit they will make from the project.

The project actors had agreed the design solution for the hospital based on Client's Requirements, ProjectCo's Proposals and Contractor's Proposals. All the construction specifications referred to the ADB, which consisted of 1:200 plan drawings and RDSs of all the areas in the building. In addition, the ADB included 1:50 drawings of some key areas. The plan drawings set out the layout for the hospital. The RDSs named the items that each room would contain and the specific environmental conditions that each room would have. Furthermore, ProjectCo's Proposals and Contractor's Proposals included 1:200 plan and section drawings and specifications of engineering systems. These documents set out the type of HV solutions the hospital would have.

In detail design development, LDL, DSSRL and CNML transform all the 1:200 drawings into 1:50 drawings. Subsequently, BCJV uses the drawings to build the hospital. LDL is the design team leader and, thus, responsible for the coordination of the detail design solution. However, it is not responsible for the coordination of the building services within ceiling voids and plant rooms. BCJV is responsible for ensuring the constructability of the design solution. It also coordinates the aspects of detail design that are not included in LDL's coordination responsibilities. Before BCJV proceeds with construction, HMU ensures, with the help of UCLH and BPFML, that the detail design solution has the desired functionality. The detail design development has two strands. These are spatial planning and engineering systems.

Opportunity Analysis 6(OA)/13

In detail design development, the ProjectCo has an opportunity to alter the design solution. However, if a proposed design change departs from Client's Requirements, HMU will need to have UCLH and ANTS approve the change. If the proposed design change is outside the parameters of Contractor's Proposals, HMU will need to have the change approved by ANTS. CBL is responsible for assessing and approving design changes on behalf of ANTS. It carries out the assessment in line with the objectives of the due diligence assessment – see 6(IA)/31. The need to have design changes approved by UCLH and/or ANTS (see 6(OA)/11) limits the ProjectCo's opportunity to implement $CWLC_P$ driven design solutions in detail design development.

Perception Analysis 6(PA)/22

The ProjectCo was perceived to have authority on the detail design solutions. However, Client's Requirements, ProjectCo's Proposals, Contractor's Proposals, and UCLH's clinical functionality requirements were seen to set the tolerances within which the detail design could be developed.

Shortly after financial close, in December 2000, Tilbury Douglas plc acquired BPGL and made it its FM subsidiary. Tilbury Douglas plc was a major UK contractor involved in the PFI market. Subsequently, Tilbury Douglas plc renamed itself Interserve plc. Consequently, the former BPGL, including BPFML, was renamed Interservefm Limited (IFML). Furthermore, Interserve plc established Interserve Investments Limited (IIL) as its InvestCo. IIL took over BPGL's equity in HMU. As a result of the acquisition, the ProjectCo actors changed. The positioning of IIL and IFML within the contractual structure of the project is illustrated in Figure 6.12.

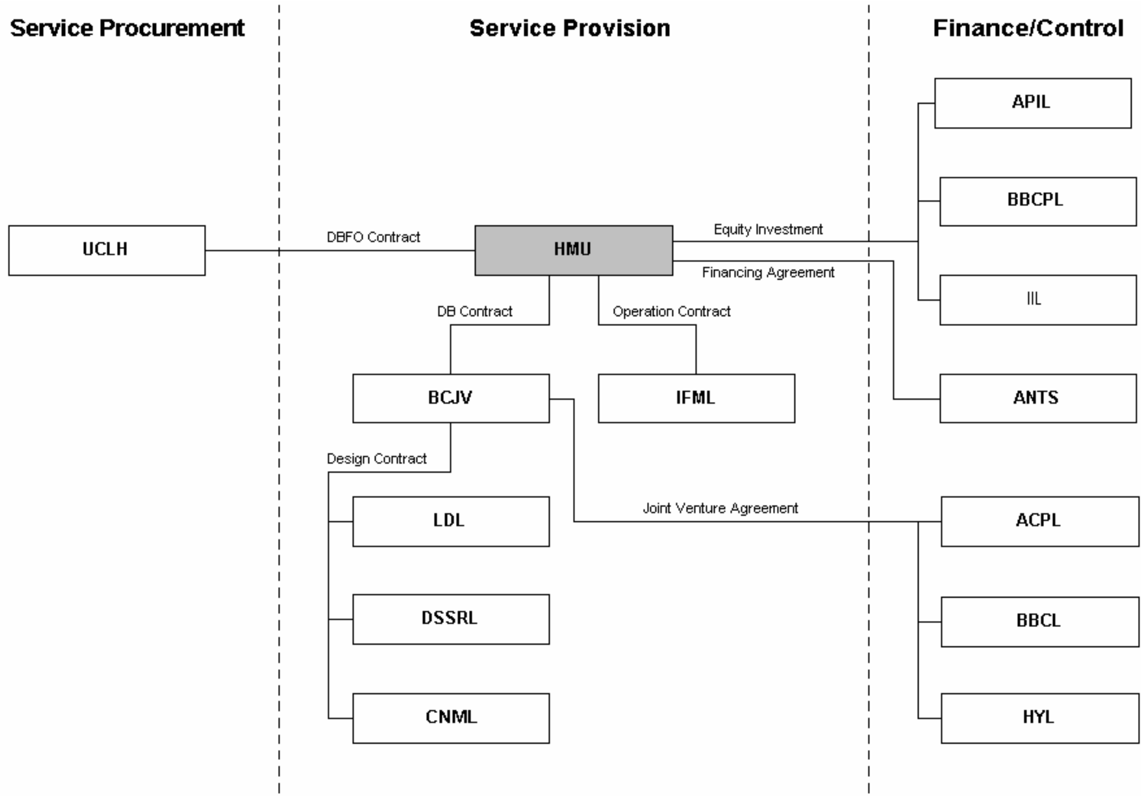

Figure 6.12. The contractual structure of the key project actors in the implementation stage.

Incentive Analysis 6(IA)/34
IFML replaced BPFML in the project as the operator. As a result, IFML adopted its incentives in detail design development – see 6(IA)/11&20&21&23&24&28&29. Furthermore, IIL replaced BPGL and, thus, took over the pursuit of its objectives in the project – see 6(IA)/1&9.

6.6.1.1. Spatial Planning

In spatial planning, LDL develops all the 1:200 plan drawings into 1:50 plan drawings and updates the RDSs. In other words, LDL loads the items a RDS specifies a room to contain onto a 1:50 plan drawing. If a change in the contents of a room is required, LDL includes it in a new version of the RDS. Once LDL has completed a departmental set of documentation and ensured its integration with the overall design solution, it submits the documentation to BCJV for approval. BCJV assesses the solution for constructability and conformance with its capital cost target. If BCJV is not satisfied with the solution, it may require it to be redesigned.

Once BCJV has approved a departmental set of documents, it issues the set to HMU. Subsequently, HMU forwards the documentation to UCLH and IFML for evaluation and approval. UCLH and IFML assess the design solution for its clinical and operational functionality respectively. They seek to ensure that as LDL developed the 1:200 plan drawings into 1:50 plan drawings, the anticipated functionality of the rooms materialised. In its assessment, UCLH focuses on the clinical areas of the hospital. It seeks to have a solution with the best possible clinical functionality. IFML places the main emphasis of its assessment on the areas it will use for operation, such as kitchens and storage rooms. However, IFML also evaluates whether it will be able to operate the clinical areas. IFML, for example, assesses whether it will be able to clean the inpatient wards effectively and efficiently. Once UCLH and IFML have completed their assessments, they issue their comments to HMU to be forwarded to BCJV.

After BCJV has received the initial comments, it holds spatial planning design meetings. UCLH, LDL and IFML attend the meetings. UCLH's team includes both procurement and clinical staff. The actors debate the functionality of the design solutions for each of the rooms in a particular department. UCLH is mainly concerned with the layout of the rooms. An example of an issue that might be discussed is the location of an x-ray viewing box in a consultation room. The RDS specifies the room to have a viewing box. However, the 1:200 plan drawing does not specify its precise location. Therefore, the location of the viewing box became apparent to UCLH and IFML only when they assessed the 1:50 plan drawing. UCLH wants to ensure that the location of the viewing box will facilitate optimal provision of healthcare. IFML wants to ensure that it will be able to operate the viewing box effectively and efficiently.

Perception Analysis 6(PA)/23

UCLH's procurement team had no prior PFI experience. In addition, all of its prior procurement experience was on relatively small projects. This was seen to make working with UCLH somewhat labour intensive. However, it was also acknowledged that the procurement team was skilled in transforming UCLH's requirements into a design solution.

Spatial planning is an iterative process. BCJV holds design meetings until UCLH and IFML have approved the design solution. In the design meetings, the actors classify the design solution of each room in one of the following three states:

- State A – the room is designed correctly and it can be built to the design,
- State B – the room is designed correctly, but minor design changes are required, or
- State C – the room is designed incorrectly and needs to be redesigned.

If UCLH or IFML are not satisfied with the design solution, they classify it as being in State B or State C and, thus, request BCJV to change its design. These changes are either variations or design developments. A *variation* is a design change that departs from the ADB. If UCLH, for example, wants to change the location of a door specified in the 1:200 plan drawings, it needs to request a variation. The actor that requests a variation has to meet the cost of its implementation. A *design development* is a change in the 1:50 drawings that is within the parameters of the ADB. IFML may, for example, request the location of an X-ray viewing box that did not appear in the 1:200 plan drawings to be changed for improved maintenance access. BCJV is liable for the cost of design developments. However, at the stage of spatial planning, the cost of a design development is the cost of the additional design work involved. It must be noted that BCJV included the responsibility for redesign arising from design developments in its fixed-price design contracts.

Opportunity Analysis 6(OA)/14
IFML can request BCJV to change its proposed spatial solution. As a result, it has an opportunity to improve the operational functionality of the hospital.

Incentive Analysis 6(IA)/35
IFML has an incentive to improve the operational functionality of the hospital. This is because improved functionality will reduce its operational cost through efficiency savings and, thus, increase the profit it will make from the project.

If UCLH or IFML requests a design change, BCJV instructs LDL to redesign the solution. Subsequently, the actors assess the updated design solution and discuss it in a spatial planning meeting. The ultimate goal of spatial planning is to develop all the rooms into state A. Once a room is in state A, its 1:50 plan drawing and RDS are reissued into the ADB. Subsequently, BCJV can proceed to build the hospital to the design.

It must be noted that as part of spatial planning UCLH also examines some engineering systems. However, this is the case only to the extent that the systems affect clinical functionality. A security system may, for example, affect UCLH's A&E patient admission procedure.

After financial close, UCLH has continued to expand. In August 2001, it acquired the Heart Hospital (HH), which, at the time, was privately owned. HH is a cardiac hospital with world-class facilities located on Westmoreland Street – see location P in Figure 6.2. Subsequently, in April 2002, the Royal London Homeopathic Hospital (RLHH) joined UCLH. RLHH is the largest NHS provider of complementary and alternative medicine. Normally, RLHH is based on Queen Square in close proximity of NHNN – see location O in Figure 6.2. However, due to the redevelopment of RLHH's permanent facilities, it is temporarily situated on Greenwell Street – see location N in Figure 6.2. As a result of its continued expansion, UCLH restructured its organisation. The reorganisation slightly changed the spatial needs of UCLH's departments. This posed an additional challenge in spatial planning.

Perception Analysis 6(PA)/24
At financial close, UCLH and HMU entered into a 40-year DBFO contract. The long-term relationship was perceived to be a partnership. This was felt to oblige the ProjectCo to provide UCLH with cost efficient accommodation of high quality. The nature of the relationship was seen to discourage the implementation of design solutions that minimised capital cost.

6.6.1.2. Engineering Systems

In engineering systems, LDL, DSSRL and CNML transform the 1:200 plan and section drawings and the specifications of engineering systems into 1:50 plan and section drawings and updated specifications. Only the ProjectCo is involved in the detail design development. UCLH is not involved because its requirements for engineering systems, defined in Client's Requirements, are output-based.

BCJV gives the designers target capital costs for the design solutions of the specific parts of the engineering systems that it intends to procure as work packages. These are known as *package costs*. The designers need to develop solutions to meet Contractor's Proposals within the package costs.

Incentive Analysis 6(IA)/36
The designers have an incentive to develop the detail design solutions to meet package costs without compromising BCJV's other objectives – see 6(IA)/10&17&20&25&27. This is because if they fail to do so, they will have to meet the additional costs arising from redesign. This will reduce the amount of profit they will make from the project.

Once DSSRL and CNML have completed a work package set of 1:50 plan and section drawings and specifications, the actors submit the documentation to LDL for coordination. After the overall design has been integrated, LDL forwards the documentation to BCJV, which assesses the solution's constructability and its capital cost against the package cost. Subsequently, LDL organises engineering systems design meetings that BCJV, DSSRL and CNML attend. The aim of these meetings is to ensure that the design solution meets its objectives and all the aspects of the design solution are fully integrated. Normally, IFML does not attend the engineering systems design meetings. However, if a meeting deals with an aspect of the design that affects operation, such as floor finishing, BCJV invites IFML to attend. If BCJV is not satisfied with a solution, it can request it to be redesigned.

Once BCJV is satisfied with an engineering system design solution, it issues it to HMU for approval. Subsequently, HMU forwards the solution to IFML for inspection. HMU instructs IFML to assess the suitability of the design solution for operation. IFML needs to ensure that the systems will enable it to operate the building to the standard set in the FMOS. HMU places great emphasis on the assessment. HMU sees it as a key process to ensure the operational and expenditure (especially LCF expenditure) certainty, and the operational efficiency of the SPS. In its assessment, IFML classifies each system into one of the following three states:

- State A – the system is designed correctly and it can be built to the design,
- State B – the system is designed correctly, but minor design changes are required, or
- State C – the system is designed incorrectly and needs to be redesigned

As IFML evaluates the design solution, it does not produce $CWLC_P$ estimates by default. Instead, it relies on its operational experience from its other hospital and PFI contracts to identify possible changes that could benefit the project. A need for a change may arise from potential improvements in completion, operational and/or expenditure certainty and/or $CWLC_P$ reductions. If IFML's experience shows that a $CWLC_P$ driven design solution could be implemented, it will seek WLC data to demonstrate the savings from its implementation to HMU. It must be noted that this is compromised by the fact that IFML does not have access to BCJV's capital cost estimate.

Opportunity Analysis 6(OA)/15

IFML has an opportunity to comment on the engineering systems detailed design solution and request changes if necessary. However, IFML's opportunity to have its proposed changes implemented is somewhat limited if they depart from Contractor's Proposals. This is because BCJV is not contractually obliged to implement such solutions. Instead, IFML needs to demonstrate to HMU that a design change will benefit the project. This requires good quality WLC data. If HMU agrees with IFML, it can negotiate a design change with BCJV.

Incentive Analysis 6(IA)/37

In detail design development, the ProjectCo can identify three types of $CWLC_P$ driven design solutions with distinct incentives and opportunities (see 6(OA)/16) for their implementation[3]. These are operation-led, construction-led and win-win solutions. The classification assumes that the contractual detail of the project cannot be easily renegotiated – see 6(OA)/16. It must be noted that if the contracts can be readily renegotiated and finance easily accessed, HMU, BCJV and IFML have an incentive to implement all three types of $CWLC_P$ driven design solution. This is because they will reduce $CWLC_P$ and, thus, yield profits, which can be shared between the three actors.

[3] Operation-led and construction-led $CWLC_P$ driven design solutions are examples of Kaldor-Hicks improvements (see Kaldor (1939) and Hicks (1939)) whereas a win-win $CWLC_P$ driven design solution is an example of a Pareto improvement – see Pareto (1971). In the implementation of a Kaldor-Hicks improvement those who are made better off could in theory compensate those who are made worse off and, thus, make the implementation a Pareto improvement.

The implementation of an *operation-led $CWLC_P$ driven design solution* increases capital cost expenditure and results in greater operational cost savings. IFML has an incentive to implement operation-led solutions. This is because such solutions will reduce its operational cost and, thus, increase the profit it will make from the project. HMU has an incentive to implement operation-led solutions if the operational cost savings include reductions in LCF expenditure and, therefore, increase its profit from the project. BCJV has an incentive not to implement operation-led solutions. This is because they will increase its capital cost and, thus, decrease the profit it will make from the project.

The implementation of a *construction-led $CWLC_P$ driven design solution* reduces capital cost, but results in a smaller increase in operational cost. BCJV has an incentive to implement construction-led solutions as they will reduce its capital cost and, as a result, increase its profits from the project. HMU has an incentive not to implement construction-led solutions if the resulting operational cost increases include increased LCF expenditure and, thus, reduce its profit from the project. IFML has an incentive not to implement such solutions as they will increase its operational cost and, therefore, reduce the profit it will make from the project.

The implementation of a *win-win $CWLC_P$ driven design solution* results in savings in both capital and operational costs, which may include reductions in LCF expenditure. BCJV and IFML have an incentive to implement win-win solutions. This is because such solutions will increase the profit the two actors will make from the project. HMU has an incentive to implement win-win solutions if they reduce LCF expenditure and, thus, increase its profit from the project.

Assuming that the contractual detail of the project cannot be easily renegotiated, the ProjectCo has a considerably stronger incentive to implement win-win $CWLC_P$ driven design solutions than operation or construction-led solutions. This arises from the alignment of HMU's, BCJV's and IFML's incentives. However, in practice contractual detail can be renegotiated, but such renegotiation can result in costs greater than the savings that can be obtained. If this is the case, the three actors do not have an incentive to implement such solutions.

Opportunity Analysis 6(OA)/16

The implementation of an operation-led $CWLC_P$ driven design solution requires HMU to agree an increase in the value of the DB contract and a decrease in the value of the operation contract. In addition, it needs to obtain additional finance to implement the solution. IFML's ability to provide the finance is limited – see 6(OA)/9. Consequently, HMU needs to obtain it from ANTS and/or APIL, BBCP and IIL. ANTS has an incentive to discourage the implementation of $CWLC_P$ driven design solutions – see 6(OA)/7. APIL, BBCPL and IIL have an incentive not to tie up resources in the project for a long period of time – see 6(IA)/9. As a result, the ProjectCo's opportunity to implement operation-led solutions is reduced further.

The implementation of a construction-led $CWLC_P$ driven solution requires HMU to negotiate a reduction in the value of the DB contract and an increase in the value of the operation contract. However, construction-led solutions do not require HMU to source additional finance. Therefore, the ProjectCo has a greater opportunity to implement construction than operation-led $CWLC_P$ driven design solutions.

The implementation of a win-win $CWLC_P$ driven design solution does not require HMU to renegotiate contractual detail or obtain additional finance. Therefore, the ProjectCo has a better opportunity to implement win-win solutions than operation, or construction-led solutions.

It must also be noted that the renegotiation of contractual detail may compromise completion certainty. This reduces the opportunity to implement operation-led and construction-led solutions further. In addition, the opportunity to implement these three types of $CWLC_P$ driven design solutions may also be limited by the requirement to have them approved by UCLH and/or ANTS – see 6(OA)/13.

IFML has a small team assessing the engineering systems detailed design solutions. On occasions, IFML has struggled to assess the solutions on programme. This was because IFML had commenced the operation of UCLH's existing facilities, which ties up the majority of its resources. However, on such occasions, BCJV agreed to extend the deadline for IFML's comments.

BCJV and IFML have learned to understand and respect each other's objectives in the project. Once HMU had been nominated the PB, BCJV and BPFML (subsequently IFML) begun to work in the same office building. This helped to create a good working relationship through constant interaction between the two actors. However, in early 2002, IFML moved into an office embedded in UCLH's existing facilities. This was because it wanted to further deepen its relationship with UCLH before the operational date of the Main Building.

Perception Analysis 6(PA)/25
BCJV and IFML were seen to have a good and constantly improving working relationship. This was perceived to result in effective design development.

As part of its assessment, IFML established that the HV solution could be improved if all the plant was relocated to the fourth floor of the Main Building Podium where the majority of the HV plant had already been located. IFML argued that the change would improve completion, operational and expenditure certainty and reduce $CWLC_P$. The plant would be more effective and efficient to install, replace, maintain and operate in a single location. In addition, the relocation of the plant would not increase capital cost. HMU agreed with IFML and instructed BCJV to redesign the location of the HV plant. As the location of the plant had been specified in Contractor's Proposals, but not in Client's Requirements, HMU had the design change approved by ANTS.

Solution Analysis 6(SA)/5
The HV plant relocation will reduce $CWLC_P$. However, it must be noted that the relocation was not solely driven by $CWLC_P$ minimisation, but also by the desire to improve completion, operational and expenditure certainty. Therefore, the solution is not a $CWLC_P$ driven design solution, but a $CWLC_P$ reducing design solution. Furthermore, the solution is a win-win solution. This is because its implementation reduces capital and operational costs, including LCF expenditure. The expert analysis concurred with the logic for classifying the HV plant relocation as a $CWLC_P$ reducing design solution.

In addition, initially, BCJV proposed a design solution where humidification was provided by individual steam generation plants serving each of the air-handling units. As IFML evaluated the solution, it established and, consequently, argued that a design solution that provided humidification using a central steam generation plant would:

- not have a higher capital cost,
- be more cost efficient to maintain,
- have more approved maintenance contractors,
- have better availability of spare parts, and
- be more energy efficient.

HMU agreed with IFML and requested BCJV to reconsider its proposed design solution. BCJV reassessed its proposal and agreed that a central steam generation plant would be the superior solution of the two alternatives. This was mainly because there was only one maintenance contractor in the UK for the initially proposed separate steam generation plants. BCJV also established that the central steam generation plant would allow it to redesign the HV solution to circulate medium temperature, instead of high temperature, hot water. This would reduce the capital cost of the HV solution and make it even more cost efficient to maintain. The redesign did not require UCLH's or ANTS' approval. This is because the method of humidification had not been specified in Client's Requirements or Contractor's Proposals.

Solution Analysis 6(SA)/6
The adoption of a single central steam generation plant will result in $CWLC_P$ savings. However, its implementation was also prompted by the desire to improve operational and expenditure certainty. Therefore, it must be classified as a $CWLC_P$ reducing design solution and not as a $CWLC_P$ driven design solution. The solution is a win-win solution because its implementation will reduce both capital and operational costs, including LCF expenditure, of the project. The expert assessment confirmed the switch to a single central steam generation plant as a solution that would reduce $CWLC_P$.

Perception Analysis 6(PA)/26
BCJV was in charge of detail design development. It was felt that its fixed-price DB contract with HMU discouraged the implementation of $CWLC_P$ driven design solutions. It must be noted that some actors felt that they had not been under pressure to reduce the quality of their design solutions. BCJV was also perceived to give the other ProjectCo actors an opportunity to suggest ways of improving the design solution. Furthermore, it was acknowledged that the DB contract gave HMU completion and expenditure certainty as a trade off for direct control over detail design.

Perception Analysis 6(PA)/27
The contractual relationships of the project actors were felt to demand $CWLC_P$ minimisation. However, the ProjectCo actors were also perceived to have a conflict of interests in the project. This was seen to direct attention away from the implementation of $CWLC_P$ driven design solutions. APIL, BBCPL and IIL were seen to focus on their short-term ROE. BCJV and IFML were seen to focus on their performance in the DB and operation contracts respectively. The fact that BCJV and IFML had separate ParentCos was seen to enforce the conflict of interest.

Perception Analysis 6(PA)/28
The renegotiation of contractual detail after financial close was perceived to be difficult, even if $CWLC_P$ driven design solutions could be identified. After contract award, the search for $CWLC_P$ driven design solutions was perceived to have continued. However, the identification of such solutions was not seen as a priority.

In December 2002, the ProjectCo actors competed the detail design solution for the Main Building. Subsequently, they proceeded to develop the detail design solution for the EGA Wing.

6.6.2. Construction

After financial close, the ProjectCo began to implement the project. UCLH commenced the vacation of 151 Gower Street as financial close became imminent. BCJV appointed a demolition contractor. After UCLH had vacated 151 Gower Street, the contractor began to demolish the building. In addition, at financial close, HMU gave notice to the tenants of St Martins House. Once the building was vacated, the demolition contractor proceeded with its disposal.

In early 2001, the demolition of the two buildings was complete. As a result, BCJV did not begin the construction of the new hospital until nearly a year after financial close. However, this gave the ProjectCo the opportunity to develop the detail design solutions to a stage required to commence works on site.

BCJV uses predominantly work package procurement in construction. It divided the project into approximately 80 work package subcontracts. BCJV included the responsibility for production design, i.e. the development of 1:20 plan and section drawings, in the work packages.

It must be noted that if BCJV anticipates that a task can be carried out more cost efficiently by managing it in-house and purchasing labour and products than by procuring a work package, it will adopt such an approach. This was the case, for example, with the small amount of brickwork needed for the Main Building.

BCJV carries out the production design and installation of building services in-house. This is the only major departure from work package procurement. Once BCJV has completed the building services production design, it proceeds with installation. It obtains management expertise and labour from ACPL and HYL and procures the required products from the market.

Procurement is one of BCJV’s key activities. BCJV uses a small number of pre-selected subcontractors and suppliers in the project. BCJV compiled the list of companies to be used based on ACPL’s, BBCL’s and HYL’s past experience. This was to ensure that BCJV obtains quality work and products and that its supply chain is likely to be in existence for at least the warranty periods, but preferably for the entire contract period.

BCJV uses a maintenance viability questionnaire (MVQ) in its procurement. The questionnaire was developed by IFML. It seeks information on the operation of the installations, components and materials included in a work package subcontract or a purchase. The MVQ asks for the following information:

- expected lifespans,
- warranties,
- maintenance and partial replacement required in the expected lifespan,
- availability of spare parts,
- consumables in the expected lifespan, and
- number of approved maintenance contractors.

Initially, BCJV was reluctant to use the MVQ in its procurement. It argued that the questionnaire would compromise the price it would have to pay for work packages and products. However, IFML counter-argued that BCJV could become liable if unavailability occurred in the hospital due to compromised maintainability. HMU supported IFML. The two actors convinced BCJV to use the MVQ. However, the actors agreed that the questionnaire would not ask for any operational cost information.

Once BCJV receives a set of bids for a subcontract or a purchase, it forwards the documentation to IFML for assessment. BCJV gives IFML an opportunity to comment on the selection of a subcontractor or a supplier. IFML analyses the bids, including the answers to the MVQ, and makes a recommendation. BCJV engages in active discussion with its subcontractors and suppliers in order to understand the behaviour and requirements of their products in the contract period. This includes ensuring that the products will be able to meet their required design lives. In making its procurement decisions, BCJV takes IFML's views into account. However, it retains the authority and responsibility for the final decision.

Opportunity Analysis 6(OA)/17
IFML is able to influence BCJV's work package subcontractor and supplier selection. As a result, it has an opportunity to promote the implementation of $CWLC_P$ driven design solutions. This is because a particular subcontractor or a supplier may be offering a product that will reduce $CWLC_P$. However, it must be noted that BCJV, not IFML, has the authority to select subcontractors and suppliers.

Perception Analysis 6(PA)/29
BCJV gives substantial consideration to its subcontractor and supplier selection. It was perceived to be because it wants to mitigate the risks for itself, APIL and BBCPL in the operational period. This was felt to result in the selection of subcontractors and suppliers with proven long-term track records and products with long-term guarantees. However, the selection process was perceived to be problematic due to lack of quality WLC information. IFML's support and the use of MVQ were perceived to facilitate the selection.

The construction of the hospital has been largely unproblematic. In December 2002, BCJV was slightly ahead of schedule for completion in early 2005.

6.6.3. Preparing for Operation

After financial close, IFML began to reform the operation of UCLH's existing facilities. The operation of both the new hospital and UCLH's retained facilities will be very different from UCLH's operation of its facilities prior to financial close. Operational expenditure had represented only a small proportion of UCLH's annual budget. Therefore, its operational efficiency had received little attention in comparison to the efficiency of its healthcare provision. IFML has been able to improve the operational efficiency of UCLH's existing facilities considerably.

UCLH, HMU and IFML had agreed the operation of the hospital based on the FMOS. However, the FMOS is output-based and, thus, leaves a lot of room for interpretation. Therefore, in parallel with the operation of UCLH's existing facilities, IFML has been developing the OMSs appended to the DBFO and operation contracts further. It is due to submit statements to UCLH in March 2005. The development of the updated OMSs has taken into account the detail design of the hospital and the lessons learned from the operation of UCLH's existing facilities.

IFML anticipates that it will use its in-house resources for the majority of the operation. This is because at financial close UCLH's non-clinical support service staff was transferred to BPFML. IFML will supplement its in-house operation with subcontracting. The exact balance between in-house and subcontracted operation has not yet been established. However, IFML anticipates that around a quarter of the operational services will be provided by subcontractors.

6.7. Concluding Remarks

The *solution analysis* revealed that not a single $CWLC_P$ driven design solution had been incorporated into the HV solution of the new UCLH hospital. Nevertheless, it identified five different $CWLC_P$ reducing design solutions. These are solutions that are expected to yield $CWLC_P$ savings but were implemented also for reasons other than the pursuit of $CWLC_P$ minimisation. However, it must be noted that the $CWLC_P$ reducing design solutions would not have been implemented in a traditionally procured project.

The *incentive analysis* established that the ProjectCo had an incentive to minimise $CWLC_P$ and, thus, implement $CWLC_P$ driven design solutions in the SPS development. However, it was found that the incentive was compromised by a number of conflicting incentives and the prospect of market testing. First, the ProjectCo had an especially strong incentive to improve the completion, operational and expenditure certainty of the hospital. These incentives arose primarily from the use of project finance. The financier had an incentive to discourage the implementation of $CWLC_P$ driven design solutions. This is because it would not be entitled to a share of the resulting profit increase but would be exposed to the resulting increase in project risks. Second, the contractor had an incentive to minimise the capital cost of the hospital subject to meeting its obligations under the contractual framework. The capital cost minimisation incentive was evident already at the PB stage as the contractor anticipated that it would be awarded a fixed-price DB contract at financial close. Third, the operational service provision was to be market tested in the contract period. As a result, the ProjectCo would be able to capture additional profit resulting from $CWLC_P$ driven design solutions only until the first round of market testing. This considerably weakened the ProjectCo's $CWLC_P$ minimisation incentive.

The *opportunity analysis* discovered that the ProjectCo had an opportunity to implement $CWLC_P$ driven design solutions in the project development process. However, in the PB stage, the opportunity began to diminish. This was because the contractor and the operator began to prepare themselves for the DB and operation contracts they were respectively going to be awarded at financial close. In addition, the design solutions had to pass a due diligence assessment prior to financial close. The assessment was designed to ensure that the design solution met the financier's objectives. In the implementation stage, the ProjectCo's opportunity to implement $CWLC_P$ driven design solutions was reduced further. This was because the contractual framework of the project was put into place. In the vast majority of cases, the ProjectCo would then have needed to renegotiate the contractual terms of the project and source additional finance to enable the implementation of $CWLC_P$ driven design solutions.

The *perception analysis* confirmed the explanations for the lack of $CWLC_P$ driven design solutions that arose from the incentive and opportunity analyses. In addition, it revealed that the lack of good quality WLC data and, thus, the uncertainty of expected $CWLC_P$ savings was seen to significantly discourage the implementation of $CWLC_P$ driven design solutions.

The HV design solution of the new UCLH hospital will not lower $CWLC_P$ and, thus, the UP as much as hypothesised. However, it is evident that the ProjectCo has developed a HV solution that will give it improved completion, operational and expenditure certainty. The ProjectCo will be able to pass the resulting benefits on to UCLH in the implementation stage of the project.

PART E - DISCUSSION AND CONCLUSION

Chapter 7 - Discussion

7.1. Introduction

This chapter discusses the findings of the case study research by placing them in the context of the contemporary PFI market. First, it comments on the applicability of the research findings. Second, the chapter highlights the design solutions that were identified to improve the economic efficiency of accommodation service provision in the case studies. Third, it explores the key issues that affect the ProjectCo's pursuit of economic efficiency through contract whole life cost ($CWLC_P$) minimisation in accommodation service PFI projects. Fourth, the chapter develops a number of solutions that should, according to *a priori* reasoning, remedy the problems the ProjectCo faces in $CWLC_P$ minimisation.

This chapter discusses the key issues that affect the ProjectCo's $CWLC_P$ minimisation in four parts defined by the research sub-questions – see Section 4.6.2. First, it considers the issues that arise from the *external environment* in which the procurement and development of the accommodation service PFI projects took place. Second, the chapter explores the issues that relate to the *project agreement between the client and the ProjectCo*. Third, it examines the issues that occur as a result of the *ProjectCo's organisation* in the development of a PFI project. Fourth, it discusses the issues that arise from the *ProjectCo's decision-making* in the project development process. In addition, in parallel with the discussion on the key issues, the chapter develops and proposes a number of solutions that can potentially enable further $CWLC_P$ minimisation.

7.2. The Applicability of the Research Findings

The **aim** of this research was *to generate a detailed understanding of how the economic efficiency of an accommodation service PFI project is determined in its development process through $CWLC_P$ minimisation.* This research used the implementation of $CWLC_P$ driven design solutions as an indirect measure of economic efficiency improvement. These solutions are the aspects of the overall design solution that can be attributed to the ProjectCo's intent to minimise the $CWLC_P$ which would not occur in a design solution for the same building had it been procured traditionally. This discussion focuses on the key issues in the development of PFI projects that affect the implementation of $CWLC_P$ driven design solutions. This research sought to identify $CWLC_P$ driven design solutions within the heating and ventilation (HV) design solutions of the project-facilities. Therefore, hereafter, the term $CWLC_P$ driven design solution is used only in reference to the HV design solution. However, it is felt that the issues that affect HV design development also affect other aspects of building design development. Thus, it is anticipated that the research findings are applicable to all areas of building design in the development of accommodation service PFI projects.

The case studies undertaken as part of this research are King's College London (KCL) Site Rationalisation project and University College London Hospitals NHS Trust (UCLH) Gower Street Redevelopment project. Hereafter, these projects are referred to as the *KCL project* and the *UCLH project* respectively. Therefore, the research findings relate only to a sample of two projects. As a result, the findings are not necessarily representative of all accommodation service PFI projects and further quantitative research is required to confirm the validity of the findings. Consequently, the recommendations made in this discussion should only be implemented after additional research has been undertaken. However, it must be noted that the knowledge gained on accommodation service PFI projects in the course of this research suggests that the research findings apply to the vast majority of PFI projects in the accommodation service market. If the research findings are not believed to apply to a typical accommodation service PFI project, it will be highlighted in the discussion. It must also be noted at this stage of the discussion that the KCL project is not a typical accommodation service PFI project. The reasons for this are discussed in Sections 7.4 to 7.7.

7.3. Economic Efficiency

This research used the implementation of $CWLC_P$ driven design solutions as a proxy of economic efficiency improvement through $CWLC_P$ minimisation. At the time the research design was developed, it was anticipated that a large number of $CWLC_P$ driven design solutions would be identified in the design solutions of the project-facilities. However, not a single $CWLC_P$ driven design solution was identified in either of the two case study projects. The underlying reasons for the absence of these solutions are explored in Sections 7.4 to 7.7.

Nevertheless, a number of design solutions that depart from traditional design solutions and are expected to reduce $CWLC_P$ were identified in the course of the research. However, it was established that $CWLC_P$ minimisation had not been the primary motive for the implementation of the solutions. Consequently, these solutions were defined to be *$CWLC_P$ reducing design solutions*. Not a single $CWLC_P$ reducing design solution was identified in the KCL project. The following $CWLC_P$ reducing design solutions were identified in the UCLH project:

Solution 1: An active chilled beam (ACB) system is used to provide heating and cooling in most (excluding critical areas such as operating theatres) of the hospital.

Solution 2: Life cycle fund (LCF) components have design lives that are expected, in the life of the contract, to reduce the total capital, replacement and major maintenance expenditure on the components.

Solution 3: Corridor modules are used to route the HV distribution.

Solution 4: All the HV plant is situated in a single location.

Solution 5: A single steam generation plant is used to provide humidification.

The lack of $CWLC_P$ driven and the limited number of reducing design solutions enforces the finding of CIC (2000) that the cost savings perceived to have been obtained in the design, build and operation of healthcare and educational PFI projects have been modest.

The issues that drove the ProjectCo to implement $CWLC_P$ reducing design solutions in the UCLH project and prevented their implementation in the KCL project are discussed in Sections 7.4 to 7.7.

In the course of this research, it became apparent that $CWLC_P$ driven design solutions could be operation-led, construction-led or win-win solutions. The implementation of an operation-led solution reduces the operational cost, but increases the capital cost of an accommodation service PFI project. The opposite is true for the implementation of a construction-led solution. The implementation of a win-win solution reduces both the capital and the operational costs of the project. This distinction becomes particularly important once a PFI project has reached financial close – see Section 7.6.

It must be noted that it is less likely that construction-led $CWLC_P$ driven or reducing design solutions are implemented in a PFI project than operation-led solutions. This is because in traditionally procured project the client gives the private sector actors an incentive to minimise the capital cost of a facility. In a PFI project, this incentive is weakened. However, PFI procurement gives the ProjectCo new opportunities for capital cost minimisation. It is possible therefore that construction-led solutions are found in PFI project-facilities.

7.4. External Environment

7.4.1. The Developing PFI Market

In 1995, KCL and UCLH projects were among the very first accommodation service projects to enter the PFI market. The two clients did not have any prior experience of PFI procurement. In addition, the governmental guidance on PFI procurement that is available today was issued only as the projects progressed. Furthermore, the ProjectCo in the KCL project did not have any, and the one in the UCLH project had only limited prior experience of PFI procurement. As a result, the procurement and the development of the two case study projects included a considerable amount of learning. It is likely therefore that the challenges posed by the unfamiliar working practices associated with PFI projects directed some of the ProjectCos' attention away from $CWLC_P$ minimisation.

As the PFI market has matured, the procurement and the development of accommodation service PFI projects have become more established. It is reasonable to assume that this will allow clients to focus more on value for money (VFM) maximisation and ProjectCos to pay more attention to $CWLC_P$ minimisation within their respective constraints. However, the public and the private sector actors should both seek to further accelerate the PFI market development.

Since the two case study projects were procured, the Government has set up a number of mechanisms to improve the procurement of PFI projects. According to HM Treasury (2003a), the actions taken included:

- Treasury Taskforce PFI unit was re-established as Partnerships UK, a Public Private Partnership, to provide public sector clients with expertise in procuring PFI projects.
- Office of Government Commerce (OGC) was established to incorporate a number of existing government agencies. OGC acts as a catalyst for VFM in PFI and other procurement. The major achievements of OGC include the development of the Gateway process (see e.g. OGC (2004)) and the standardisation of the PFI contract – see e.g. HM Treasury (2004).
- Government departments, such as Department of Health (DoH), have been enabled to set up internal PFI units to provide procurement advice to clients within their departments. These PFI units have issued PFI guidance documents such as DoH's model Output Specification (OS) – see e.g. NHS Executive (2003)
- Public Private Partnership Programme (4Ps) was created to assist local government in PFI procurement.
- Project Review Group was founded to ensure the quality of projects procured by local government.

According to HM Treasury (2003a), in the near future the Government will:

- Establish a system to accredit external public sector advisers to ensure the quality of advice provided to clients.
- Set up vehicles to provide support for coordination of PFI procurement in priority areas.
- Promote adoption of best practice across the public sector.

CIC (2000) established that PFI projects procured by repeat clients are perceived to yield more cost savings in design, build and operation than projects procured by clients previously inexperienced in PFI. KCL and UCLH are unlikely to procure further PFI projects in the near future. Therefore, in order for the public sector to obtain the most benefits from the two case study projects, it needs to capture and utilise the experience and expertise accumulated on subsequent projects. A potential solution to achieve this is for the departmental PFI units to recruit KCL's and UCLH's procurement staff to ensure that the sector specific PFI expertise generated in the projects is retained in the public sector.

Recommendation 1
The departmental PFI units should recruit staff who have gained experience and expertise in procuring projects for clients within the department.

The ProjectCo actors also have a role in improving the development of future accommodation service PFI projects. However, it must be noted that it is unlikely that the ProjectCo actors will be willing to share their PFI development experience and expertise widely with other actors in the PFI market. This is because it could result in the loss of the competitive advantage they have gained through participating in PFI projects. This was evident particularly in the development of the KCL project. Some of the project actors did not have access to all the cost information on the project even though it might have enabled the implementation of further $CWLC_P$ driven design solutions and, therefore, benefited the project as a whole.

Private sectors actors should seek to actively share their experience and expertise with the actors they typically form ProjectCos with to pursue PFI projects because the improved performance of a ProjectCo will improve the performance of each of its actors in the PFI market.

Recommendation 2
The ProjectCo actors should actively share their PFI experience and expertise with the actors they typically work with in pursuing and undertaking PFI projects.

It must also be noted that in the course of this research the theoretical understanding of the principles of PFI has improved. Ive (2004), for example, has made a significant contribution.

7.4.2. Output Specification

KCL and UCLH used an output specification (OS) to procure their respective projects. In principle, the specification allowed the ProjectCos to propose any given HV solutions to be used in the project-facility, subject to environmental condition constraints. The buildings are required to have specific environmental conditions for the client to be able to provide its core public service. However, in relation to HV, the OSs also referred to a number of guidance documents and standards that the HV design solution had to comply with. These documents and standards had been developed at a time when traditional procurement had been the dominant procurement method. These constraints substantially limited the private sector actor's opportunity to implement $CWLC_P$ driven design solutions. This is because the guidance had been developed to govern the design of traditionally procured buildings used for provision of public services. The guidance documents and standards had not been challenged to allow the implementation of $CWLC_P$ driven design solutions during the dominance of traditional procurement. This occurred because in most cases there is no capital cost benefit from implementing $CWLC_P$ driven and/or reducing design solutions. However, on both projects, the ProjectCo actors perceived that the existing design guidance limited innovation. It must be concluded therefore that some of the existing design guidance may not be appropriate to govern design in PFI projects.

The existing guidance documents and standards that govern the design of PFI buildings need to be updated to accommodate solutions that arise as a result of $CWLC_P$ minimisation. This needs to be done by the public sector organisations responsible for issuing the relevant documents. However, the ProjectCo actors also need to be willing to actively challenge the documentation as potential $CWLC_P$ driven design solutions are identified. This will accelerate change and eventually enable $CWLC_P$ driven design solutions to be implemented.

Recommendation 3
The relevant public sector bodies should update the guidance documents and standards governing design development in accommodation service PFI projects.

Recommendation 4
The ProjectCo actors should actively challenge the existing design guidance if it is found to be in conflict with the implementation of $CWLC_P$ driven design solutions.

7.4.3. Competition

KCL invited six ProjectCos to bid for the project and subsequently received two SPSs. However, only one of the solutions was feasible. As a result, KCL was left with a single bidder at an early stage of the procurement process. KCL did not nominate a preferred bidder (PB) until the price of the project was within a negotiating distance of its affordability constraint. UCLH invited three ProjectCos to submit SPSs and, subsequently, received only one solution. UCLH nominated the PB after it had ensured that the SPS it had received was compliant.

It must be concluded that the competition in the procurement of the two case study projects was limited. It was inadequate to force the ProjectCos to implement $CWLC_P$ driven design solutions. Competition is essential to ensure that a client procures a PFI project that is VFM because it forces the ProjectCos to lower their bid price ($CWLC_C$) through $CWLC_P$ minimisation in order to increase their respective probabilities of being nominated the PB. Consequently, KCL and UCLH needed to use the affordability and VFM assessments to substitute for competition – see Section 7.4.5.

Recommendation 5
The client should always nominate the PB as a result of a genuine competition to ensure that it procures the best VFM accommodation service PFI project available in the market.

According to HM Treasury (2003a), the Government is seeking to make bidding for PFI projects more attractive to the private sector. Specifically, the Government is working to reduce the time it takes for a PFI project to proceed from its initial advertisement to financial close and to lower the ProjectCos' bid costs in PFI projects. HM Treasury (2003a) acknowledges these to be the main areas of private sector concern in PFI procurement. It is likely therefore that if the Government is successful in achieving its aim, the level of competition in PFI procurement will increase.

NHS Executive (2002a) has recently recommended that the NHS clients should invite three or four ProjectCos to bid for PFI projects below and above the capital value of £60 million respectively. The limited number of bidders is intended to make the ProjectCos more willing to commit resources to bidding because the likelihood of their success in the bidding competition is increased. In smaller projects, the NHS client should nominate the PB based on the submissions. However, in larger projects, the NHS clients should shortlist two bidders for revised SPS submissions so that both shortlisted bidders would have an equal chance of becoming the PB. A potential solution to assuring effective competition and the continued development of the SPSs is for the client to commit to refunding a proportion of the losing short-listed bidder's bid cost. This type of arrangement could guarantee that the client is able to select the SPS and the service provider based on a genuine competition. However, according to HM Treasury (2003a), the Government has considered and ruled out this type of approach.

7.4.4. Affordability Assessment

In both case study projects, initially the client defined its affordability constraint in terms of its maximum annual expenditure on the unitary payment (UP) for the accommodation service provision. However, early in the procurement, KCL redefined its affordability constraint as maximum capital cost expenditure. The capital cost constraint arose from the financing arrangement for the project – see Section 7.6.4.

On both projects, leading to financial close, the SPS was value engineered to meet the client's affordability constraint. If the projects were to remain unaffordable, they would not be implemented and the ProjectCos would not be reimbursed for their bid costs. This is a classic example of the hold-up problem described by Williamson (1985). The focus of value engineering in the KCL project was on capital cost, which prevented the implementation of operation-led $CWLC_P$ driven design solutions. In the UCLH project, the pressure was to value engineer the SPS to a state where the UP was affordable to the client. The pressure to make the SPS affordable forced the private sector actors to $CWLC_P$ minimise and partially resulted in the implementation of Solution 2.

It is essential that the client focuses only on UP in determining whether the SPS is affordable. The client needs to give the ProjectCos confidence that this will be the case, which will enable the ProjectCo to engage in $CWLC_P$ minimisation in SPS development. If the ProjectCo suspects that the client is attracted to a low capital cost project, it may be tempted to minimise the capital cost of the project to increase the likelihood being awarded the contract. This would have a detrimental effect on $CWLC_P$ minimisation and, therefore, the VFM of the PFI project.

Recommendation 6
The client should focus only on the UP in assessing whether an accommodation service PFI project is affordable.

In the KCL project, the client influenced the technical solution significantly due to its affordability constraint. This had an adverse effect on the implementation of $CWLC_P$ driven design solutions as the client wanted the capital cost of the project to be reduced. It is critical for the ability of PFI procurement to deliver improved VFM that the client does not interfere with the HV solution as long as it is capable of providing the required environmental conditions. Any intervention beyond this point is a violation of the fundamental principles of PFI.

Recommendation 7
The client should not interfere with the SPS for reasons of affordability as long as it meets the OS.

It must be noted that as the Government has began to use the Gateway Review and the Project Review Group methodologies in central and local government procurement respectively, it should, in theory, be impossible for clients to proceed to the market with projects that prove to be unaffordable as the bids are evaluated.

7.4.5. Value for Money Assessment

KCL and UCLH both assessed whether the projects they were about to procure were likely to be VFM using a Public Sector Comparator (PSC) project. KCL did not share its PSC project with the ProjectCo. Instead, it informed the ProjectCo whether its proposed SPS had passed the VFM assessment. If the ProjectCo's SPS had been more expensive than the PSC project, it would have failed the assessment. However, the ProjectCo could not verify the respective costs of the solutions independently as it did not have access to the comparator.

The emphasis of KCL's VFM assessment was felt to be on capital cost. This was a result of the intended financing arrangement of the project – see Section 7.6.4. KCL communicated the capital cost emphasis and it prevented the ProjectCo from implementing operation-led $CWLC_P$ driven design solutions. Such solutions would have been more expensive in capital cost than solutions with similar functionalities available in the market. Therefore, KCL would have judged them not to be VFM.

UCLH included both its VFM assessment methodology and its initial PSC project in the Invitation to Negotiate Documentation (ITND). In addition, it kept the ProjectCo informed of their further development. As a result, the ProjectCo understood the type of SPS that could pass the VFM assessment. UCLH's assessment methodology took into account the comparative benefits of the SPS and the PSC project. This led the ProjectCo to implement Solution 1 as it enabled the benefits the project would generate to be increased.

Just prior to financial close, HM Treasury instructed UCLH to compile an additional PSC project known as the Conventionally Funded Option (CFO). This was because the initial PSC project was radically different from the ProjectCo's SPS. HM Treasury was of the opinion that VFM could not be established by comparing those two solutions. The CFO had identical design, construction and operation solutions to the ProjectCo's SPS. However, the option was priced on the basis that it would be financed publicly and procured traditionally.

UCLH assessed the VFM of the SPS against the PSC solution in $CWLC_C$. However, as UCLH compiled the CFO, it decided also to assess the VFM of the SPS in capital cost. The main reason was that, at the time, the high capital costs of PFI buildings were receiving negative publicity, which it wanted to avoid. The capital cost emphasis prevented the ProjectCo from implementing operation-led $CWLC_P$ driven design solutions. This is because such solutions would have failed the VFM assessment by being more expensive in capital cost than the risk adjusted market prices of solutions with similar functionalities.

In conclusion, in both projects, the VFM assessment clashed with the underlying principles of PFI. If PFI procurement is to deliver improved VFM projects through $CWLC_P$ minimisation, the clients must focus only on $CWLC_C$ of the service over the duration of the contract in their VFM assessments. However, it must be noted that in both projects, the PSC project was used as a substitute for competitive pressure. This was also the reason why KCL decided to keep its PSC project private. It is possible that the absence of competition led the clients to assess the capital costs of the SPSs in greater detail than they would have done, if the projects had been procured more competitively.

Recommendation 8
The client should focus on the $CWLC_P$ in assessing the VFM of an accommodation service PFI project. The client should not pay any attention to the capital cost of the project-facility.

The VFM assessment has been subject to considerable debate – see, e.g. Shaoul (forthcoming). According to HM Treasury (2003a), the Government is in the process of reforming the VFM assessment. In the future, it will require a more rigorous assessment in accordance with HM Treasury (2003b) before clients are allowed to advertise their projects. This assessment will seek to ensure that PFI procurement is likely to deliver the best VFM of the available procurement methods. If the assessment shows that this is likely not to be the case, the clients should use conventional procurement methods. The reform of the VFM assessment is a response to the criticism that the current use of PSC is not necessarily the most effective way to determine whether a PFI project will be VFM. NAO (1999b; 2003a), for example, has found that comparators can be error-prone and spuriously accurate.

According to HM Treasury (2003a), the Government will extend the VFM assessment to ensure that the market has the capacity to deliver the project and that the competition in the procurement process is effective. If these two aspects had been assessed in the case study projects, it is likely that they would have not proceeded in the formats that they did.

In addition, OGC (2003) has updated its guidance on whole life costing. The document will assist clients in compiling more robust PSC projects and, thus, in improving their understanding of the costs involved in PFI projects.

7.4.6. Procurement Timescale

The two case study projects were subject to considerable delays. The KCL project took 27 months to proceed from the Expression of Interest (EoI) Notice to financial close. This period of time is known as the *procurement timescale*. The main cause of delay in the project was that the ProjectCo's SPS was initially unaffordable. Consequently, the client and the ProjectCo had to value engineer the SPS to affordability. This took approximately 12 months.

The procurement timescale in the UCLH project was 54 months. A number of issues contributed to the delay. The most significant of these was political uncertainty. It was not known whether a future Labour Government would continue to use PFI as a public procurement method and whether it would allow UCLH to proceed with the procurement of the project. According to HM Treasury (2003a), the average procurement timescale for a health PFI project has been 40 months. However, the timescales have ranged from 22 to 60 months. Therefore, the UCLH project is one of the projects that have taken the longest to reach financial close.

In both projects, the uncertainty on whether they were going to reach financial close made the ProjectCos less keen to innovate. This is likely to have had a negative effect on the implementation of $CWLC_P$ driven design solutions. However, the unfortunate delays also allowed the ProjectCos additional time to develop their SPSs prior to financial close. It must be noted that this enabled the ProjectCos to develop the SPSs in line with their objectives. If $CWLC_P$ minimisation had been one of the ProjectCos' priority objectives it is possible that a larger number of $CWLC_P$ driven design solutions would have been implemented.

As the PFI market has matured, the procurement and the development processes have become more established. In addition, the Government appears to be fully committed to the use of PFI procurement. Therefore, it is unlikely that delays in future accommodation service PFI projects will be experienced for the same reasons that occurred in the case study projects. HM Treasury (2003a) acknowledges private sector concerns on long PFI procurement timescales. It anticipates that the strong enforcement of standardisation of the procurement process and the improvement of public sector procurement skills will reduce the procurement timescales.

Recommendation 9
The client should proactively seek to identify and eliminate the uncertainties surrounding the PFI procurement process.

Recommendation 10
The client should allow the private sector actors adequate time to develop their SPS.

7.4.7. Partnership

Good working relationships between the clients and ProjectCos are evident in the two case study projects. The relationships are best described as partnerships. The public and private sector actors are aware that they have entered into mutually beneficial long-term relationships. The partnerships were reinforced particularly in the period leading to financial close because both parties had invested considerable resources in the procurement and development of the projects. They were only able to recover their sunk costs if they arrived at a solution that was acceptable to both parties and could be used as a basis for financial close. This is in line with NAO (2001), which found that 72% of clients and 80% of ProjectCos perceive their relationship to be either good or very good.

A good working relationship between the client and the ProjectCo is essential for reaching financial close on a mutually beneficial project. If the public and private sectors work closely together, especially leading to financial close, it is easier for them to align their aims of VFM and economic rent maximisation subject to respective constraints. The implementation of $CWLC_P$ driven design solutions is at the heart of achieving the objectives of both parties. If the ProjectCo identifies potential $CWLC_P$ driven or reducing design solutions, a good working relationship with the client can facilitate their implementation. This is the case, especially, if the implementation requires the support of the client. This might be the case after financial close when a contractual agreement is already in place.

Recommendation 11
The client and the ProjectCo should consider their relationship as a key asset of the project and manage it accordingly.

7.5. Project Agreement

7.5.1. Risk Allocation

The key principle for risk transfer in the contract between the public and private sectors is to allocate risks to the party best able to manage them. This is expected to result in economic efficiency because the party that has the superior expertise and capability in a specific task will manage its execution. This principle was to a large extent followed in the two case study projects. The only exception is energy risk – see Section 7.5.4

It must be noted that KCL used a design, build and operate (DBO) contract in its project. In other words, the client financed the design and the construction of the project-facility. This was because it could obtain finance for the project through governmental grants and the sale of sites the project made surplus to its requirements. Therefore, it was VFM for KCL to retain the responsibility for and the risk of financing the project. As a result, the KCL project is not a typical accommodation service PFI project.

The risk allocation in the two case study projects is similar. The clients allocated the vast majority of design, construction, and operation risks to the private sector. The clients retained only a proportion of some *force majeure* -type risks and the risk of PFI-specific changes in legislation. It must, therefore, be concluded that the risk allocation achieved in the case study projects is likely to yield VFM for the clients with the exception of energy risk allocation.

KCL and UCLH used long-term DBO and design, build, finance and operate (DBFO) contracts in their projects respectively. This created an opportunity for the private sector actors to take an integrated and a long-term view of design, construction and operation in the projects. In other words, the contract gave the ProjectCos an opportunity to implement $CWLC_P$ driven design solutions post financial close within the constraining documentation appended to the contracts. The contracts also gave the ProjectCos an incentive to do so because they entitled them to any economic rent that arises as efficiency savings as a result of implementation of $CWLC_P$ driven design solutions.

In the course of this research, the understanding of risk allocation in PFI projects has improved. Akintoye *et al.* (2001b), Akintoye *et al.* (2003) and Bing *et al.* (forthcoming), for example, have made significant contributions.

7.5.2. Service Commencement

In the KCL project, the contract specifies the duration of the construction and operational phases of the project to be 20 months and 25 years respectively. If the start of the operational phase had been delayed, the ProjectCo would have become liable for liquidated damages. However, it must be noted that a liquidated damages clause in not usually used between the client and the ProjectCo in accommodation service PFI projects. This arrangement arose in the KCL project as the client financed the project directly and paid the ProjectCo during the construction period. Nevertheless, the liquidated damages clause gave the ProjectCo an incentive to improve the completion certainty of the project-facility. Consequently, it completed the building on programme.

In the UCLH project, the contract period is 40 years from financial close onwards. The client will not begin to pay the ProjectCo until the building has been completed. This created an incentive for the ProjectCo to improve the completion certainty of its SPS because the ProjectCo's failure to complete construction on time would result in it not beginning to receive the anticipated revenue from the project. It would therefore face difficulties in meeting its loan repayment obligations and it would incur additional costs in rescheduling those commitments. In addition, the operational phase and, thus, the period for which the ProjectCo would receive the UP for, would reduce by the delay period. This would decrease the total revenue the ProjectCo would receive from the project. The incentive to improve completion certainty led the ProjectCo to implement Solution 3 as it improved constructability and, thus, made problems resulting in delays in the construction period less likely. The completion risk transfer in the UCLH project is representative of accommodation service PFI projects.

In both projects, the client transferred completion risk to the ProjectCo. As a result, the ProjectCos had an incentive to improve the completion certainty of their respective SPSs. It is possible that the incentive directed attention away from the implementation of $CWLC_P$ driven design solutions. However, it must be noted that completion certainty is likely to yield VFM for the clients because time overruns have been a major problem in traditional procurement. A survey by NAO (2003b) established that the construction of PFI buildings has been completed on time in 76% of projects. This is a significant improvement to the finding of HM Treasury (1999) that 30% of traditionally procured buildings were completed on schedule. It must therefore be concluded that PFI is successful in delivering improved VFM though effective completion risk transfer. The reasons for ProjectCo's approach to completion certainty are discussed in Section 7.6.4.

7.5.3. Performance Related Payment

In both projects, the payment for the accommodation service is performance related. In other words, the clients will only pay the ProjectCos for services delivered. The performance related payment gives the ProjectCos an incentive to ensure that they will receive the UP in full subject to not incurring disproportionate costs.

In the KCL project, the UP is potentially subject to underperformance and unavailability deductions. The definition of underperformance is that a space is outside its specified environmental condition requirements. The definition of unavailability is that a space cannot be used for its intended purpose. The size of an underperformance deduction is 25% of the UP if the level of underperformance exceeds a pre-specified threshold. The ProjectCo can reclaim up to 75% of the underperformance deduction if it does not incur additional UP deductions for a specified period of time following the initial underperformance deduction. The size of an unavailability deduction is a function of the relative importance of the unavailable area.

In the UCLH project, the UP consists of a service payment (SP) and an availability payment (AP). The SP is linked to operational service provision, such as cleaning, whereas the AP is related to the availability the building. The definition of unavailability is that the environmental conditions in a space are outside its specified environmental requirements. The AP mechanism divides the building into three spatial categories according to their relative importance. This categorisation specifies the amount of time the ProjectCo has to rectify the cause of unavailability before AP deductions begin to apply. It also affects the magnitude of the deduction for each square metre of area affected.

In both projects, the potential UP deductions gave the ProjectCos an incentive to improve the operational certainty of their SPSs. This is because any deductions would reduce their revenues from the project. In the UCLH project, this led the ProjectCo to implement Solution 4 and Solution 5 as they decreased the likelihood of unavailability in the project-facility. It is possible that the incentive to improve operational certainty diverted ProjectCos' attention away from $CWLC_P$ minimisation. However, it is also likely that increased operational certainty in comparison to traditionally procured facilities will yield VFM to clients as disruptions in their core service provision are reduced.

In the two projects, the number of $CWLC_P$ driven and reducing design solutions implemented did not vary according to the payment mechanism. It was anticipated that in areas where the margin for triggering a payment deduction was greater, the ProjectCo would implement a greater number of $CWLC_P$ driven design solutions. This was found not to be the case. However, as a result of the incentive to improve operational certainty, the HV solution in the UCLH project-facility has considerably larger back-up facilities than it would have had if procured traditionally.

The case studies provide no evidence of how different types of payment mechanisms affect $CWLC_P$ minimisation. Future research is therefore required to establish the best practice for developing a payment mechanism. It must be noted that departmental PFI units, such as DoH PFI Unit, have recently issued model payment mechanisms – see NHS Executive (2002b).

Recommendation 12
Further research must be undertaken to establish how different types of payment mechanisms affect the design solutions of accommodation service PFI project-facilities.

7.5.4. Energy Risk Allocation

Energy risk is divided into energy price risk and energy consumption risk. In both projects, the client retained the risk of fluctuations in the market price of energy. This is consistent with the principle of allocating risks to the actor best able to manage them. The ProjectCos do not have any control over the market price of energy. They would therefore have been likely to charge a premium for accepting the risk. This would not have been VFM for the clients.

KCL retained the energy consumption risks. In other words, the ProjectCo will invoice KCL for the energy consumed in the project-facility. KCL retained the risk because of its affordability constraint. If KCL had allocated some of the energy consumption risk to the private sector the ProjectCo would have had to increase expenditure on energy saving design solutions. As a result, the capital cost of the project-facility would have increased. As KCL defined its affordability constraint in terms of capital cost, this would have made the project unaffordable. It must be noted that the way energy is paid for excludes energy saving design solutions from the definition of $CWLC_P$ driven design solutions.

KCL's retention of energy consumption risk gave the ProjectCo an incentive to increase the likelihood of reaching financial close and, subsequently, its economic rent by neglecting energy saving aspects of the design. This will increase KCL's overall expenditure on the operation of the buildings in the life of the DBO contract. It must be noted that in accommodation service PFI projects typically at least some element of energy consumption risk is allocated to the ProjectCo. The energy risk allocation in the KCL project is not therefore a typical case of energy risk allocation. However, it is acknowledged that the KCL project was one of the very first instances of negotiating energy risk transfer.

In the UCLH project, the energy consumption risk is shared. The client and the ProjectCo agreed a standard for maximum annual energy consumption to be used as part of the risk sharing mechanism. The ProjectCo will invoice the client for energy consumption. The ProjectCo will be responsible for the cost of energy consumption above the standard if it is proven to result from designing, building or operating the project-facility. It must be noted that the ProjectCo can choose to rectify the causes of above expected energy consumption at its own cost. The energy risk sharing mechanism also gives a relatively weak incentive to the ProjectCo to reduce energy consumption. The ProjectCo is entitled to 10% of the savings in energy consumption below the energy standard. This clause gives the ProjectCo some incentive to implement energy saving design solutions.

The additional payment incentive to reduce energy consumption below the energy standard did not affect the HV design solution. However, the incentive created by penalties for excess energy consumption resulted in changes in the HV and interrelated design solutions. It must therefore be concluded that the incentive not to consume energy in excess of the standard was appropriate. In addition, it appears that the incentive to reduce energy consumption below the energy standard was too weak. However, an alternative explanation for its ineffectiveness was identified and it is discussed in Section 7.6.9.

The cost of energy that will be consumed in the project-facilities in the operational periods of the two case study projects is expected to be substantial. However, energy consumption has been somewhat neglected as an area of VFM for the public sector and profit for the private sector. The ProjectCo must see the management of energy consumption as a business opportunity. Furthermore, it is possible that the clients should give a greater proportion of the realised energy consumption savings to the ProjectCo in order to strengthen its incentive to implement energy saving design solutions.

Recommendation 13
Further research should be undertaken to establish the appropriate level of incentives in relation to energy consumption, which will result in the minimum expenditure on energy and energy saving design solutions.

Recommendation 14
The ProjectCo should approach energy consumption management as a genuine business opportunity.

It is acknowledged that in the course of this research energy efficiency has become more of an issue in PFI projects. The OGC (2002) has, for example, provided guidance on procuring PFI projects with energy efficient project-facilities.

7.5.5. Market Testing

In both KCL and UCLH projects, the contract between the client and the ProjectCo requires the components of the soft operational service provision, such as cleaning, to be benchmarked and/or market tested. The ProjectCos have priced these components at financial close. The exercises take place on pre-specified dates in the contract period. In the KCL project, the services are market tested if the ProjectCo has incurred more than a pre-specified amount of UP deductions, but otherwise benchmarked. In the UCLH project, the client decides whether the services are benchmarked or market tested. It must be noted that to date neither benchmarking nor market testing has been undertaken in either project because both projects are still in their early stages.

In benchmarking the ProjectCo compares its price for a service component to the price of equivalent service provision in the market. Subsequently, the corresponding part of the UP is adjusted according to a pre-specified formula.

The exact method for market testing has not been established in either project. However, it is anticipated that the ProjectCos will invite bids for a soft operational service component from a number of pre-selected providers. The lowest price obtained from the market will become the new price for the service component and the UP will be adjusted accordingly.

In the KCL and the UCLH projects, the services will potentially be market tested for the first time after 7 and 5 years service commencement respectively. This weakens the ProjectCos' incentive to implement $CWLC_P$ driven design solutions because the ProjectCo will lose the expected efficiency savings from the solutions after market testing as illustrated in Figure 7.1. It must be noted that benchmarking does not have the same effect. This is because the existence of a $CWLC_P$ driven or reducing design solution in the project-facility does not affect the prices that the service provision is benchmarked against.

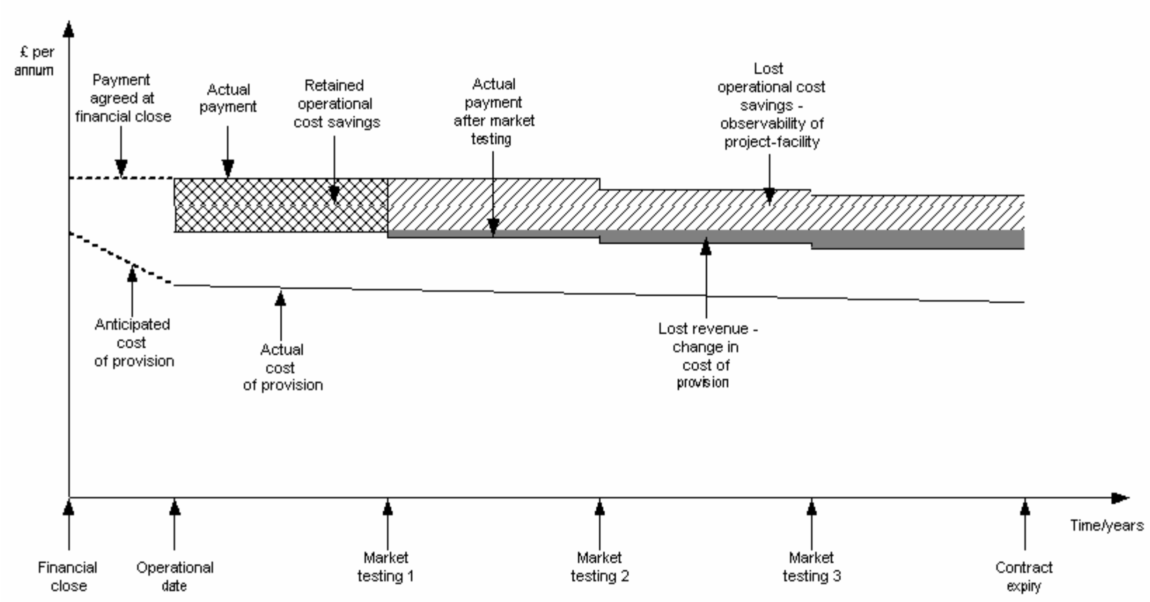

Figure 7.1. Market testing of a soft operational service component.

This effect is best illustrated by a hypothetical example. The construction specification appended to the contract specifies only a minimum level of filtration for the fresh air to be provided to the office space in the project-facility. Therefore, in the detail design development, the ProjectCo can choose to increase the level of filtration. As a result, it will increase the capital cost of the project. However, the increased filtration of the air will lower operation cost by reducing the need for cleaning. The discounted net present value of increasing the level of filtration is positive and, thus, it is a $CWLC_P$ driven design solution. However, cleaning potentially needs to be market tested. The DBFO contract specifies the price of cleaning, which is market tested in year 5 of the operational period. A service provider in the market that bids for the cleaning knows the level of filtration in the building. It therefore formulates its bid price accordingly. As a result, its bid price is lower than the price specified in the contract. Subsequently, after market testing, the UP is reduced accordingly. The ProjectCo can anticipate that this will happen. Therefore, it will chose to increase the level of filtration only if the discounted savings in cleaning in the first 5 years are greater than the additional capital expenditure required to increase filtration. This is because it will not be able to capture the efficiency savings after market testing. Thus, it does not have an incentive to implement such solutions. It is acknowledged that the prospect of market testing is likely to influence the design of other aspects of the project-facility more than the HV solution.

There are at least two possible solutions to this problem. First, the client can increase the frequency of benchmarking in order to ensure that that cost of soft operational service provision is in line with market prices. Second, the client and the ProjectCo can redefine the prices for the service components to be market tested at service commencement. This would enable the ProjectCos to capture efficiency savings created in detail design development by implementing $CWLC_P$ driven solutions as illustrated in Figure 7.2. As a result, ProjectCo would have a stronger incentive to implement such solutions. It is acknowledged that the ProjectCos would initially capture all the gains. However, it can be assumed that the solutions would quickly become best practice. Therefore, the efficiency savings that are expected to materialise as a result of such solutions would be reflected in the bid prices on the following wave of PFI projects. Thus, through competition, the client would be able to access these expected savings. However, these savings cannot be accessed if the solutions do not become best practice. This will only happen if the ProjectCos are given an incentive to implement them.

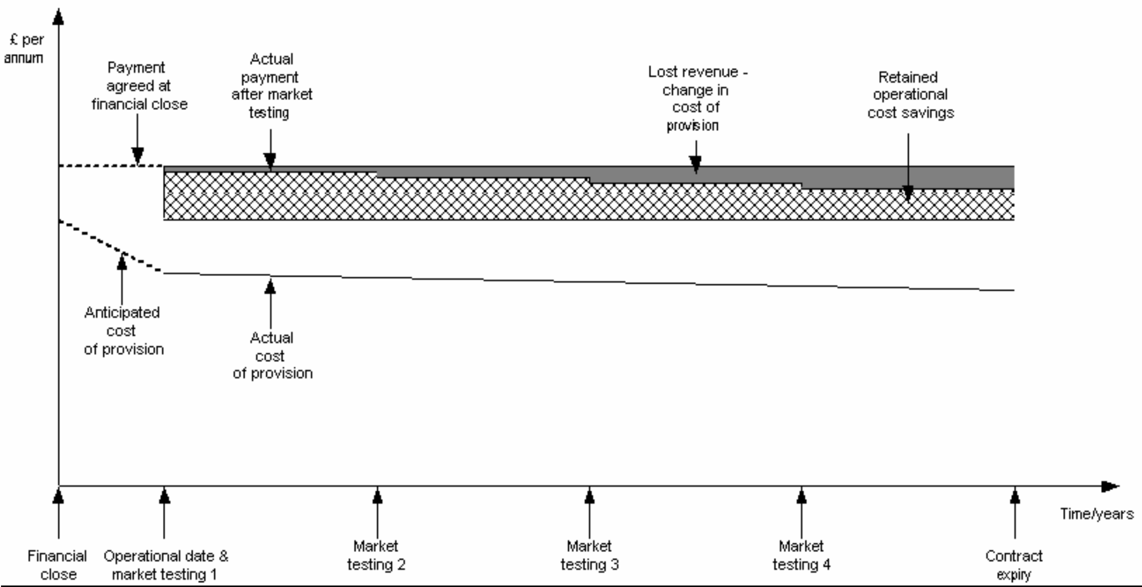

Figure 7.2. Alternative market testing strategy for a soft operational service component.

Recommendation 15
The client should abandon the market testing of soft operational service provision components for more frequent benchmarking or, alternatively, it should agree to re-price the components at service commencement and allow the ProjectCo to keep the resulting surplus.

It must be noted that HM Treasury (2004) continues to enable clients to use market testing in procuring PFI accommodation services.

7.6. ProjectCo Organisation

7.6.1. Bid Vehicle

A Bid Vehicle (BV) is the legal entity that brings the private sector actors together to pursue a PFI project. It is the private sector interface with the client in SPS development prior to financial close. In the KCL project, the BV was a special purpose vehicle (SPV) fully owned and controlled by a property developer who provided the BV with strategic direction and financial resources in the project development process. The BV appointed a specialist project management consultancy to manage the SPS development. In addition, it placed contracts with an architect and building services and structural designers to develop design solutions to be part of the SPS.

KCL's affordability constraint (see Section 7.4.4) placed the emphasis in the SPS development on capital cost minimisation. Due to KCL's affordability constraint it would have been difficult to implement $CWLC_P$ driven design solutions because the ProjectCo would have needed to obtain finance for the increased capital cost from alternative sources. Therefore, throughout the SPS development process, the ProjectCo had little incentive to implement $CWLC_P$ driven design solutions. However, the organisational structure used prior to financial close did not prevent $CWLC_P$ minimisation

The BV proceeded to develop the SPS to an advanced scheme design stage. At this time, a contractor and an operator were added to the BV in the development process through competitive bidding. As a result of their late involvement, the two actors had only a limited opportunity to influence the SPS. Consequently, their opportunity to implement $CWLC_P$ driven design solutions at the early stages was restricted. The contractor and, especially, the operator should be involved in the SPS development from inception because the two actors have significant expertise on solutions that are likely to reduce $CWLC_P$. It must be noted that a contractor and an operator are involved in the development of most accommodation service PFI projects from inception.

Recommendation 16
The contractor and the operator should be involved in SPS development from inception.

In the UCLH project, the BV was initially a joint venture (JV) between the ParentCos of a contractor and an operator who were to execute the project. Thus, the ParentCos adopted the roles of InvestCos. Subsequently, these roles were overtaken by their subsidiaries that specialised in bidding for and investing equity in PFI projects and an additional contractor organisation joined the ProjectCo.

The BV obtained project management resources from the InvestCos. The BV appointed an architect, the contractor and the operator to develop the SPS for the project from inception. It must be noted that the contractor itself was a JV. The contractor placed contracts with building services and structural designers to develop the design solution to be part of the SPS.

As a result of the organisational structure used, all the ProjectCo actors had an opportunity to influence the SPS from the initial stages of its development. They had therefore an opportunity to implement $CWLC_P$ driven design solutions. In addition, at least initially, they had an incentive to do so because UCLH assessed the affordability and VFM of the project solely based on the UP and $CWLC_C$ respectively until financial close became imminent.

In both projects, the contractor had more influence on the SPS than the operator. The operator developed the operational solution as a response to the design and construction solutions. One of the reasons for this was perceived to be the uncertainty associated with whole life cost (WLC) data. The operator could not use the data to convince the other actors that a change in the SPS would result in operational savings that would reduce $CWLC_P$. Consequently, the operators became more reactive than proactive. This is likely to have had an adverse effect on the implementation of $CWLC_P$ driven design solutions. An active involvement of the operator in the SPS development in accommodation service PFI projects is essential because the actor has the most expertise of potential $CWLC_P$ driven design solutions.

Recommendation 17
The operator should seek to take a more proactive approach in SPS development, which the other ProjectCo actors should embrace.

In both projects, the private sector actors did not actively pursue $CWLC_P$ minimisation prior to financial close. This reluctance was related to the organisational structure to be used post financial close and the fact that the ProjectCo actors were aware of the structure to be adopted.

It must be noted that a property developer is typically not an actor in accommodation service PFI projects. Therefore, the private sector organisation in the KCL project pre financial close is not representative of accommodation service PFI projects. The private sector organisation in the UCLH project is more representative of the typical case. However, it is acknowledged that usually there is only one contractor and, consequently, one contractor InvestCo involved in a PFI project, which was not the case in the UCLH project.

7.6.2. Special Purpose Vehicle

In the KCL project, at financial close, the contractor and the operator established another SPV that entered into the DBO contract with the client. The contractor and the operator therefore also adopted the roles of InvestCos. The SPV was to be responsible for designing, building and operating, but not financing, the project-facility. The SPV placed design and build (DB) and operation contracts with the contractor and the operator respectively to execute the project. These two contracts were fully reflective of the responsibilities included in the DBO contract. The SPV's organisational structure in the KCL project is given in Figure 7.3.

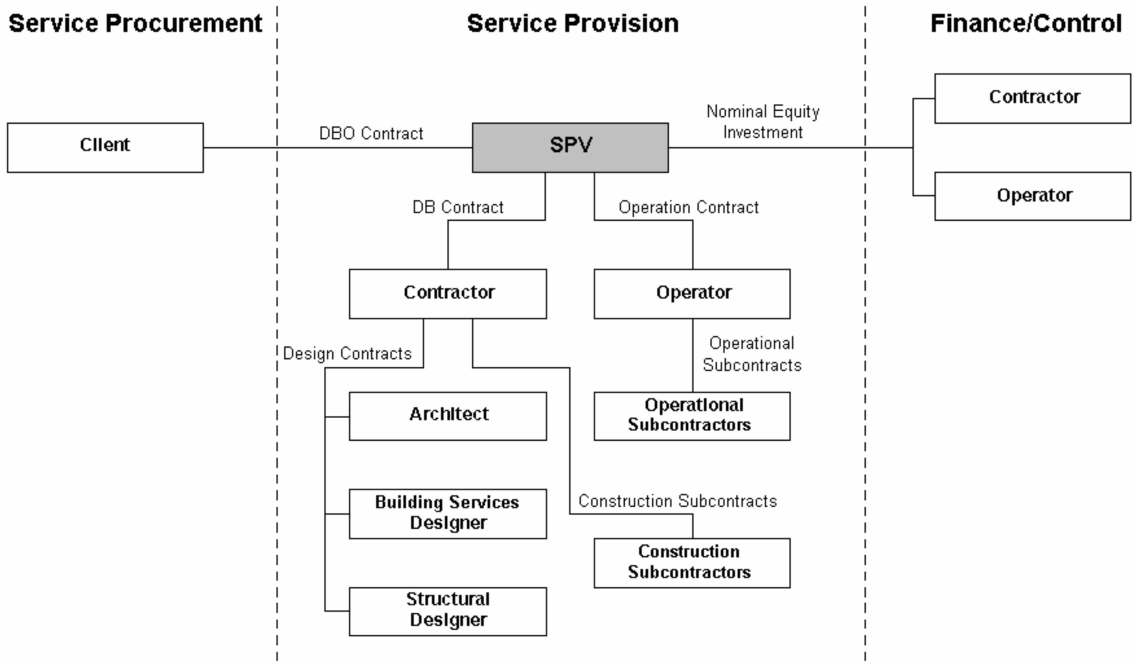

Figure 7.3. Organisational structure in the KCL project post financial close.

In the UCLH project, at financial close, the InvestCos established an SPV that entered into the DBFO contract with the client. The SPV was to be responsible for designing, building, operating and financing the project-facility. The SPV placed a DB contract with the contractor and an operation contract with the operator. In addition, it entered into a financing agreement with a financier. The DB and operation contracts and the financing agreement mirrored the DBFO contract with the exception of Life Cycle Fund (LCF) management, which was retained by the SPV – see Section 7.6.10. The organisational structure used in the UCLH project is illustrated in Figure 7.4 in a simplified format.

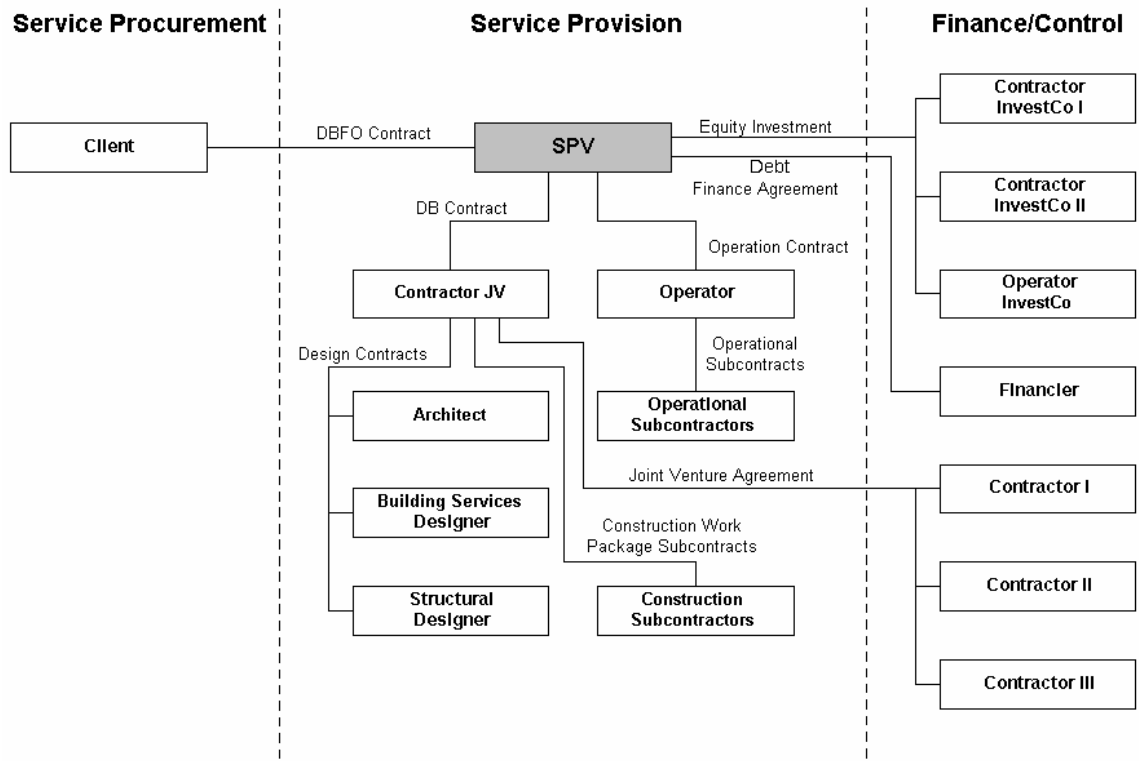

Figure 7.4. Organisational structure in the UCLH project post financial close.

7.6.3. Investment Company

In the KCL project, the contractor and the operator invested equity in the SPV and were therefore also the InvestCos. However, their equity investment was nominal. It gave the two actors control of the SPV but it was not used to finance the project. In addition, the SPV was not structured to make a profit and, thus, to pay dividends. As a result, the SPV did not have an incentive to minimise $CWLC_P$. Instead, the contractor and the operator were to make their respective profits in their contracts with the SPV. In other words, the SPV devolved the profit maximisation incentives and opportunities to the DB and operation contracts. This limited the incentives and opportunities the contractor and the operator had to implement $CWLC_P$ driven design solutions.

The nominal equity investment weakens the ProjectCo actors' incentive to ensure the operational and expenditure certainty in the project. This is because if the SPV runs into problems in the operational phase it is only faced with the termination of the contract and, thus, the loss of future revenues from the project, but not with the loss of significant equity investment. However, this problem does not present itself in the KCL project because the contractor and the operator have the same ParentCo. As a result, the contractor had an incentive not to compromise operational certainty in the project as it could compromise its ParentCo's profit through its operator subsidiary. However, it must be noted that the fact that the contractor and the operator were SisterCos did not create a $CWLC_P$ minimisation incentive for either of the actors because the two actors had individual profit targets to deliver to their ParentCo.

Recommendation 18
The ProjectCo must finance a proportion of a PFI project through dividend paying equity investment to guarantee a long-term interest in the economic efficiency of the project as a whole.

In the UCLH project the InvestCos invested significant equity in the SPV, which was used to finance the capital cost of the project. The equity investment gave the InvestCos an incentive to maximise completion, operational and expenditure certainty as their equity investments were at risk. They also had an incentive to minimise $CWLC_P$, as this would increase their return on equity (ROE). However, the InvestCos appeared to have target ROE rates to deliver to their ParentCos. Therefore, the InvestCos preferred to reduce the risks associated with their investment instead of increase the ROE on their investment. This had an adverse affect on the implementation on $CWLC_P$ driven design solutions.

7.6.4. Financier

KCL financed the design and construction of the project-facility. As a result, the SPV did not use project finance and a financier was not a ProjectCo actor. It must be noted that the ProjectCo actors did not implement any HV design solutions, which sought to increase the operational certainty of the project-facility. It is believed that this was partly because project finance was not used and, thus, the SPS did not have to pass a due diligence assessment. It must be noted that it is also partly because the InvestCos did not have a strong interest in operational certainty.

In the UCLH project, the SPV financed 90% of the project’s capital cost through project finance and the remainder through equity investment. The financier lent the project finance to the SPV at a thin margin. As a result, the financier was extremely averse to risk. It agreed to finance the project only if it felt that completion, operational and expenditure certainty of the project were acceptable and the loan repayment would not be at risk. As a result, the ProjectCo actors implemented a number of solutions that increased these certainties. Unfortunately, these solutions were not systematically identified as part of this research. However, the design of dual HV distribution is an example of a solution that will increase the operational certainty of the project-facility. Furthermore, the implementation of solutions 2, 3, 4, and 5 were driven more by desire to improve completion, operational and expenditure certainty than to minimise $CWLC_P$.

The ProjectCo appreciated that the financier was extremely averse to risk. It was aware that the SPV would be unable to secure the finance for the project unless its completion, operational and expenditure certainty were deemed acceptable in the due diligence assessment. As a result, the ProjectCo had an incentive to use established design solutions and avoid innovations. This was the case even if potential $CWLC_P$ driven design solutions that were expected to increase the SPV's profit from the project could be identified. This was because the financier would not receive a share of the profit that would result from their implementation. Thus, the financier did not have an incentive to allow their implementation. Consequently, the ProjectCo did not actively seek to minimise $CWLC_P$. This had an adverse effect on the implementation of $CWLC_P$ driven design solutions.

There appear to be at least three potential solutions to the problem that result from the financier's aversion to risk. The first one would be to increase the proportion of equity investment in financing the capital cost of the project. This would give the ProjectCo actors other than the financier a greater say on the details of the SPS. However, it is acknowledged that equity investment is likely to be more expensive than project finance. Therefore, the ProjectCo needs to consider whether the efficiency savings that result from the implementation of $CWLC_P$ driven design solutions would exceed the increased cost of financing the project.

The second potential solutions would be to require the financier to invest equity in the project. This would create a $CWLC_P$ minimisation incentive for the financier because part of its profit from the project would be ROE, which could be increased by implementing $CWLC_P$ driven design solutions. This could be an adequate solution to achieve a small shift from the emphasis from completion, operational and expenditure certainty improvement towards $CWLC_P$ minimisation. However, the problem with such an arrangement would be that the financier could have a disproportionate amount of influence in SPS development. It must be noted that it is believed that financiers hold equity in some PFI projects. However, it is not known whether this has resulted in the implementation of a larger number of $CWLC_P$ driven design solutions. Further research is therefore needed to establish how financier's equity investment affects $CWLC_P$ minimisation.

Recommendation 19
Further research should be undertaken to establish how financier's equity investment affects $CWLC_P$ minimisation.

The third solution would be for the client to finance directly the proportion of the capital cost of the project-facility currently provided by the financiers. The InvestCos should provide the remainder as equity investment. This would enable the client to capture the best of both worlds. First, the client would be likely to be able to obtain finance on more favourable terms than the ProjectCo. This is because the public sector borrows against its ability to raise taxes whereas the private sector borrows against the future revenues of a PFI project. Second, the equity investment in the SPV would guarantee the ProjectCo actors' long-term interest in the project. It would maintain an incentive not to compromise completion, operational and expenditure certainty as the equity investment would be at risk. It would also not affect the $CWLC_P$ minimisation incentive. The SPS would not be subject to a due diligence assessment. This would enable the ProjectCo to implement innovative $CWLC_P$ driven design solutions that would be rejected in the assessment. The InvestCos have more expertise in design, construction and operation than the financier. Therefore, if they are satisfied that a $CWLC_P$ driven design solution will not subject their equity investment to a disproportionate risk, the solution should be implemented. It is possible that for this solution to work the amount of equity investment would need to be a higher proportion of the project's capital cost than it is at the moment.

Recommendation 20
The public sector clients should pilot a model where the client finances the majority share of the project's capital cost directly with the ProjectCo financing the minority share through equity investment.

7.6.5. Contractor

In both projects, at financial close, the SPV and the contractor entered into a fixed-price DB contract. As a result, the contractor had an incentive to maximise its profit from the project through capital cost minimisation, subject to being able to complete a project-facility that met the construction specifications appended to the contract on time. The contractor did not have an incentive to minimise $CWLC_P$. In the UCLH project, however, specifications included minimum design lives for LCF components that the contractor had to comply with – see Section 7.6.10. This is because the BV had wanted to enforce Solution 2 on the contractor as it had anticipated that it might be tempted to engage in capital cost minimisation.

In both projects, the DB contract included a substantial liquidated damages clause. If the contractor could not complete the building on time it would incur liquidated damages. These would quickly offset any profits the contractors were to make from the projects. This gave a strong incentive to the contractors to improve completion certainty to ensure that the project-facilities would be commissioned on time. It is possible that this directed attention away from $CWLC_P$ minimisation.

In the KCL project, the contractor and the operator were SisterCos. Therefore, in theory, the contractor should have cooperated with the operator to maximise their combined profit from the project because such action would have maximised the profit to their ParentCo. However, in practice, both the contractor and the operator sought to maximise the profit from their respective contracts because both companies had individual profit targets to deliver to the ParentCo. The contractor had therefore only a weak incentive to implement $CWLC_P$ driven design solutions. However, the contractor did have an incentive to avoid causing problems for the operator in the contract period by compromising operational or expenditure certainty as by mutual agreement it would have to compensate the operator. The contractor did not increase operational or expenditure certainty of the project-facility beyond contemporary good practice. However, neither did it implement solutions that could have been seen as bad practice. This is the case even though some such solutions would have increased its profit from the project.

In the UCLH project, the contractors' SisterCos were equity investors in the SPV. Therefore, if the SPV were to incur UP deductions, the contractors' SisterCos and, consequently, its ParentCos would be faced with lower than expected revenues. As a result, the contractor had an incentive not to compromise the operational and expenditure certainty of operation. This led the contractor to implement solutions 2, 4 and 5.

7.6.6. Operator

In both projects, at financial close, the operator signed an operation contract with the SPV. This contract included the provision of a wide range of hard and soft operational services. There were two major differences in the operation contracts used in the two projects. First, in the KCL project, the responsibility for LCF management was included in the operation contract whereas in the UCLH project the responsibility was retained by the SPV – see Section 7.6.10. Second, in the UCLH project, the operation contract included an incentive to operate the project-facility energy efficiently – see Section 7.6.10.

In both projects, the operator will maximise its profit from the project through operational cost minimisation subject to successful service delivery. Therefore, it had an incentive to implement $CWLC_P$ driven design solutions that reduced operational cost. However, its opportunity to do so was limited because finance for such solutions was not readily available. The operator was to be paid only after the project-facility had become operational and, thus, did not have funds available to compensate the contractor. This had an adverse affect on $CWLC_P$ minimisation.

Recommendation 21
ProjectCo need to improve the access to finance for the implementation of $CWLC_P$ driven design solutions post financial close.

In both projects, the operator has an incentive to maximise the operational certainty of the project-facility. This is because, if the SPV were to incur UP deductions, the operator could become liable for those deductions. If the operational certainty were to be severely compromised, the operator's contract with the SPV could be terminated and it would, thus, lose any future revenue from the project. Furthermore, in the UCLH project, one of the InvestCos was the operator's SisterCo. Therefore, any UP deductions would also compromise the operator's ParentCo's expected revenues from the project through its InvestCo subsidiary. It is likely the operators' incentive to increase operational certainty had an adverse affect on $CWLC_P$ minimisation.

7.6.7. Designers

In the KCL project, the architect, the building services and structural designers worked for the BV until financial close. However, at financial close, the three designers were novated across to the contractor. In the UCLH project, the architect worked initially for the BV. Shortly before financial close, it was novated across to the contractor. The building services and structural designers worked for the contractor from the beginning of their involvement.

In both projects it was apparent pre and post financial close that the designers pursued the objectives of their clients in design development. For example, in the UCLH project, the designers sought to ensure that the design lives of the LCF components would be met with the minimum capital cost – see Section 7.6.10. The designers' incentives and opportunities to minimise the $CWLC_P$ were largely those of the BV or the contractor, depending on the stage of the project. Therefore, it must be concluded that the future development of PFI must focus on improving the incentives and the opportunities of the BV and the contractor to implement $CWLC_P$ driven design solutions.

7.6.8. Alternative Organisational Structure

The ProjectCo needs to adopt a new type of organisational structure in the PFI development process. This is because the problems with the incentives and the opportunities to implement $CWLC_P$ driven design solutions that existed in the KCL and the UCLH projects appear to be solvable using an alternative organisational structure. This alternative structure is illustrated in Figure 7.5.

In the alternative structure, at financial close, the SPV would place only one DBO subcontract to a project management joint venture (PMJV). The PMJV would be a JV between the contactor InvestCo and the operator InvestCo. The PMJV would be designed not to make profit. Instead, it would only invoice the SPV for its costs in undertaking the project.

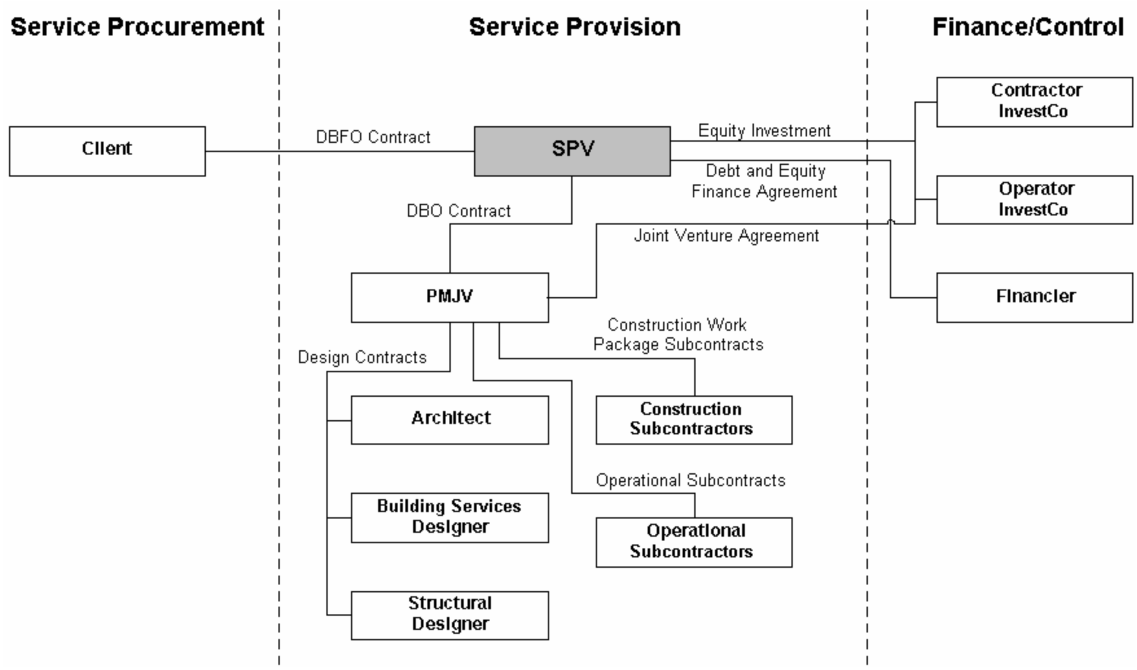

Figure 7.5. Alternative organisational structure for accommodations service PFI projects.

The PMJV would have labour supply agreements with the InvestCos. The PMJV would obtain the resources for design management, construction management and FM through these agreements at a pre-specified unit rate. This would require a change in the industry. At the moment, the InvestCos are specialised in bidding for and investing equity in PFI projects. They would need, therefore, to develop expertise in managing the implementation of PFI projects. At the moment, the contractor and the operator are responsible for managing the execution of the projects. These two actors are the SisterCos of the InvestCos. Therefore, the InvestCos would be able to obtain these resources through intra group restructuring.

The PMJV would retain the responsibility for design management, construction management and FM in-house. It would procure the design solutions by placing the appropriate design contracts. It would execute construction by placing a number of work package subcontracts. Subsequently, it would operate the project-facility by placing a number of service provision contractors. This type of arrangement would give the PMJV the ability to control all aspects of the SPS from the initial stages of its development. Therefore, it would have the opportunity and the authority to implement $CWLC_P$ driven design solutions.

The PMJV would not make any profit. Therefore, the PMJV would not give the two InvestCos any profit. Instead, the InvestCos would receive their profit as dividend payments from the SPV. These dividends would equal the SPV's profit. This profit would be the difference of the UP stream, i.e. $CWLB_P$ and the payment for the PMJV for designing, building and operating the project-facility plus the cost of finance repayment, i.e. $CWLC_P$. The InvestCos could only increase their profit from the project by reducing the amount that the SPV pays to the PMJV. As the two InvestCos would manage the SPS development and project execution they would have an incentive to implement $CWLC_P$ driven design solutions.

It must be noted that the use of such an alternative organisational structure would remove the incentives to minimise the capital cost and the operational cost independently of each other. However, it must be noted that work package and operational subcontractors would still have an incentive to minimise the cost of executing the tasks included in their respective subcontracts. The PMJV would specify these subcontracts and manage their execution. Therefore, the subcontractors would have very limited opportunities to deviate from the $CWLC_P$ driven design solutions specified to be implemented. In addition, the use of the alternative organisational structure would not change the SPV's incentives to achieve completion, operational and expenditure certainty in SPS development.

It must be noted that in order to enable the SPV to finance a PFI project using this type of structure, the contractor InvestCo or its ParentCo would need to give the financier guarantees of completion of the project-facility for a fixed cost. The contractor or its ParentCo gives a similar guarantee in all PFI projects. This should not therefore be a problem. Thus, if there were a significant problem in the execution of the project, the SPV would have to revert back to using DB and operation contracts. It is acknowledged that the proposed alternative organisational structure has not been subjected to a due diligence assessment and it is conceivable that issues that need to be resolved might arise in the course of such an assessment.

Recommendation 22
The ProjectCo should pilot an alternative organisational structure in accommodations service PFI projects.

7.6.9. Energy

KCL retained the full energy risk – see Section 7.5.4. As a result, ProjectCo had an incentive to exclude all energy saving design solutions from the SPS because the implementation of such solutions would have increased the capital cost of the project, but not yielded any additional revenue for ProjectCo.

In the UCLH project, the client and the SPV shared the consumption energy risk. The SPV is responsible for energy consumption in excess to an energy standard if it arises from design, construction or operation. It passed on the risk of meeting the energy standard to the contractor and the operator. First, the SPV gave the contractor the responsibility to ensure that the building was designed and built to meet the energy standard. If the outturn energy consumption proves to be above the standard due to design and construction, the contractor will be liable for the cost of additional energy consumption and possibly the cost of rectifying the situation. Therefore, the contractor had an incentive to ensure that energy consumption would not exceed the standard. Second, the SPV allocated the operator the responsibility to ensure that the facility was operated to the energy standard. If the outturn energy consumption exceeds the energy standard due to servicing of the building, the operator would be liable for the additional costs. As a result, the operator had an incentive to ensure that its service provision would not cause the energy consumption in the building to exceed the standard.

In addition, the SPV passed an additional payment incentive for below standard energy consumption (see Section 7.5.4) to the operation contract. As a result, the contractor did not have an incentive to implement energy saving design solutions. The operator did have an incentive to implement such solutions, however, it had only very limited opportunities to do so. This was because the contractor controlled the detail design development. This had an adverse effect on the implementation of energy saving design solutions.

Recommendation 23
The ProjectCo should ensure that the actors that have an incentive to implement energy saving design solutions also have an opportunity to do so.

7.6.10. Life Cycle Fund

The LCF is used for the *major* maintenance and replacement of building components that are going to require significant expenditure over the contract period. In the KCL project, the operator is responsible for managing the LCF. The operator has an incentive to manage the LCF components as cost efficiently as possible because it is entitled to any surplus in the LCF at the end of the contract period. However, because the SPV used separate DB and operation contracts, the operator did not have an opportunity to select the initial set of LCF components in design development. This limited the operator's opportunity to implement $CWLC_P$ driven design solutions.

In the UCLH project, the SPV is responsible for managing the LCF. The SPV had an incentive and an opportunity to minimise $CWLC_P$ of LCF components. The SPV has the incentive to do so because it is entitled to any surplus in the LCF at the end of the contract period. It also has the opportunity because it is the client of the contractor and the operator and can, therefore, instruct them to change their respective solutions. This enabled the implementation of $CWLC_P$ driven and reducing design solutions. It led the SPV to implement Solution 2. However, it must be noted that the implementation of the solution was driven more by expenditure certainty maximisation than $CWLC_P$ minimisation.

In the light of the knowledge gained in the course of this research it is believed that the LCF management practices used in the KCL and the UCLH projects are equally common in accommodation service PFI projects.

Recommendation 24
An actor that has the ability and the authority to resolve conflicts between capital and operational expenditure should retain the responsibility for LCF management.

The existence of reserved funds for major maintenance and replacement of LCF components is likely to benefit the clients of PFI projects. This is because in traditional accommodation service provision the expenditure on major maintenance and replacement is largely influenced by the constraints on the client's operating budget. Often the client cannot afford the optimal maintenance of its facilities. Therefore, its condition deteriorates and the client's accommodation is compromised. This is less likely to happen in accommodations service PFI projects due to existence of the LCF. However, the first accommodation service PFI projects are only a few years into their operational periods. This cannot therefore be verified *ex post*.

7.7. ProjectCo's Decision-making

7.7.1. Availability of Whole Life Cost Information

At the time that KCL and UCLH procured their respective projects, the public availability of whole life cost (WLC) data was limited. In both projects, the ProjectCos used their contacts in the construction and FM industries and beyond in an attempt to obtain good quality data. However, the vast majority of the data that they managed to obtain was of low quality. This occurred because:

- The data was inconsistent. It had been formatted using a number of different classification systems. This made its interpretation laborious.
- The methods that had been used to collect the data were not known. Therefore, it could not be confirmed that the data was accurate and reliable.
- The data was non-specific. It related mostly to component types rather than specific components. As a result, it could not be used to decide between two components of the same type.
- The data related to conventionally procured buildings. It was not known how the performance of the components would change, if they were to be part of a PFI project-facility.
- The data corresponded to old components. The rapid technological development of the equipment used, especially in HV, made it extremely unlikely that the same components would be used in the project-facilities.

In conclusion, the publicly available WLC data was not very useful and had considerable uncertainties associated with it.

In the KCL project, the operator provided the vast majority of the WLC data that was used. However, due to KCL's affordability constraint, $CWLC_P$ minimisation was of low priority. In the UCLH project, the project actors obtained WLC data in two ways. Pre financial close, they elicited WLC data from the experience and the expertise of the individuals involved in SPS development. Post financial close, the contractor used a maintenance viability questionnaire to extract WLC data from potential suppliers and subcontractors. The contractor wanted to ensure that the building components to be used in the project-facility would give their expected performance in the operational phase.

Recommendation 25
Both clients and ProjectCos need to rectify the absence of quality WLC information by systematic data collection.

The quantity and quality of WLC data available needs to be improved. More reliable data will encourage the ProjectCos to implement further $CWLC_P$ driven solutions as the uncertainty of the realised expenditure is reduced. This uncertainty was perceived to have a major influence on making design decisions. The public sector needs to engage in active and systematic WLC data collection form all PFI projects. This data should be made publicly available: it is in the public sector's interest that the ProjectCos develop their SPS based on reliable data.

Recommendation 26
The public sector clients should make WLC data publicly available.

The ProjectCos also need to engage in active WLC information collection. However, it is unlikely that the ProjectCo actors will be prepared to share their data, as it is a source of competitive advantage. Nevertheless, the ProjectCo actors should share their data with the actors they typically collaborate with in PFI projects. This process will enable the quality of the data to improve. In addition to soft FM service providers and maintenance contractors, the ProjectCo actors should actively seek to involve material suppliers in the process of data collection.

Recommendation 27
The ProjectCo actors need to actively share WLC information with the actors they work with on accommodation service PFI projects.

It can also be observed that as the PFI market has matured, cost consultants have expanded their service provision into provision on WLC estimates. In addition, the ProjectCo actors have begun to share data among themselves. An example of this type of arrangement is the Whole Life Cost Forum (WLCF), which is an exclusive Building

Research Establishment run members-only club (WLCF, 2004). It is likely that this type of development will enable further $CWLC_P$ minimisation. However, it must be noted that the services of cost consultants and data sharing clubs are still believed to suffer from limited availability of WLC data.

In addition, it must noted that more sophisticated whole life costing techniques have emerged, such as those introduced by Boussabaine and Kirkham (2003), which account for the uncertainties in the WLC information.

7.7.2. Estimation Procedure

In the KCL project, the ProjectCo did not use an integrated $CWLC_P$ estimation procedure. Instead, the contractor and the operator priced the DB and operation contracts independently. The contractor and the operator did not share their detailed pricing with the other ProjectCo actors. The operator especially felt that the data it used was a source of its competitive advantage in the market. This had an adverse affect on $CWLC_P$ minimisation as the contractor and the designers did not know how changes in the design and construction solutions would affect operational cost. However, it must be noted that post commissioning, the operator has carried out sophisticated modelling on the LCF. Nevertheless, this modelling seeks to ensure that the project-facility is operated as efficiently as possible.

In the UCLH project, the ProjectCo did not use WLC information to govern the development of SPS from inception. Instead, they developed the concept design in line with the principles of traditional procurement. Once the design was sufficiently advanced, $CWLC_P$ of the SPS was quantified. Subsequently, $CWLC_P$ minimisation began, however within the already existing design constraints. A cost consultant was involved in the process to develop a formal $CWLC_P$ model.

Recommendation 28
The ProjectCo must use $CWLC_P$ estimates to guide SPS development.

In the course of this research, it became apparent that the ProjectCo actors had given a greater emphasis to $CWLC_P$ minimisation in other areas of building design than in HV. It is thought that this is because some other aspects of building design require less interdependent decision-making than HV design. The change of type of floor finishing has little or no effect on other aspects of building design. On the one hand, the $CWLC_P$ of floor finishing is a function of its capital and operational cost, which largely consists of cleaning and replacement. On the other hand, the change in the capacity of an air-handling unit can affect anything from the glazing ratio to size of the distribution ductwork. These all have $CWLC_P$ implications. Unfortunately, $CWLC_P$ driven and reducing design solutions were only systematically identified within the HV solution.

The small number of $CWLC_P$ reducing design solutions implemented in the case study projects can be partially explained by bounded rationality. The consequences of a change in a HV design solution and the interrelated aspects of design on the SPS and subsequently on the $CWLC_P$ are too complex for the human mind to compute. This is the case even if the decision maker is aided by information technology. This leads into a satisficing, as opposed to an optimising, search for $CWLC_P$ driven design solutions within the HV solution. Because of this particular issue, it is felt that the focus on HV design solution gave a pessimistic account of the impact that PFI has had on the cost of accommodation service provision. However, it must also be emphasised that HV is an area that holds significant potential for reductions in $CWLC_P$ in accommodation service PFI projects.

A potential solution to this problem would be to have an additional stream of design development. The objective of this stream should be to ensure that the SPS has the minimum $CWLC_P$ subject to the solution not compromising completion, operational and expenditure certainty. All the ProjectCo actors would have to approve the SPS as meeting this objective. It is likely that if such a systematic approach were taken in the future, more $CWLC_P$ driven design solutions would be implemented.

Recommendation 29
The SPS development should have a stream of design development to ensure that $CWLC_P$ of the project has been minimised subject to not compromising completion, operational and expenditure certainty.

7.8. Concluding Remarks

The two case study projects were found not to have any $CWLC_P$ driven design solutions and only a small number of $CWLC_P$ reducing design solutions in the project-facilities. The PFI market is still developing and so the theoretical principles of the procurement method do not yet fully function in practice. A number of problems were identified. The clients and the ProjectCos must experiment with solutions to these problems, which should be researched real-time in order to enable them to be rectified. However, the most significant reason for the lack of evidence of $CWLC_P$ minimisation is believed to be the way that the ProjectCo actors organise themselves in PFI development. The prevailing organisational structure of the ProjectCo limits its opportunities and weakens its incentives to implement $CWLC_P$ driven design solutions.

Chapter 8 - Conclusions and Recommendations

8.1. Introduction

This chapter draws conclusions from the research as a whole and makes recommendations based on those conclusions. First, it provides an overview of how the research aim and objectives were pursued. Second, the chapter presents the main research findings. Third, it makes recommendations on how the public sector client and the ProjectCo might better maximise value for money (VFM) and economic rent respectively in accommodation service PFI projects subject to their respective constraints. The recommendations also clarify the future research agenda on PFI. Fourth, the chapter highlights the contribution to knowledge that this research makes.

8.2. Research Overview

The fundamental aim of the client in an accommodations service PFI project is to procure a service that is the maximum VFM subject to affordability. The ProjectCo's aim is to maximise its economic rent from undertaking the project subject to successful service delivery. The client needs to make the ProjectCo pursue its aim. The client has successfully aligned the ProjectCo's aim with its own if contract whole life cost ($CWLC_P$) minimisation has become the ProjectCo's objective. In order for the client to make the ProjectCo pursue its aim with increasing effectiveness, the behaviour of the ProjectCo in relation to $CWLC_P$ in PFI development and the underlying rationale of that behaviour need to be understood. This need defined the aim for this research.

The **aim** of this research was **to generate a detailed understanding of how the economic efficiency of an accommodation service PFI project is determined in its development process through $CWLC_P$ minimisation**. The aim was pursued by qualitative case study research on two projects. First, qualitative research was chosen, as it was perceived that the existing knowledge on PFI at research commencement could not be significantly advanced with quantitative research. Second, case study research was seen to be particularly suitable as it is at its best in answering *how* and *why* questions. Third, a dual case study design was opted for, as the in-depth analysis of a previously relatively unexplored area of research was likely to produce revelatory findings. The use of two case studies, as opposed to just one, was felt to enable the possibility of misinterpretation of research findings to be reduced. The two projects studied were King's College London (KCL) Site Rationalisation and University College London Hospitals NHS Trust (UCLH) Gower Street Redevelopment. The data collected was ProjectCo actor interviews, public and private sector issued documentation and expert assessments.

The research aim was broken down into three research objectives. The **first objective** was **to highlight the $CWLC_P$ driven design solutions implemented**. These solutions are the departures that the ProjectCo has made in the heating and ventilation (HV) design solution of the project-facility from the design solution that would have been implemented if the project had been traditionally procured. Thus, $CWLC_P$ driven design solutions were used as an indirect measure of $CWLC_P$ performance. HV design was used as the specific focus because it has a significant impact on $CWLC_P$, especially if the cost of energy consumption is included in $CWLC_P$. It was anticipated that the findings relating to HV design could be generalised to be representative of all aspects of building design. The first objective was pursued by *solution analysis* of the HV design solutions of the case study project-facilities. The analysis used the data from interviews, public and private sector issued documentation and expert assessments.

The **second objective** was **to establish how PFI development is different from the development of traditionally procured projects**. The second objective was pursued by the first stage of the *opportunity analysis*. The analysis used a simplified version of a process protocol maps as a tool to describe the PFI development processes. In addition, it used actor-role matrixes as tools to describe the development processes in greater detail and to develop hypothetical traditional development processes alongside it. The process differences were identified from the actor-role matrixes. The analysis used interviews and public sector issued documentation as source data.

The **third objective** was **to identify the forces in the PFI development process that either encouraged or discouraged the implementation of $CWLC_P$ driven design solutions**. In other words, the third objective was to establish how the development process differences related to the design outcome differences. The third objective was pursued by incentive analysis, the second stage of the opportunity analysis and perception analysis.

The *incentive analysis* identified the ProjectCo actors' incentives to minimise $CWLC_P$ and the other incentives affecting that incentive. The analysis used organisational diagrams of the relationships of the key project actors as tools to reveal some of the incentives. The incentive analysis used interviews and public sector issued documentation as source data.

The second stage of the *opportunity analysis* highlighted the ProjectCo actors' opportunities to implement $CWLC_P$ driven design solutions and the constraints on those opportunities. The second stage of the analysis was based on the process protocol maps and actors-role matrixes compiled in the first stage of the analysis.

The *perception analysis* used storyline maps as tools to establish what in the individual ProjectCo actors' perceptions either encouraged or discouraged the implementation of $CWLC_P$ driven design solutions. The perception analysis was based on the interview data.

The attainment of the three research objectives enabled conclusions to be drawn on how the $CWLC_P$ was determined in the PFI development process, which was the overall aim of this research.

8.3. Research Findings

The research findings have limitations that arise from the chosen research methodology. The findings relate only to two accommodation service PFI projects. Therefore, they are merely hypotheses that need to be confirmed or rejected as representative of all accommodation service PFI projects using quantitative research. It must be noted that the KCL project is a design, build and operate (DBO) and the ULCH project a design, build, finance and operate (DBFO) project. Thus, the KCL project is not an example of a typical accommodation service PFI project. As a result, the findings relating to the UCLH project are felt to be more representative of all accommodation service PFI projects.

The presentation of the research findings is broken down into five sections. Section 8.3.1 discusses $CWLC_P$ performance of the case study projects. Sections 8.3.2 to 8.3.5 discuss the forces in PFI development that were found to affect the implementation of $CWLC_P$ driven design solutions under four themes that derive from the research sub-questions presented in Section 4.6.2.

8.3.1. Findings Related to Economic Efficiency

Not a single $CWLC_P$ driven design solution was identified in the HV design solutions of the case study project-facilities. However, a number of $CWLC_P$ reducing design solutions were identified in the UCLH project-facility. These are design solutions that will reduce $CWLC_P$, but were not implemented solely in the pursuit of $CWLC_P$ savings. This would suggest that the resulting VFM and economic rent improvements for the client and the ProjectCo respectively in accommodation service PFI projects are marginal.

Nevertheless, based on the observations made in the course of the research, it must be emphasised that PFI has delivered other benefits. Unfortunately, evidence of these benefits was not collected systematically as such collection was not directly in line with the pursuit of the research aim. First, the completion certainty of the HV solutions has improved, for example, as a result of increased use of pre-assembly. Second, the operational certainty of the HV solutions has increased, for instance, as a result of having additional back up facilities.

It was also observed that more $CWLC_P$ driven design solutions had been implemented in other areas of building design, such as floor finishes, than in HV design. However, these solutions were clearly identifiable only in areas where a single actor was responsible for making the relevant decisions. It would therefore appear that PFI has not resulted in $CWLC_P$ minimisation in areas that require inter-dependent decision-making such as HV design where the potential impacts of the implementation of $CWLC_P$ driven design solutions on other aspects of the SPS are considerable.

8.3.2. Findings Related to External Environment

The KCL and UCLH projects were two of the very first accommodation service projects to enter the PFI market. Thus, both the clients and the ProjectCos lacked experience of PFI procurement and development respectively. This directed attention away from $CWLC_P$ minimisation.

KCL and UCLH used output specifications (OSs) to procure the PFI projects. This gave the ProjectCos an opportunity to select the appropriate design solutions to produce the required outputs. However, the opportunity to implement $CWLC_P$ driven design solutions was considerably restricted by the existing guidance documentation that governs the design of buildings used in the provision of public services. The documentation has been developed for traditional procurement. As a result, some of it is unsuitable to govern design development in PFI projects. This is because new types of design solutions are likely to emerge as a consequence of the clients' use of new types of mechanisms to govern procurement.

At the time the case study projects were procured, the PFI market was immature and flooded with projects. As a result, the intensity of the procurement competitions was insufficient to generate a strong incentive for the ProjectCos to implement $CWLC_P$ driven design solutions.

The PFI procurement competitions were based on the discounted present cost of the accommodation service provision to the client ($CWLC_C$). As a result, the ProjectCos had an incentive to minimise $CWLC_P$. However, due to the lack of competition, the clients used affordability and VFM assessments to reintroduce competitive pressure to the procurement processes. The clients chose not to assess only the annual UP and $CWLC_C$ in the two assessments respectively. Instead, they paid attention in varying degrees to the capital costs of the projects. This made difficult the implementation of $CWLC_P$ driven design solutions that would have increased the capital costs of the projects.

The case study projects were subject to considerable delays in reaching financial close. The delays gave the ProjectCo additional time and, thus, an opportunity to explore potential $CWLC_P$ driven design solutions. However, the prolonged period of uncertainty also made the ProjectCos cautious of increasing their exposure to a failure to reach contract award. This resulted in some loss of enthusiasm to innovate.

In both case study projects, the clients and the ProjectCos entered into long-term relationships, which have enforced a sense of partnership between them. This has enabled problematic issues to be resolved and mutually beneficial solutions to be agreed with relative ease between the actors.

8.3.3. Findings Related to Project Agreement

The UP for the accommodation service provision in both case study projects is performance related. The deductions for failures to meet the agreed performance standards can be severe. In addition, the DBO contract in the KCL project had a termination clause linked to operational service performance. As a result, the ProjectCos had an incentive to improve the operational certainty of the projects. This incentive was stronger than the incentive to minimise $CWLC_P$ and, thus, it shifted emphasis away from the implementation of $CWLC_P$ driven design solutions. The magnitude of potential UP deductions is different in different parts of the project-facilities. As a result, the strength of the ProjectCos' incentive to improve operational certainty varies accordingly. However, this did not influence the implementation of $CWLC_P$ driven design solutions.

In both projects, the clients would only commence the UP once the ProjectCos had completed the project-facilities. The DBO contract in the KCL project also had a liquidated damages clause. Consequently, the ProjectCos had an incentive to improve the completion certainty of the project-facilities. This incentive drew the ProjectCos' attention away from $CWLC_P$ minimisation.

The risk allocation in the case study projects between the public and the private sectors appears to be one that is likely to yield the maximum VFM for the client with one exception. The exception is the allocation of energy risk. In the KCL project, the client retained the energy consumption risk in full. This resulted in the removal of the energy saving design solutions from the project-facility. In the UCLH project, the client used a strong incentive not to cause the energy consumption to exceed a pre-specified standard and a weak incentive to reduce the energy consumption below the standard. The strong incentive not to cause excess consumption resulted in energy saving design solutions, but the weak incentive to reduce consumption did not.

KCL and UCLH require the ProjectCos' soft operational service provision to be potentially market tested in the operational phase. As a result, the ProjectCos' $CWLC_P$

minimisation incentives were weakened. This is because the ProjectCos may lose the operational cost savings generated through the implementation of $CWLC_P$ driven design solutions after the first round of market testing.

8.3.4. Findings Related to ProjectCo Organisation

Initially, in both case study projects, the ProjectCos had the opportunity and the incentive to implement $CWLC_P$ driven design solutions. However, as the development of the projects progressed, the opportunities became constraint and the incentives weakened. This was a result of the way that the ProjectCo actors organised themselves.

In the UCLH project, the contractor and operator were part of the ProjectCo from inception. Thus, the ProjectCo had an opportunity benefit from their experience and expertise in $CWLC_P$ minimisation. However, in the KCL project, the contractor and the operator only became ProjectCo actors briefly prior to financial close. This prevented the ProjectCo from benefiting from their experience and expertise on $CWLC_P$ driven design solutions in the early stages of SPS development.

In both projects, the SPV implemented the project by placing separate DB and operation contracts at financial close with the contractor and the operator respectively. This changed the ProjectCo actors' opportunities and incentives. The contractor and the operator gained separate capital and operational cost minimisation incentives. In addition, the use of two separate contracts significantly limited the ProjectCo actors' opportunities to implement $CWLC_P$ driven design solutions. This was because the vast majority of potential $CWLC_P$ driven design solutions would have required the contractual terms to be negotiated.

The clients' use of DB and operation contracts did not only affect the opportunities and the incentives after the contracts were awarded, but also pre financial close as the ProjectCo actors began to prepare themselves for the type of contractual framework that was going to be used in the projects. The contractors became more powerful in SPS development than the operators. This was because they were to take the responsibility for design and construction and, thus, the authority to take decisions in design development. This had an adverse effect on the implementation of $CWLC_P$ driven design solutions as the contractors' capital cost minimisation incentive was stronger than their $CWLC_P$ minimisation incentive.

The ProjectCos also had incentives to improve completion, operational and expenditure certainty of the projects. These incentives were stronger than the $CWLC_P$ minimisation incentive. In the KCL project, the incentive arose from the performance related payment and the liquidated damages and termination clauses. In the UCLH project, they arose from the performance related payment, but were amplified by the use of project finance. The financier was only willing to finance the project if it felt that the completion, operational and expenditure certainly of the projects were at a level that made it extremely unlikely that the SPV would face difficulties in meeting its dept repayment obligations. In addition, the financier had an incentive to discourage the implementation of $CWLC_P$ driven design solutions. This is because it would not be entitled to a share of the resulting economic rent increase but would be exposed to the resulting increase in project risks.

In addition, in the KCL project the ProjectCo actors' incentive to minimise $CWLC_P$ was weakened by the fact the actors did not invest divided paying equity in the project. Thus, they would not be able to benefit from the economic rent arising from the implementation of $CWLC_P$ driven design solutions.

8.3.5. Findings Related to ProjectCo's Decision-making

The WLC data available in the PFI industry is extremely limited and the data available is of low quality. As a result, the ProjectCos cannot use reliable $CWLC_P$ estimates as the basis for their decision-making in SPS development. The uncertainty associated with the outturn cost implications and, thus, the perceived risk of implementing $CWLC_P$ driven design solutions prevents the ProjectCos actively from pursuing $CWLC_P$ minimisation.

In the UCLH project, the ProjectCos developed mechanisms to cope with the lack and poor quality of WLC data. These include WLC workshops where ProjectCo actors debate the reliability of the WLC data. The ProjectCo substituted some of the data with information extracted from the experience and expertise of individuals involved. After financial close, the ProjectCo obtained WLC information from subcontractors and suppliers. This enabled the ProjectCo to remove some of the uncertainty surrounding the implementation of $CWLC_P$ driven design solution and, thus, to create an environment where $CWLC_P$ reductions could be secured.

8.4. Recommendations

The recommendations made in this section relate specifically to accommodation service PFI projects. It must be noted that the recommendations are made based on research findings, which are, due to the nature of the chosen research methodology, hypothesis at their current state. The research findings need to be confirmed or rejected by means of quantitative research as representative of all accommodation service PFI projects Therefore, caution needs to be exercised in implementing the recommendations.

1. The departmental PFI units should recruit individuals that have gained experience and expertise in procuring projects for clients within the department. These individuals would be able to advise a client procuring a PFI project within the department and, thus, enable the client to avoid having to dedicate a considerable amount of resources to learning how PFI procurement works in theory and in practice. This would enable the ProjectCo to work with the client more effectively and, as a result, to dedicate more effort into the pursuit of $CWLC_P$ minimisation.

2. The ProjectCo actors should actively share their PFI experience and expertise with the actors they typically work with in pursuing and undertaking PFI projects. As a result, best practice SPS development would become established faster and the ProjectCo could allocate more of its resources to exploring potential $CWLC_P$ driven design solutions. It must be noted that as a result the understanding of $CWLC_P$ driven design solutions would also improve.

3. The relevant public sector bodies should update the guidance documents and standards governing design development in accommodation service PFI projects. This would enable the ProjectCo to implement $CWLC_P$ driven design solutions that emerge as a result of the governance mechanisms that the client uses in PFI procurement and that are not permitted by the existing guidance.

4. The ProjectCo actors should actively challenge the existing design guidance if it is found to be in conflict with the implementation of $CWLC_P$ driven design solutions. This would accelerate the change in the guidance documentation and allow for further $CWLC_P$ driven design solutions to be implemented.

5. The client should always nominate the PB as a result of a genuine competition to ensure that it procures the best VFM accommodation service PFI project available in the market. Increased competition would strengthen the ProjectCo's $CWLC_P$ minimisation incentive and, consequently, lead to improved VFM accommodation service PFI projects.

6. The client should focus only on the UP in assessing whether an accommodation service PFI project is affordable. This is because the focus on capital cost weakens the ProjectCo's incentive to implement $CWLC_P$ driven design solutions and, thus, reduces the ability of PFI procurement to deliver improved VFM projects.

7. The client should not intervene with the SPS for reasons of affordability as long as it meets the OS. If the client introduces additional technical constraints on the SPS on grounds of affordability, it limits the ProjectCo's ability to implement $CWLC_P$ driven design solutions.

8. The client should focus on the $CWLC_C$ in assessing the VFM of an accommodation service PFI project. The client should not pay any attention to the capital cost of the project-facility. This is because such focus weakens the ProjectCo's incentive to pursue $CWLC_P$ savings.

9. The client should proactively seek to identify and eliminate the uncertainties surrounding the PFI procurement process. This would enable the ProjectCo to commit to exploring $CWLC_P$ driven design solutions without having to be concerned about not reaching financial close for reasons beyond its control.

10. The client should allow the ProjectCo actors adequate time to develop their SPS. This is because the ProjectCo is likely to revert to traditional design solutions under time constraints.

11. The client and the ProjectCo should consider their relationship as a key asset of the project and manage it accordingly. This is because a partnership enables the two parties to agree the implementation of mutually beneficial solutions, including $CWLC_P$ driven design solutions.

12. Further research must be undertaken to establish how different types of payment mechanisms affect the design solutions of accommodation service PFI project-facilities. Performance related payment appears to have generated an incentive for the ProjectCo to improve the operational certainty of the project-facility as a whole as opposed to specific parts of it. This might not result in the maximum VFM for the client.

13. Further research should be undertaken to establish the appropriate level of incentives in relation to energy consumption that will result in the minimum expenditure on energy and energy saving design solutions. At the moment, the most effective incentive structures in relation to energy consumption in accommodation service PFI projects are not known.

14. The ProjectCo should approach energy consumption management as a genuine business opportunity. It is felt that the client could achieve energy savings and the ProjectCo economic rents if more resources were allocated to exploring energy saving design solutions and to managing energy consumption.

15. The client should abandon the market testing of soft operational service provision components for more frequent benchmarking or, alternatively, it should agree to re-price the components at service commencement and allow the ProjectCo to keep the resulting surplus. This would remove the ProjectCo's disincentive to implement $CWLC_P$ driven design solutions that result in soft operational cost savings.

16. The contractor and the operator should be involved in SPS development from inception. This would enable the ProjectCo to take advantage of their experience and expertise on $CWLC_P$ driven design solutions from the beginning of project development.

17. The operator should seek to take a more proactive approach in SPS development, which the other ProjectCo actors should embrace. This is because of all the ProjectCo actors, the operator is likely to possess the most experience and expertise on the type of solutions that will lead to $CWLC_P$ savings.

18. The ProjectCo must finance a proportion of a PFI project through dividend paying equity investment to guarantee a long-term interest in the economic efficiency of the project as a whole. The equity investment strengthens the ProjectCo's $CWLC_P$ minimisation incentive by enabling it to access the resulting economic rent.

19. Further research should be undertaken to establish how the financier's equity investment affects $CWLC_P$ minimisation. In theory, such equity incentive should strengthen the ProjectCo's incentive to implement $CWLC_P$ driven design solutions. However, it is not known whether this is true in practice.

20. The public sector clients should pilot a model where the client finances the majority share of the project's capital cost directly, with the ProjectCo financing the minority share through equity investment. The financier's aversion to risk prevents the implementation of $CWLC_P$ driven design solutions. Therefore, it should be established whether the removal of this aversion improves the VFM of PFI projects.

21. ProjectCo needs to improve the access to finance for the implementation of $CWLC_P$ driven design solutions post financial close. As the SPV places the DB and operation contracts, the implementation of operation-led $CWLC_P$ driven design solutions becomes extremely problematic, unless finance for the increased capital cost is readily available.

22. The ProjectCo should pilot an alternative organisational structure in accommodation service PFI projects. An organisational structure exists that appears, based on *a priori* reasoning, to remove the ProjectCo's incentives to minimise capital and operational costs in isolation and to improve the opportunities to implement $CWLC_P$ driven design solutions.

23. The ProjectCo should ensure that the actors that have an incentive to implement energy saving design solutions also have an opportunity to do so. The SPV's use of DB and operation contracts to undertake the project can separate incentives from opportunities.

24. An actor that has the ability and the authority to resolve conflicts between capital and operational expenditure should retain the responsibility for LCF management. If the LCF management is included in the SPV's operational contract, the authority to determine the initial LCF component selection becomes removed from the incentive for its efficient management.

25. Both clients and ProjectCos need to rectify the absence of quality WLC information by systematic data collection. The existence of good quality WLC information would reduce the perceived risk in the implementation of $CWLC_P$ driven design solutions, enabling further $CWLC_P$ savings to be achieved.

26. The public sector clients should make WLC data publicly available. This would accelerate improvements in the quality of WLC data. This is because the available data would be subject to considerable debate on its accuracy.

27. The ProjectCo actors need to actively share WLC information with the actors they work with on accommodation service PFI projects. This is because concealing WLC information has a detrimental effect on the $CWLC_P$ performance of the project and, thus, on the performance of the actors withholding the data.

28. The private sector actors must use $CWLC_P$ estimates to guide SPS development. This will enable the ProjectCo to remove some of the perceived risk in implementing $CWLC_P$ driven design solutions and, consequently, achieve further $CWLC_P$ reductions.

29. The SPS development should have a stream of design development to ensure that $CWLC_P$ of the project has been minimised subject to not compromising completion, operational and expenditure certainty. A systematic approach to exploring $CWLC_P$ driven design solutions would enable a greater number of such solutions to be implemented.

8.5. Contribution to Knowledge

This research is the first time that the behaviour of the ProjectCo actors in the development of accommodation service PFI projects has been analysed at this level of detail. Thus, the descriptive case studies are significant contributions to knowledge in their own right. In addition, this research contributed to existing knowledge by:

- strengthening the theoretical understanding of procurement and development of accommodation service PFI projects by analysing the processes using economic theories,
- developing a novel research methodology enabling a rigorous examination of accommodation service PFI projects,

- providing evidence on whether PFI projects had delivered both VFM for the client and profit for the ProjectCo via improvements in economic efficiency achieved through implementation of $CWLC_P$ driven design solutions,
- identifying the forces in the PFI development process that either encourage or discourage the implementation of $CWLC_P$ driven design solutions,
- developing potential solutions to the problematic issues identified in the procurement and development of accommodation service PFI projects, and
- clarifying the future research agenda on PFI.

This research yielded a number of unexpected findings. Economic theory suggests that the provision of PFI accommodation services should be considerably more economically efficient than the provision of traditionally procured services. However, this research found very little evidence of such efficiency. Moreover, it identified features of the procurement and the development of accommodation service PFI projects that violated the principles of the economic theories governing the processes. These features explain the lack of evidence of improved economic efficiency.

The procurement and the development of accommodation service PFI projects have four features that are especially significant in preventing considerable improvements in economic efficiency of the projects. The public and private sectors must address these with immediate effect for the benefit of future projects. First, the guidance documentation used to govern design development in the projects has been created for traditional procurement. As a result, the documentation reduces the ProjectCos' opportunities to pursue economic efficiency. Second, the inclusion of the prospect of market testing of soft operational services into the contractual terms between the client and the SPV significantly weakens the incentives the ProjectCo actors have to implement $CWLC_P$ driven design solutions that reduce the cost of providing soft operational services. Third, in the project development, the ProjectCo actors organise themselves in a manner that negates the incentives and the opportunities that the client passes onto them to pursue economic efficiency. This is the single most significant finding of this research. Fourth, the uncertainty inherent in the information that the ProjectCo actors use to estimate expected $CWLC_P$ reductions *ex ante* prevents them from firmly committing to the pursuit of economic efficiency.

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APPENDIX I

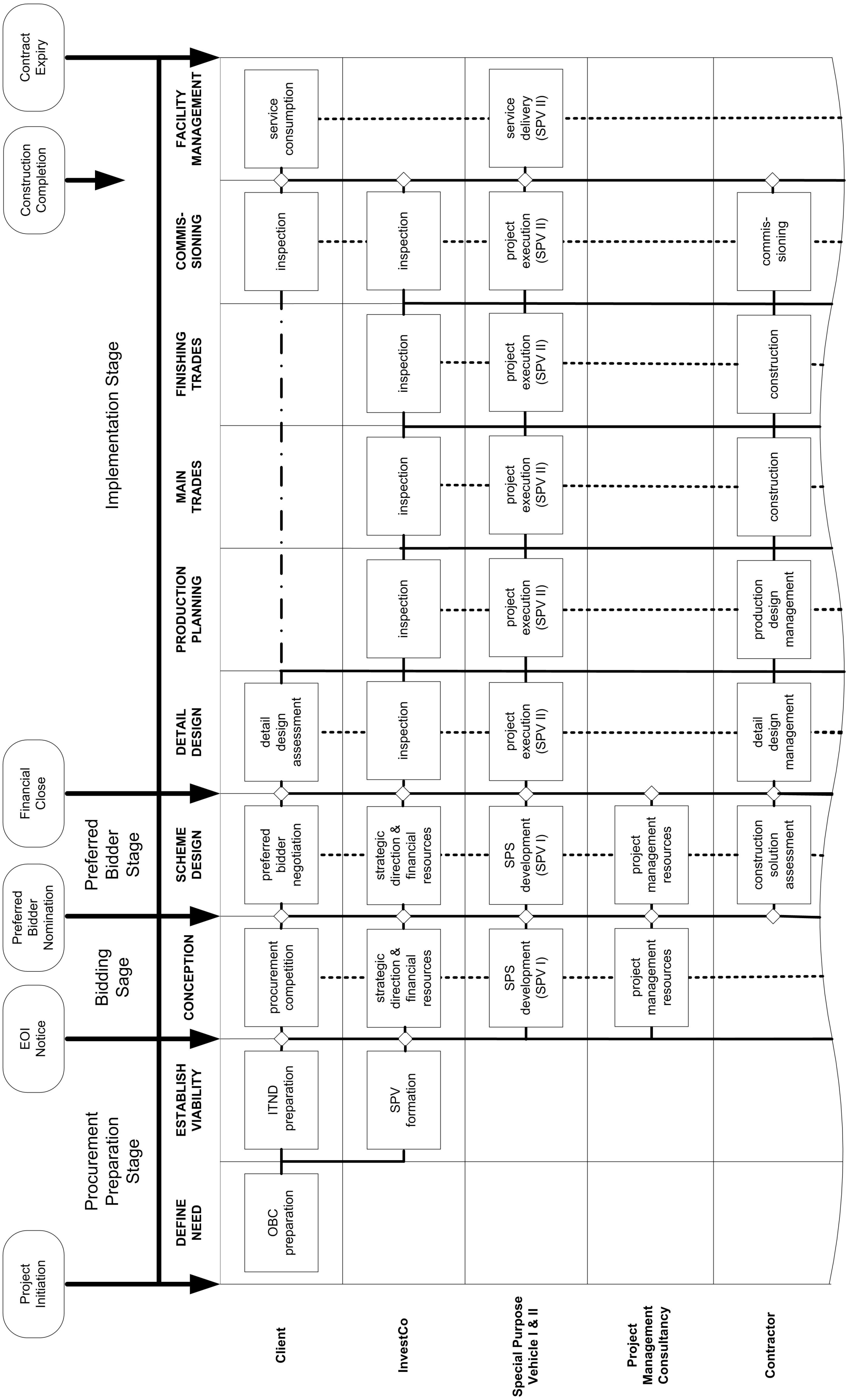

Figure A1.1. KCL Site Rationalisation process protocol map – Part I.

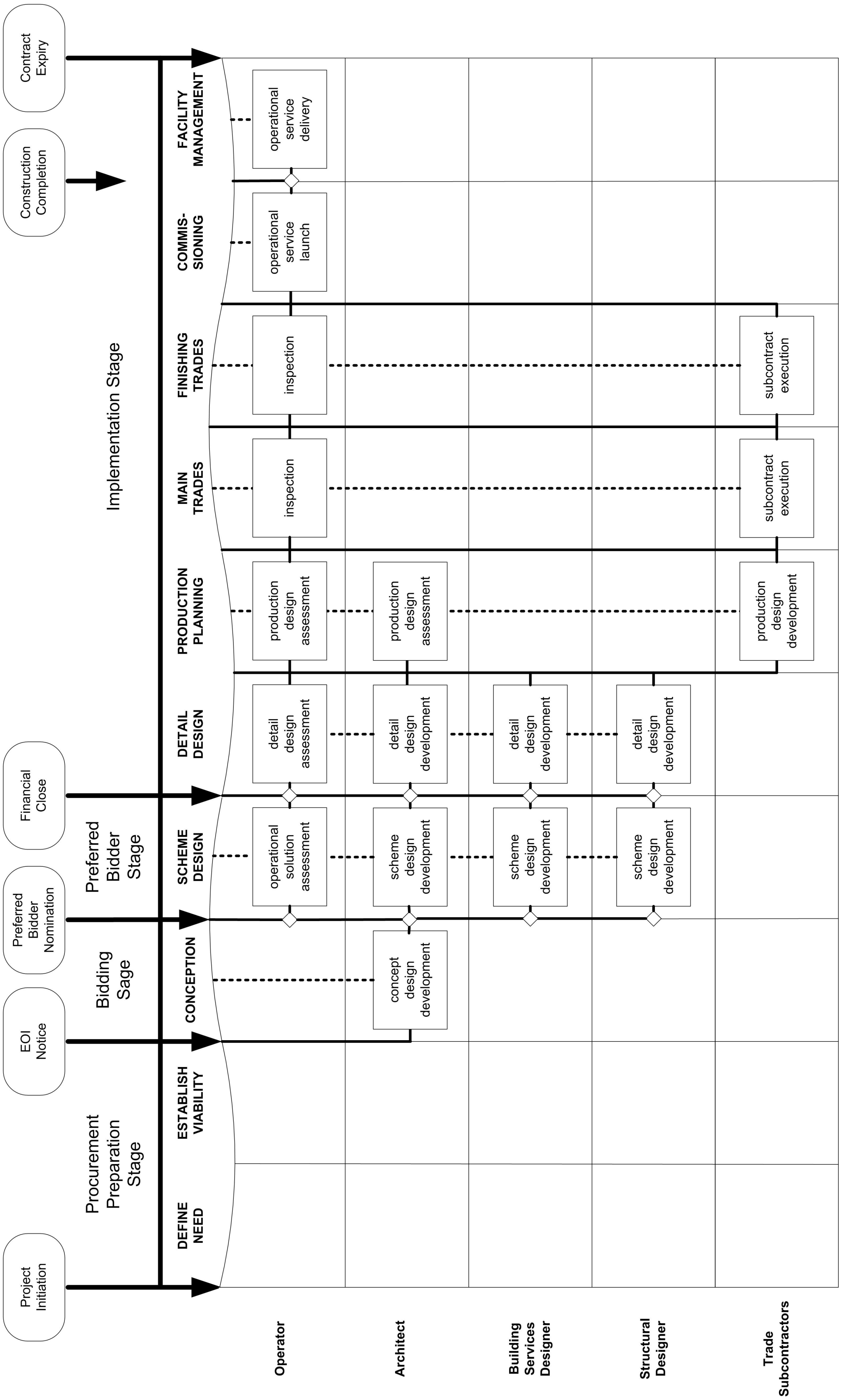

Figure A1.2. KCL Site Rationalisation process protocol map – Part II.

APPENDIX II

Procurement Preparation Stage		
	Client - KCL	
Role	***PFI Procurement***	***Traditional Construction & Service Procurement***
Developer	- develop OBC (case for either traditional or PFI procurement) - develop ITND - develop PSC project	- develop FBC (case for traditional procurement) - obtain finance for design and construction - develop Invitation to Tender Documentation
Designer	- procure concept design solution for PSC project	- procure architectural concept, scheme & detail design solutions - procure building services scheme & detail design solutions - procure structural scheme & detail design solutions
Builder	- procure capital cost estimate for PSC project	- procure capital cost estimate
Operator	- procure operational cost estimate for PSC project	
Owner		
User		

Figure A2.1. Client actor-role matrix part I.

Bidding Stage		
Client - KCL		
Role	***PFI Procurement***	***Traditional Construction & Service Procurement***
Developer	- prequalify ProjectCos to bid for the project - issue ITND to ProjectCos - evaluate SPS submission - appoint preferred bidder	- preselect contractors to bid for the project - issue Invitation to Tender documentation to contractors
Designer	- evaluate and negotiate concept design solution (part of SPS)	
Builder	- evaluate and negotiate (concept) construction solution (part of SPS)	- evaluate tenders - appoint contractor
Operator	- evaluate and negotiate (concept) operational solution (part of SPS)	
Owner		
User	- evaluate and negotiate (concept) spatial design solution (part of SPS)	

Figure A2.2. Client actor-role matrix part II.

Preferred Bidder Stage		
Client - KCL		
Role	***PFI Procurement***	***Traditional Construction & Service Procurement***
Developer	- assess, negotiate and agree SPS, construction price and UP - obtain finance - develop FBC (case for DBO contract award) - award DBO contract	
Designer	- assess, negotiate and agree engineering scheme design solution	
Builder	- assess, negotiate and agree (scheme) construction solution	
Operator	- assess, negotiate and agree (scheme) operational solution	
Owner		
User	- assess, negotiate and agree spatial scheme design solution	

Figure A2.3. Client actor-role matrix part III.

Implementation Stage		
Client - KCL		
Role	***PFI Procurement***	***Traditional Construction & Service Procurement***
Developer		
Designer	- assess and agree engineering detail design solution	
Builder	- procure construction monitoring - approve commissioning	- procure construction monitoring - approve commissioning
Operator		- procure operational services
Owner	- own facility - accept operational service provision	- own facility - procure major maintenance and replacement
User	- assess and agree spatial detail design solution - consume accommodation service - provide core services in new facilities	- provide core services in new facilities

Figure A2.4. Client actor-role matrix part IV.

Procurement Preparation Stage		
	Investment Company - ELPL	
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- monitor market for opportunities in PFI - monitor KCL's progress in procurement - establish SPV (ELDL)	
Designer		
Builder		
Operator		
Owner		
User		

Figure A2.5. InvestCo actor-role matrix part I.

Preferred Bidder Stage		
Investment Company - ELPL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- supply financial resources to SPV (ELDL) - provide strategic direction to SPV (ELDL) - dissolve SPV (ELDL)	
Designer		
Builder		
Operator		
Owner		
User		

Figure A2.6. InvestCo actor-role matrix part II.

Preferred Bidder Stage		
Investment Company - ELPL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- supply financial resources to SPV (ELDL) - provide strategic direction to SPV (ELDL) - dissolve SPV (ELDL)	
Designer		
Builder		
Operator		
Owner		
User		

Figure A2.7. InvestCo actor-role matrix part III.

Implementation Stage		
Investment Company - ELPL		
Role	PFI Development	Traditional Construction & Operational Service Development
Developer		
Designer		
Builder	- monitor construction	
Operator		
Owner		
User		

Figure A2.8. InvestCo actor-role matrix part IV.

Procurement Preparation Stage		
Project Management Consultant - Mace		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- monitor KCL's progress in procurement - formulate bidding strategy	
Designer	- establish relationship with architect	
Builder		
Operator		
Owner		
User		

Figure A2.9. Project management consultant actor-role matrix part I.

Bidding Stage		
Project Management Consultant - Mace		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- assemble ProjectCo - manage prequalification to bid for the project - manage (concept) SPS development - submit SPS	
Designer	- procure architectural concept design solution - obtain advise on and develop building services strategy - obtain advise on and develop structural strategy	
Builder	- develop (concept) construction solution	
Operator	- develop (concept) operational solution	
Owner		
User		

Figure A2.10. Project management consultant actor-role matrix part II.

Preferred Bidder Stage		
Project Management Consultant - Mace		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- manage (scheme) SPS development - obtain advise on WLC and price SPS - manage project transfer from one SPV (ELDL) to another SPV (EL	
Designer	- procure architectural, building services and structural scheme design solutions	
Builder	- develop (scheme) construction solution - select DB contractor	
Operator	- develop (scheme) operational solution - select operator	
Owner		
User		

Figure A2.11. Project management consultant actor-role matrix part III.

Implementation Stage		
Project Management Consultant - Mace		
Role	PFI Development	Traditional Construction & Operational Service Development
Developer		
Designer		
Builder		
Operator		
Owner		
User		

Figure A2.12. Project management consultant actor-role matrix part IV.

Procurement Preparation Stage		
Contractor - BUKL		
Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer		
Designer		
Builder	- monitor market for construction opportunities in PFI	- monitor market for construction opportunities
Operator		
Owner		
User		

Figure A2.13. Contractor actor-role matrix part I.

Bidding Stage		
Contractor - BUKL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer		
Builder	- monitor market for construction opportunities in PFI	- bid for construction
Operator		
Owner		
User		

Figure A2.14. Contractor actor-role matrix part II.

Preferred Bidder Stage		
Contractor - BUKL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- establish SPV (ELL)	
Designer	- provide feedback on architectural, building services and structural scheme design solutions	
Builder	- bid for construction - provide feedback on (scheme) construction solution	
Operator	- provide feedback on (scheme) operational solution	
Owner		
User		

Figure A2.15. Contractor actor-role matrix part III.

Implementation Stage		
Contractor - BUKL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- take ownership of architectural, building services and structural scheme design solutions - procure architectural, building services and structural detail design solutions - manage detail and production design development	
Builder	- develop (detail) construction solution - procure and manage subcontracts - construct - commission	- manage construction - procure subcontracts - construct - commission
Operator	- provide feedback on (detail) operational solution	
Owner	- inject nominal equity to SPV (ELL) - manage SPV (ELL)	
User		

Figure A2.16. Contractor actor-role matrix part IV.

Procurement Preparation Stage		
Operator - ESL		
Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer		
Designer		
Builder		
Operator	- monitor market for operation opportunities in PFI	- monitor market for operation opportunities
Owner		
User		

Figure A2.17. Operator actor-role matrix part I.

Bidding Stage		
Operator - ESL		
Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer		
Designer		
Builder		
Operator	- monitor market for operation opportunities in PFI	- monitor market for operation opportunities
Owner		
User		

Figure A2.18. Operator actor-role matrix part II.

Preferred Bidder Stage		
Operator - ESL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide feedback on architectural, building services and structural scheme design solutions	
Builder	- provide feedback on (scheme) construction solution	
Operator	- bid for operation - provide feedback on (scheme) operational solution	- monitor market for operation opportunities
Owner		
User		

Figure A2.19. Operator actor-role matrix part III.

Implementation Stage		
Operator - ESL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide feedback on architectural, building services and structural detail design solutions	
Builder	- provide feedback on (detail) construction solution	
Operator	- develop (detail) operational solution - manage and deliver operational service provision - procure operational service subcontracts	- bid for operation contracts - provide operational services
Owner	- inject nominal equity to SPV (ELL) - manage SPV (ELL)	
User		

Figure A2.20. Operator actor-role matrix part IV.

Procurement Preparation Stage		
Architect - ADL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- monitor market for design opportunities in PFI	- monitor market for design opportunities - develop architectural concept, scheme & detail design solutions - coordinate buildings services scheme & detail design solution - coordinate structural scheme & detail design solution
Builder		
Operator		
Owner		
User		

Figure A2.21. Architect actor-role matrix part I.

Bidding Stage		
Architect - ADL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- prequalify to bid for the project as part of ProjectCo - develop architectural concept design solution - bid for the project as part of ProjectCo	
Builder	- provide feedback on the (concept) construction solution	
Operator	- provide feedback on the (concept) operational solution	
Owner		
User		

Figure A2.22. Architect actor-role matrix part II.

Preferred Bidder Stage		
Architect - ADL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop architectural scheme design solution - coordinate building services scheme design solution - coordinate structural scheme design solution	
Builder	- provide feedback on (scheme) construction solution	
Operator	- provide feedback on (scheme) operational solution	
Owner		
User		

Figure A2.23. Architect actor-role matrix part III.

Implementation Stage		
Architect - ADL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop architectural detail design solution - coordinate production design solution	
Builder	- provide feedback on (detail) construction solution	- monitor construction
Operator	- provide feedback on (detail) operational solution	
Owner		
User		

Figure A2.24. Architect actor-role matrix part IV.

Procurement Preparation Stage		
Building Services Designer - TBAL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- monitor market for design opportunities in PFI	- monitor market for design opportunities - develop building services scheme & detail design solutions - provide feedback on architectural scheme & detail design solutions - provide feedback on structural scheme & detail design solutions
Builder		
Operator		
Owner		
User		

Figure A2.25. Building services designer actor-role matrix part I.

Bidding Stage		
Building Services Designer - TBAL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide advise on building services strategy - provide feedback on architectural concept design solution - provide feedback on structural strategy	
Builder	- provide feedback on the (concept) construction solution	
Operator	- provide feedback on the (concept) operational solution	
Owner		
User		

Figure A2.26. Building services designer actor-role matrix part II.

Preferred Bidder Stage		
Building Services Designer - TBAL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop building services scheme design solution - provide feedback on architectural scheme design solution - provide feedback on structural scheme design solution	
Builder	- provide feedback on (scheme) construction solution	
Operator	- provide feedback on (scheme) operational solution	
Owner		
User		

Figure A2.27. Building services designer actor-role matrix part III.

Implementation Stage		
Building Services Designer - TBAL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop building services detail design solution - provide feedback on architectural detail design solution - provide feedback on structural detail design solution	
Builder	- provide feedback on (detail) construction solution	- monitor construction
Operator	- provide feedback on (detail) operational solution	
Owner		
User		

Figure A2.28. Building services designer actor-role matrix part IV.

Procurement Preparation Stage		
Structural Designer - PFCL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- monitor market for design opportunities in PFI	- monitor market for design opportunities - develop structural detail design solution - provide feedback on architectural detail design solution - provide feedback on building services detail design solution
Builder		
Operator		
Owner		
User		

Figure A2.29. Structural designer actor-role matrix part I.

Bidding Stage		
Structural Designer - PFCL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide advice on structural strategy - provide feedback on architectural concept design solution - provide feedback on building services strategy	
Builder	- provide feedback on the (concept) construction solution	
Operator	- provide feedback on the (concept) operational solution	
Owner		
User		

Figure A2.30. Structural designer actor-role matrix part II.

Preferred Bidder Stage		
Structural Designer - PFCL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop structural scheme design solution - provide feedback on architectural scheme design solution - provide feedback on building services scheme design solution	
Builder	- provide feedback on (scheme) construction solution	
Operator	- provide feedback on (scheme) operational solution	
Owner	- provide feedback on LCF (major maintenance and replacement)	
User		

Figure A2.31. Structural designer actor-role matrix part III.

Implementation Stage		
Structural Designer - PFCL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop structural detail design solution - provide feedback on architectural detail design solution - provide feedback on building services detail design solution	
Builder	- provide feedback on (detail) construction solution	- monitor construction
Operator		
Owner		
User		

Figure A2.32. Structural designer actor-role matrix part IV.

APPENDIX III

Interviewees

Name:	Bruno Bodin
Organisation:	ESL
Role:	Deputy Managing Director
Involvement	March 1997 to end of case study research in September 2001
Key responsibilities:	Management of project on senior level Management of SPV

Name:	Christopher Box
Organisation:	ESL
Role:	Contract Manager
Involvement:	December 1998 to end of case study research in September 2001
Key responsibilities:	Operational solution development Management of operational service provision

Name:	Roger Cross
Organisation:	TBAL
Role:	Partner/Design Team Leader
Involvement	early 1997 to September 1999
Key responsibilities:	Management of project on senior level Management of building services design

Name:	Michael Green
Organisation:	ADL
Role:	Technical Manger
Involvement	mid 1996 to September 1999
Key responsibilities:	Architectural design development Management of architectural design on site

Name:	Simon Holliday
Organisation:	ESL
Role:	General Manager
Involvement	November 1997 to end of case study research in September 2001
Key responsibilities:	Management of operational solution development Management of operation contract

Name:	Dominique Lascault
Organisation:	BUKL
Role:	Design Manager
Involvement	October 1997 to September 1999
Key responsibilities:	Management of design development

Name:	Richard Lamb
Organisation:	PFCL
Role:	Director/Design Team Leader
Involvement	early 1997 to September 1999
Key responsibilities:	Management of project on senior level
	Management of structural design

Name:	Oliver-Marie Racine
Organisation:	BUKL
Role:	Managing Director
Involvement	March 1997 to end of case study research in September 2001
Key responsibilities:	Management of project on senior level
	Management of SPV

Name:	Howard Wright
Organisation:	Mace/ELPL
Role:	Project Director
Involvement	March 1996 to September 1999
Key responsibilities:	Management of BV
	Management of bidding and SPS development
	Construction Monitoring

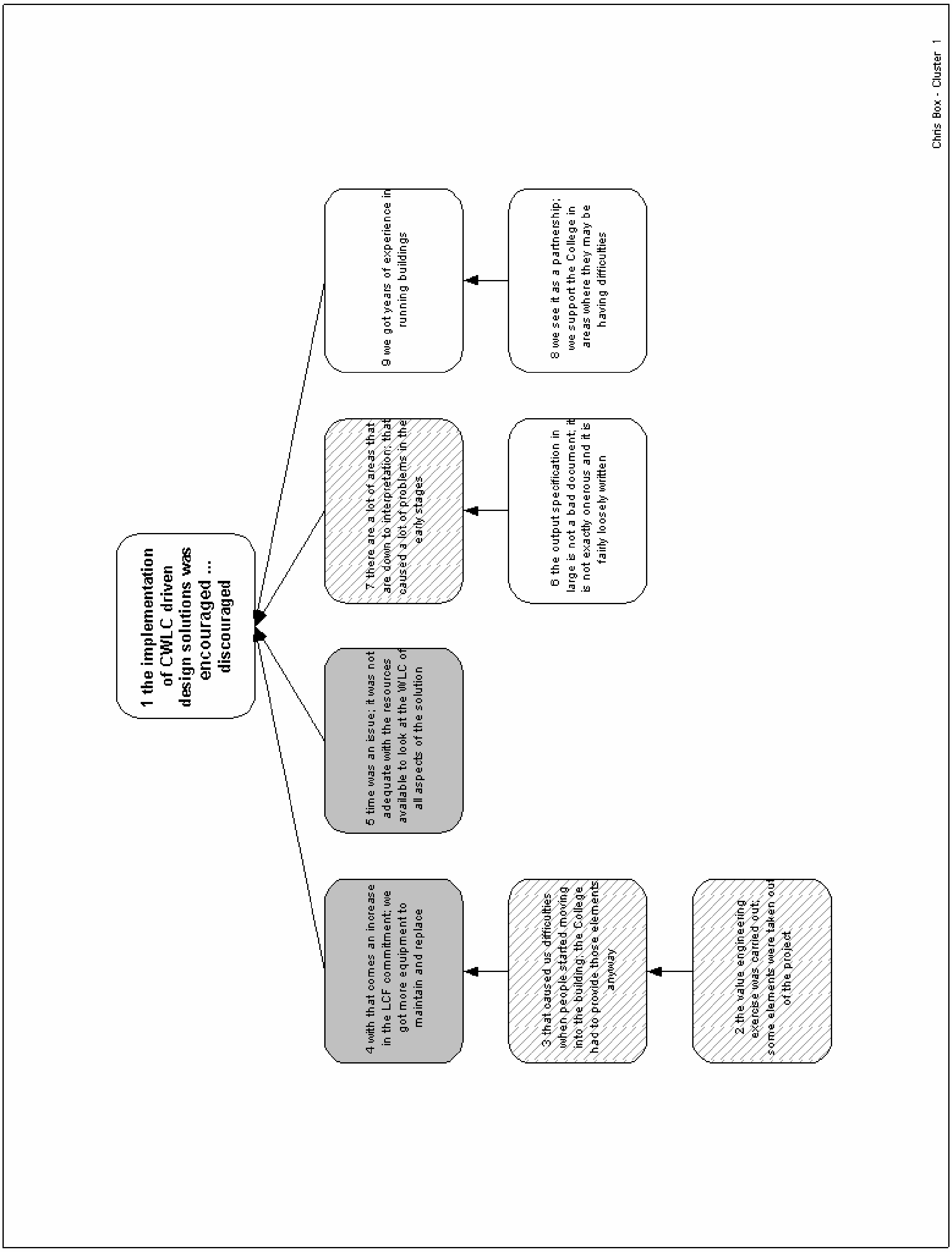

Figure A3.1. Box storyline map Cluster 1.

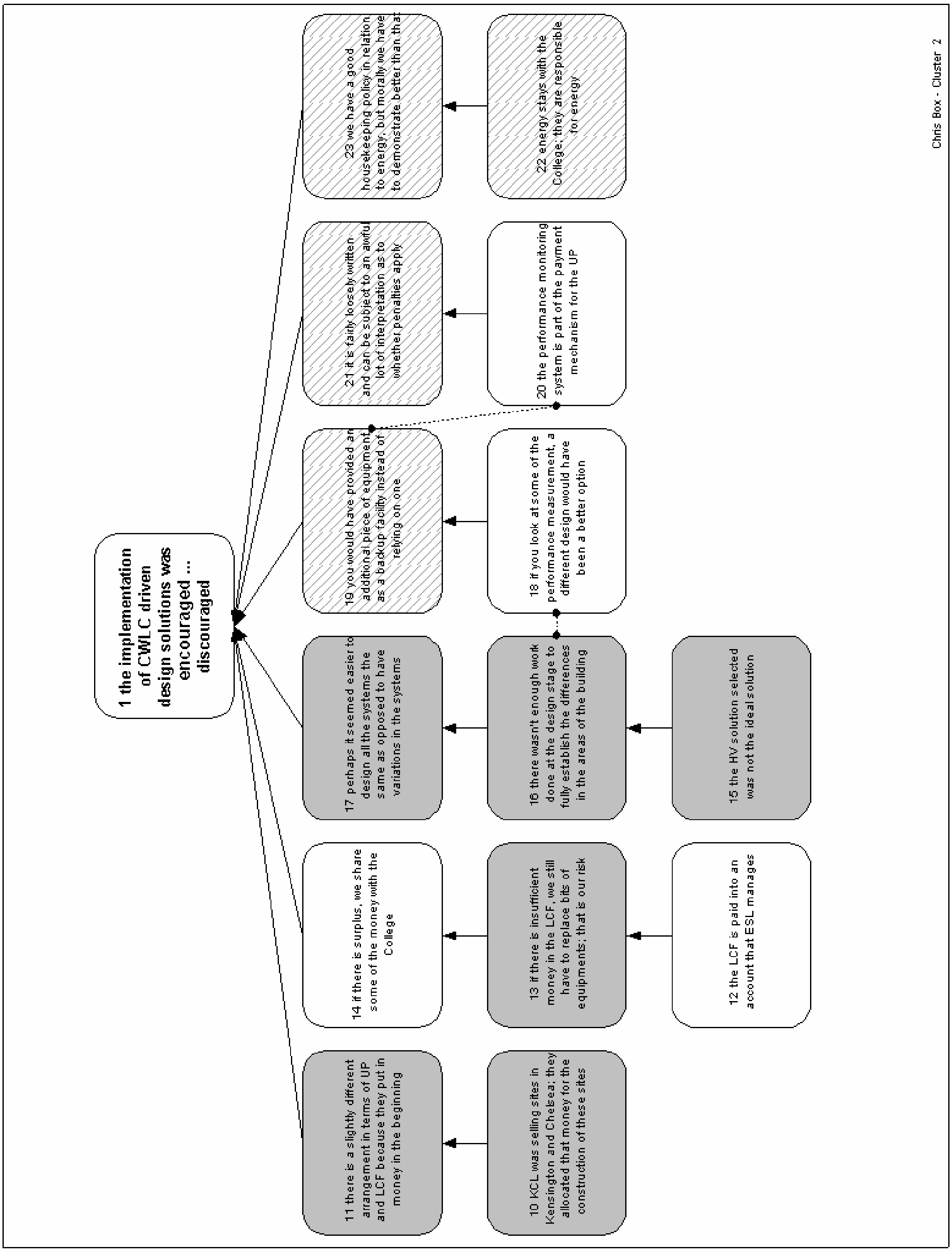

Figure A3.2. Box storyline map Cluster 2.

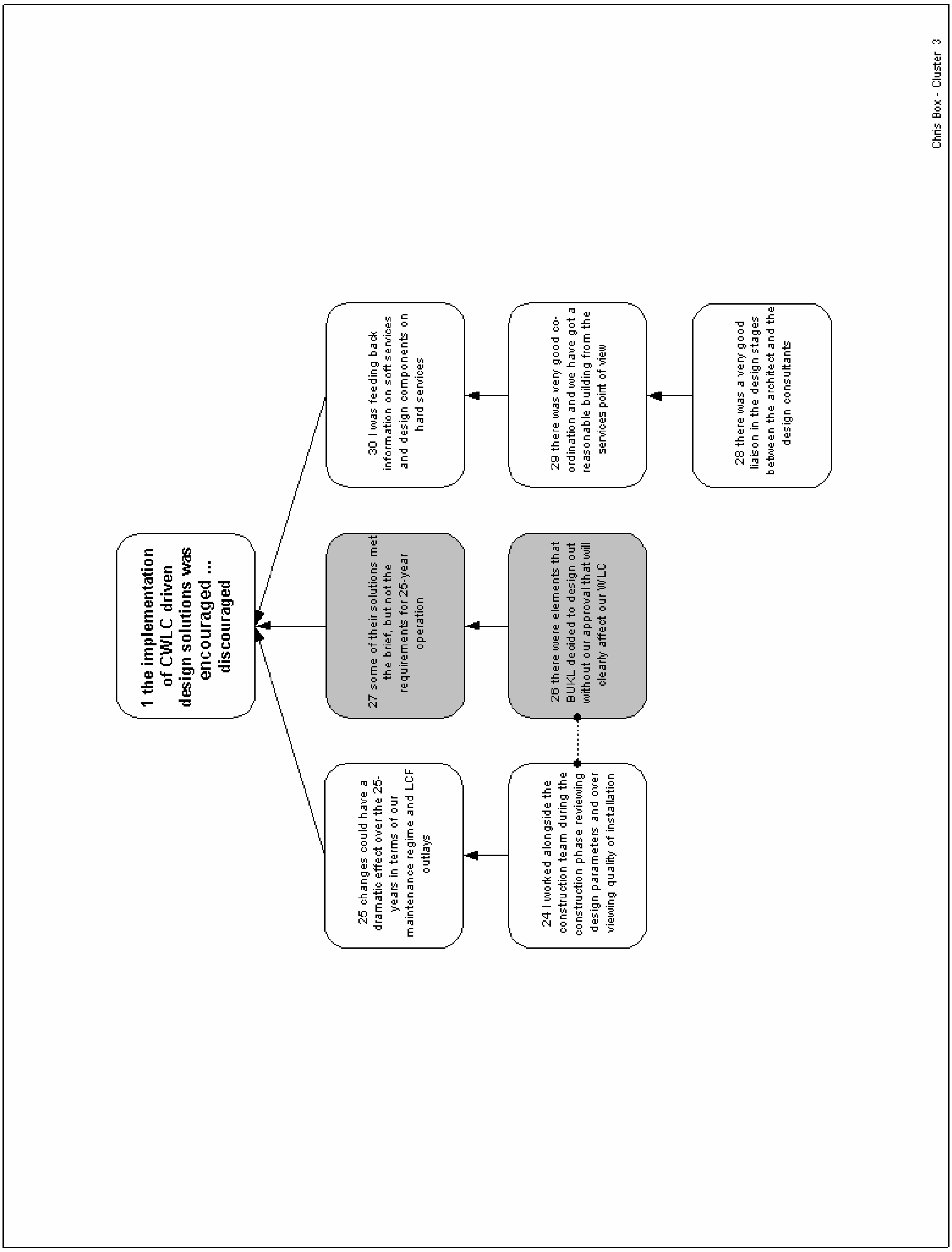

Figure A3.3. Box storyline map Cluster 3.

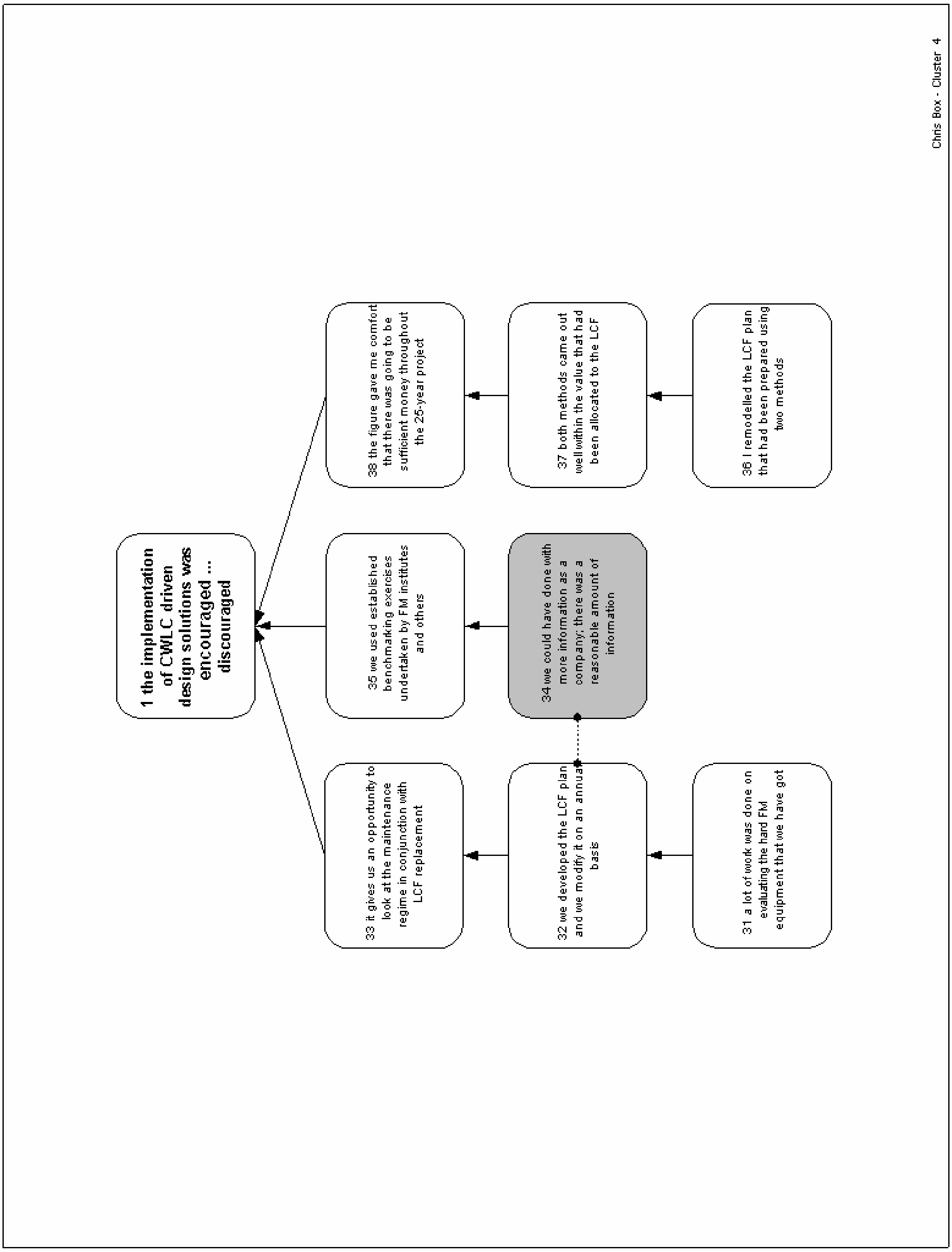

Figure A3.4. Box storyline map Cluster 4.

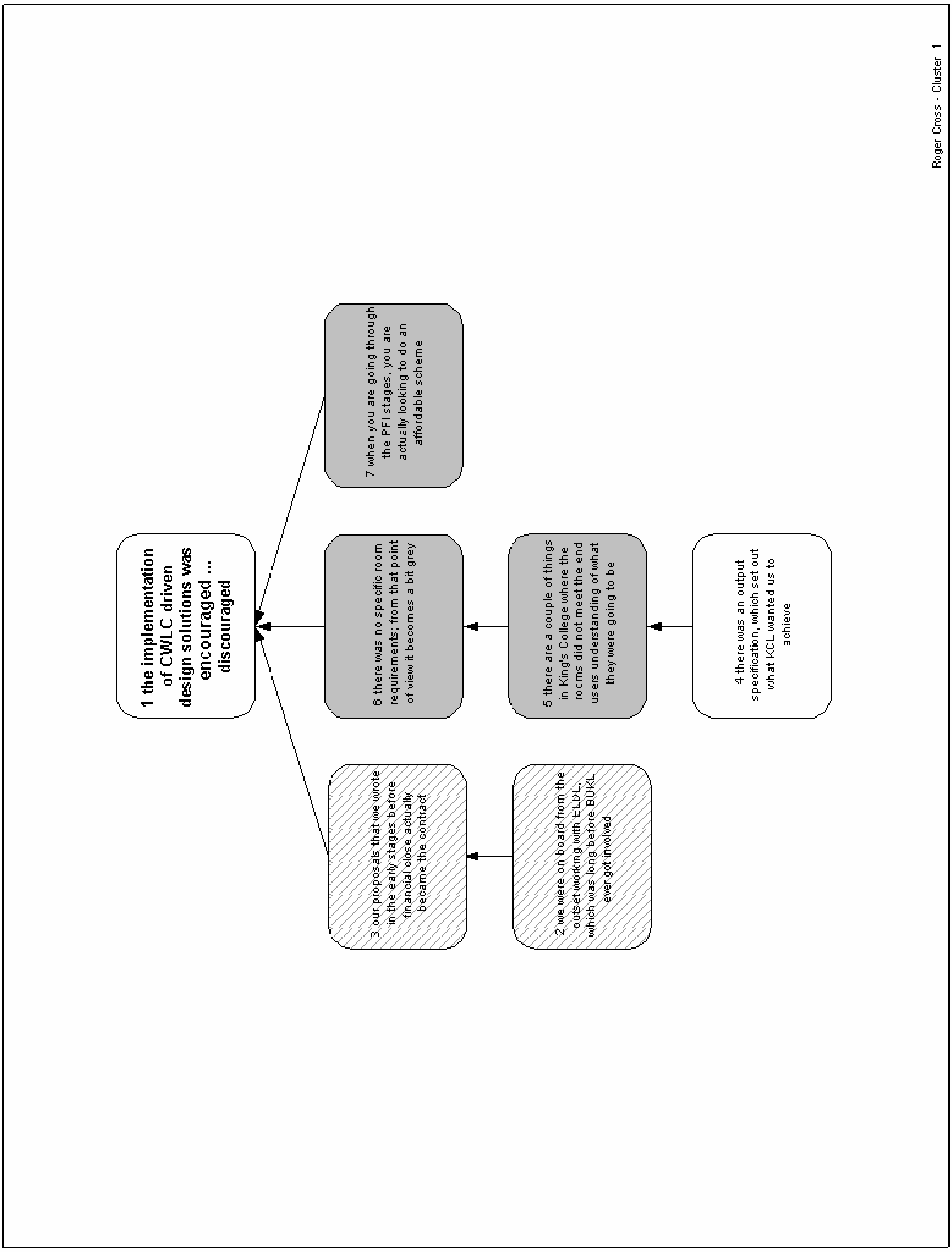

Figure A3.5. Cross storyline map Cluster 1.

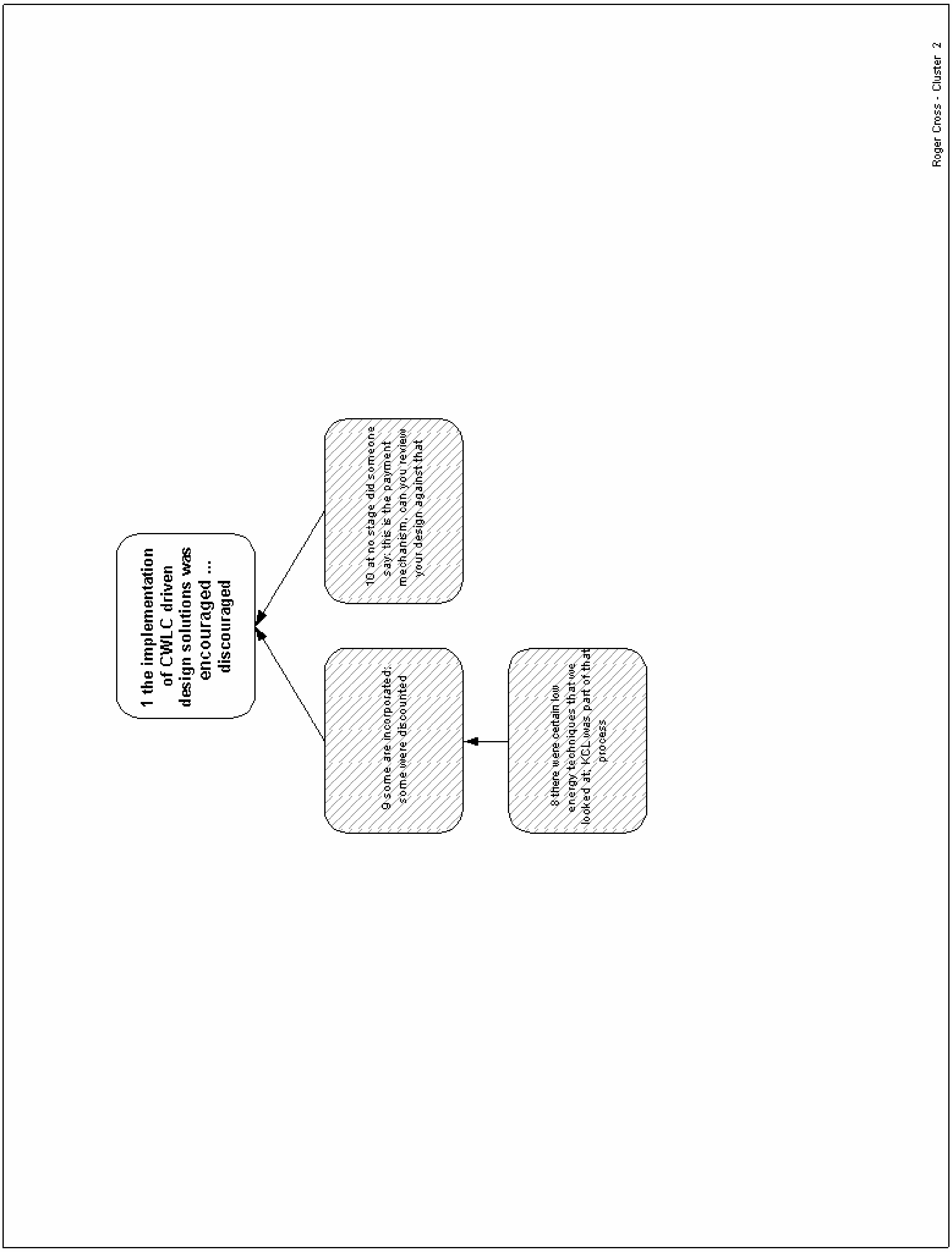

Figure A3.6. Cross storyline map Cluster 2.

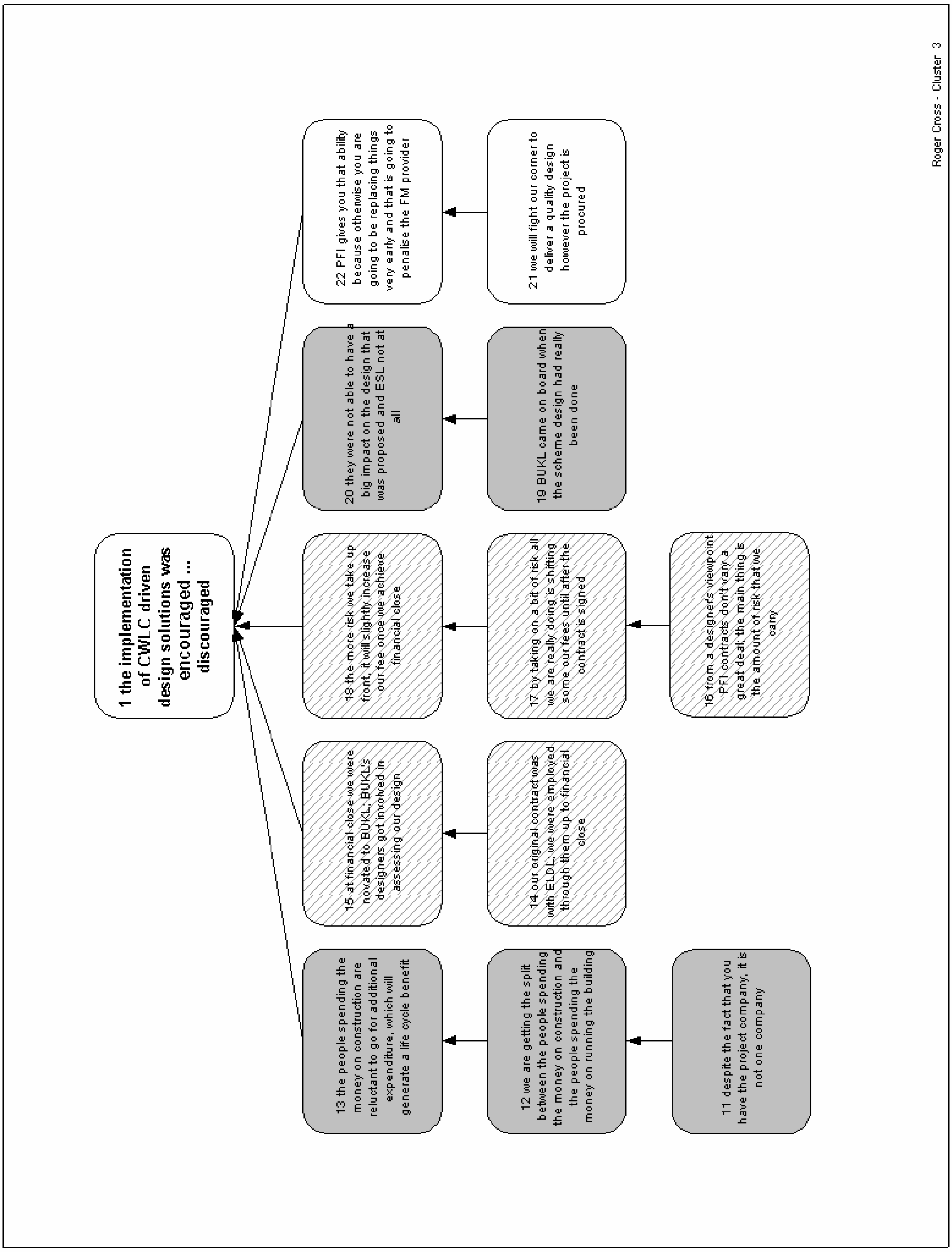

Figure A3.7. Cross storyline map Cluster 3.

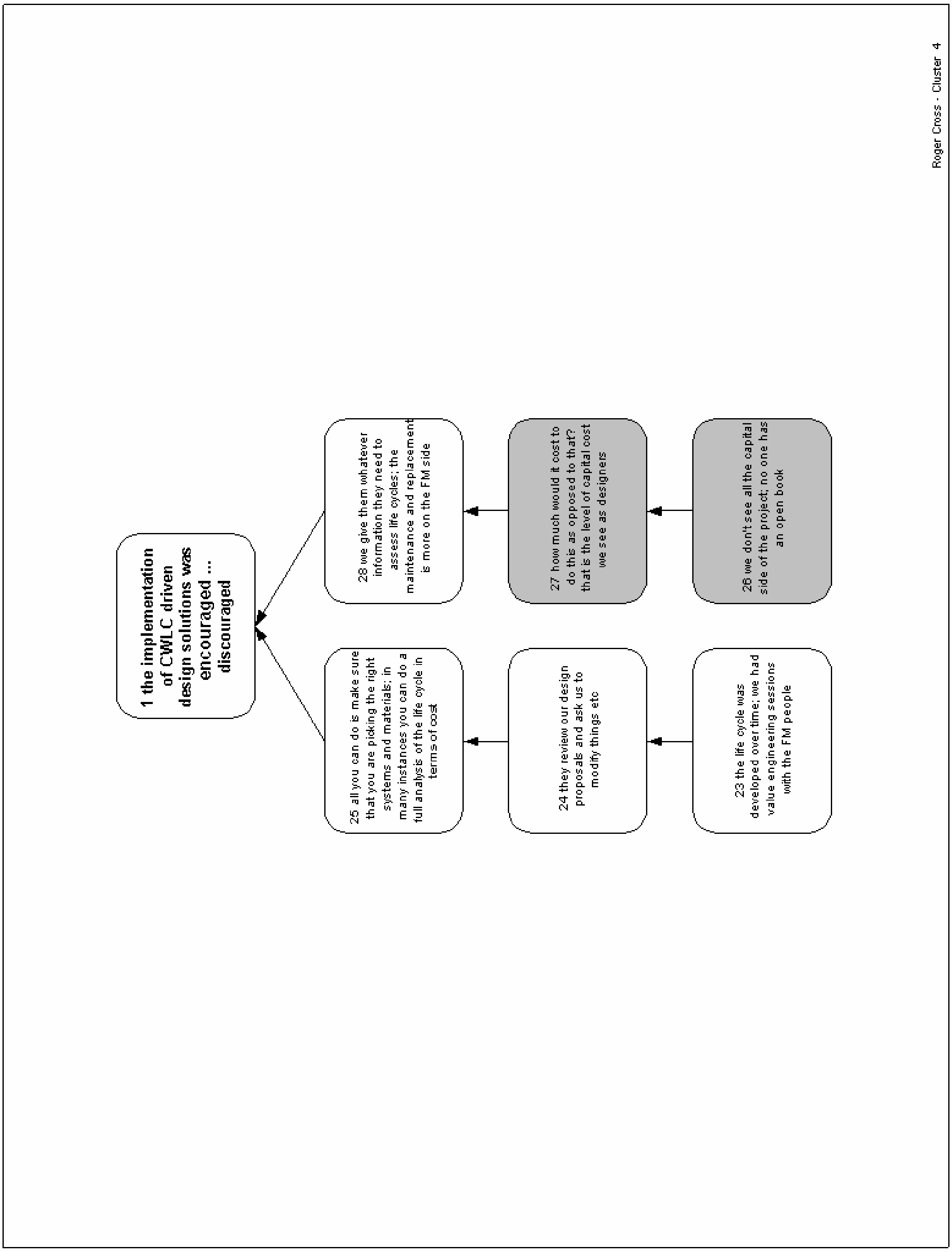

Figure A3.8. Cross storyline map Cluster 4.

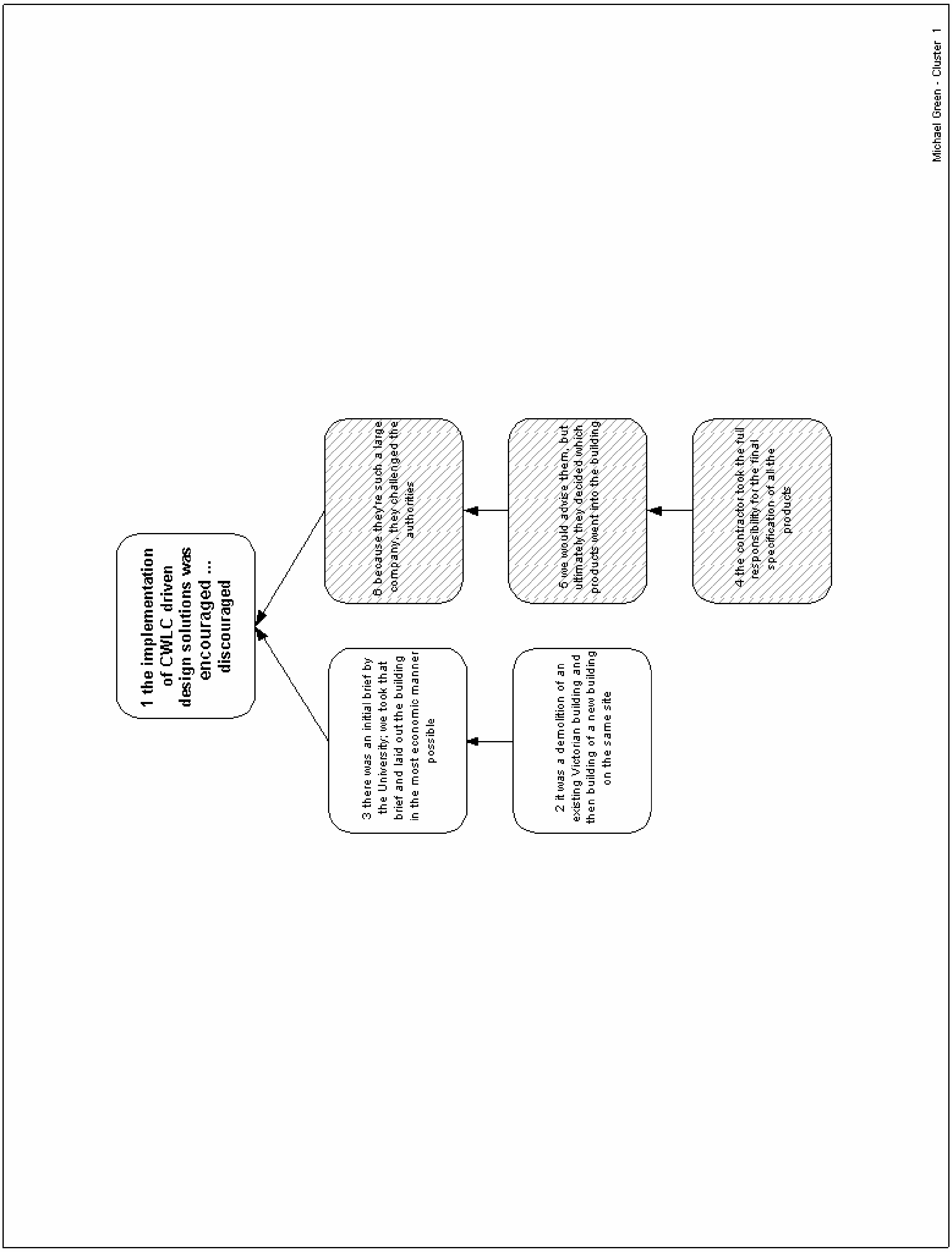

Figure A3.9. Green storyline map Cluster 1.

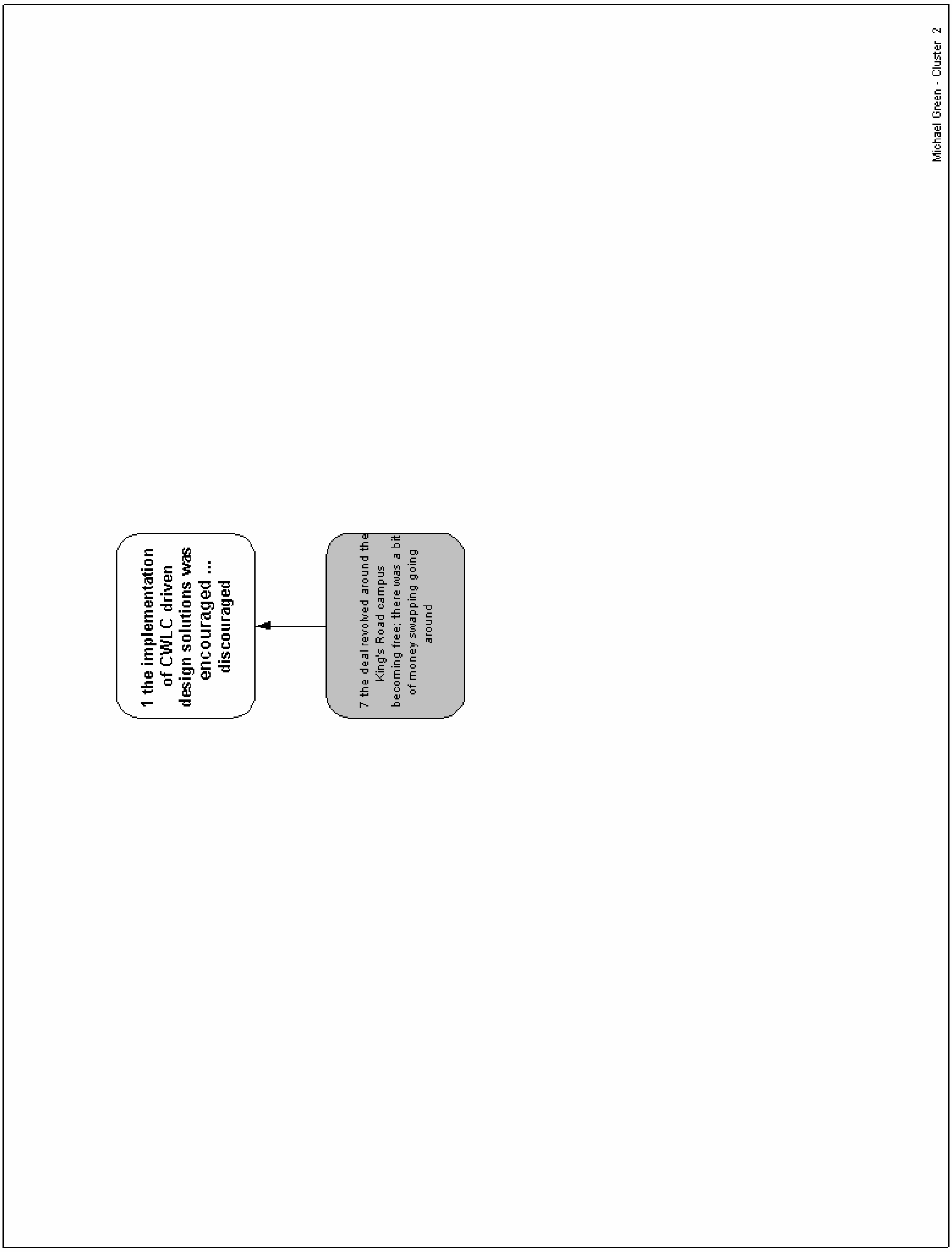

Figure A3.10. Green storyline map Cluster 2.

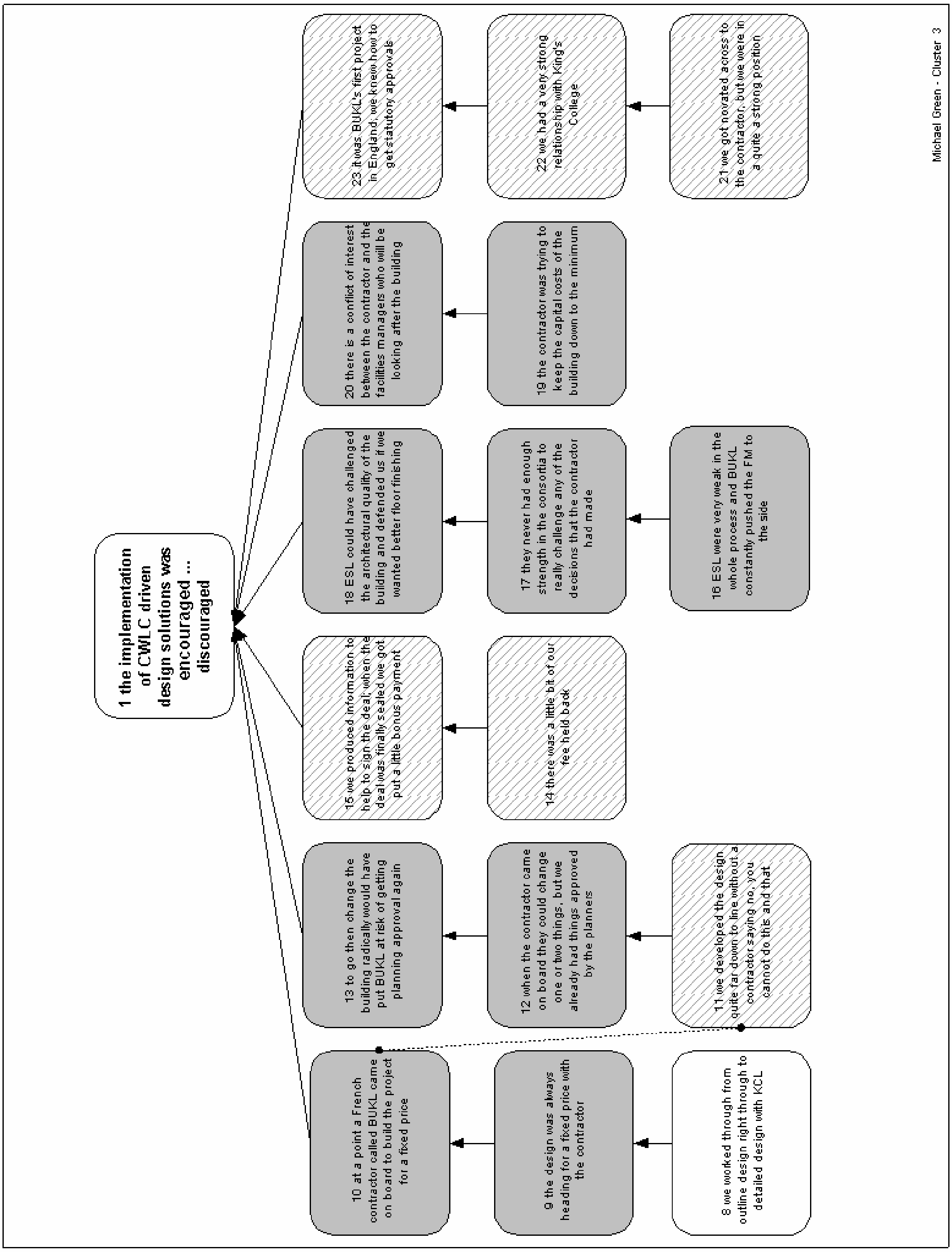

Figure A3.11. Green storyline map Cluster 3.

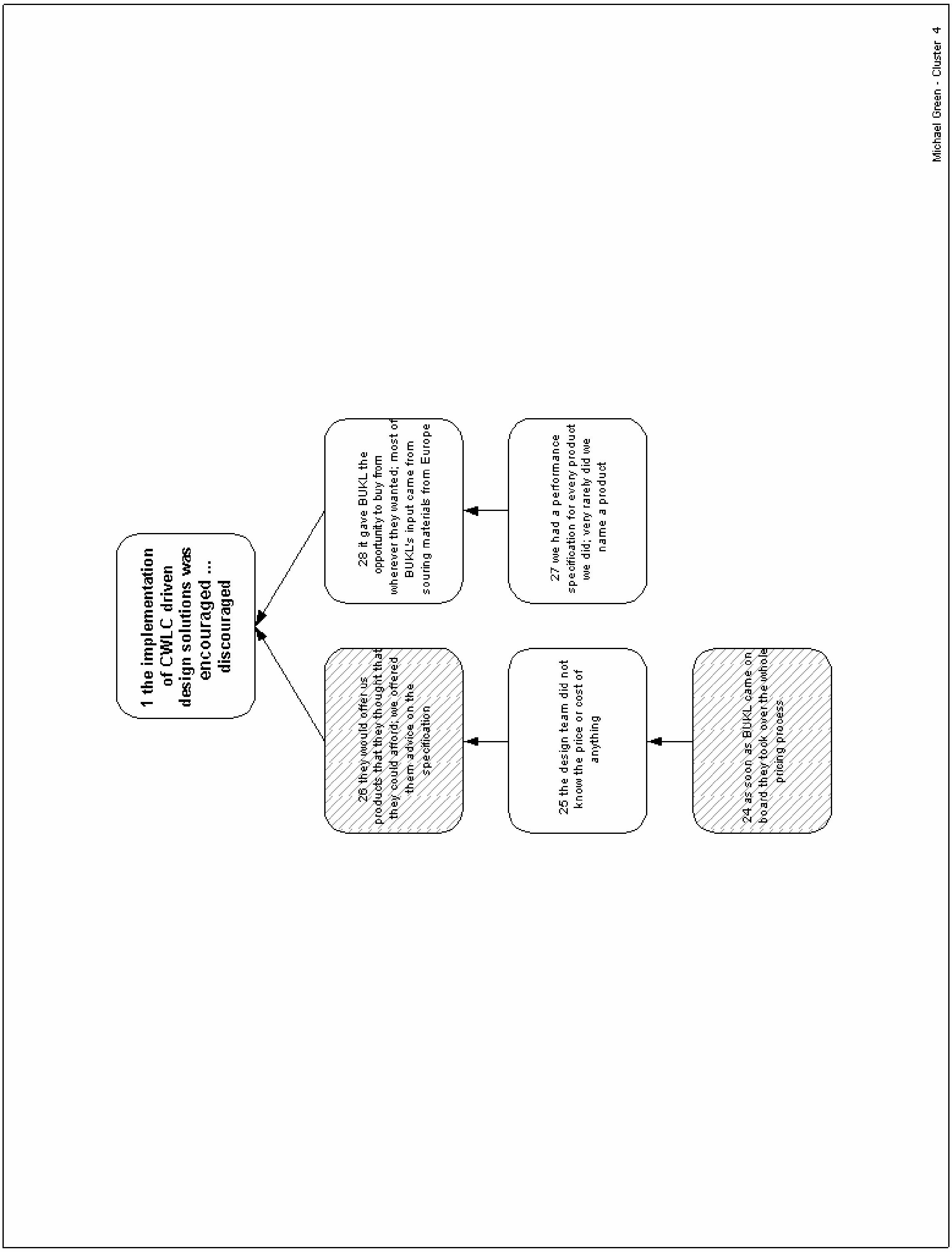

Figure A3.12. Green storyline map Cluster 4.

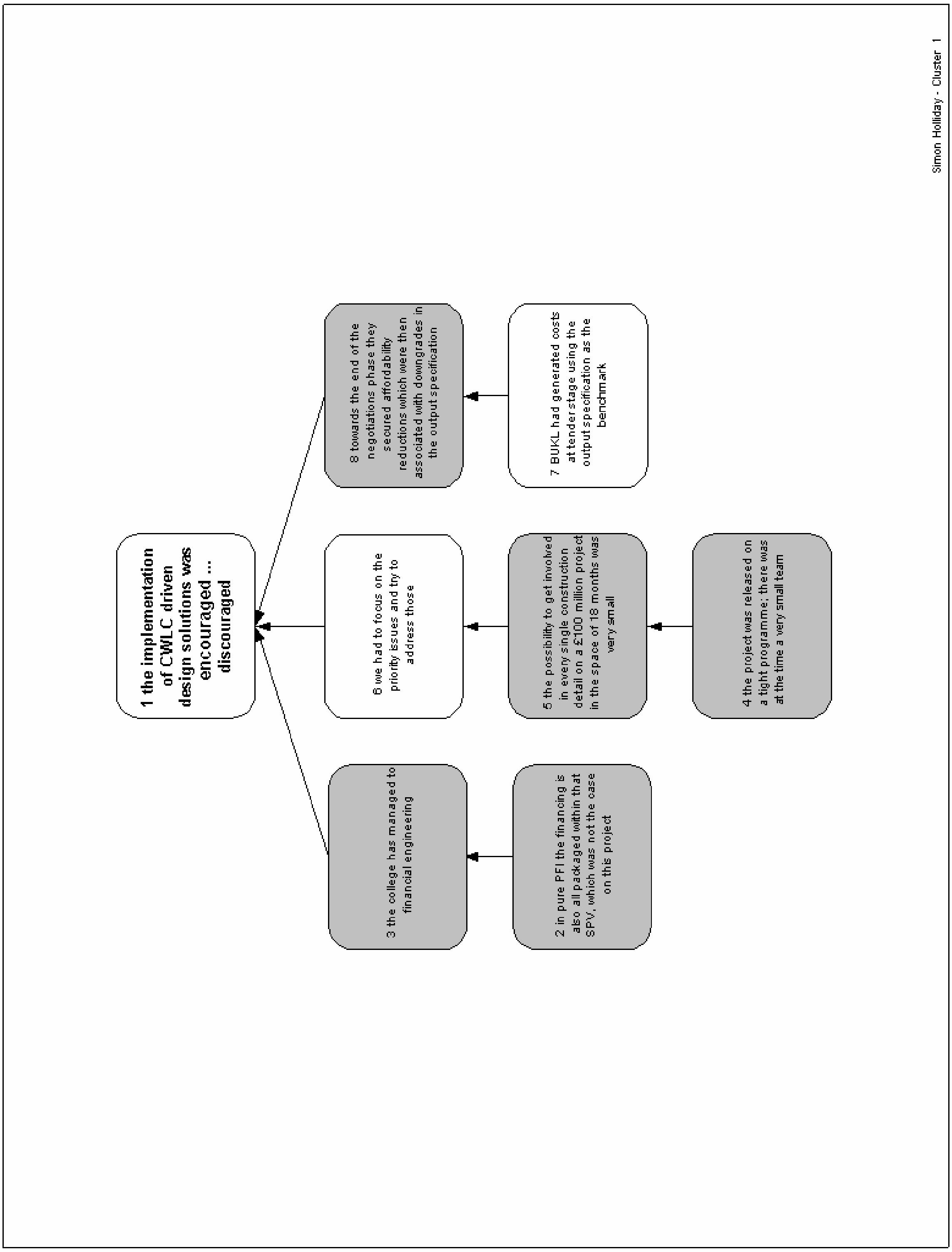

Figure A3.13. Holliday storyline map Cluster 1.

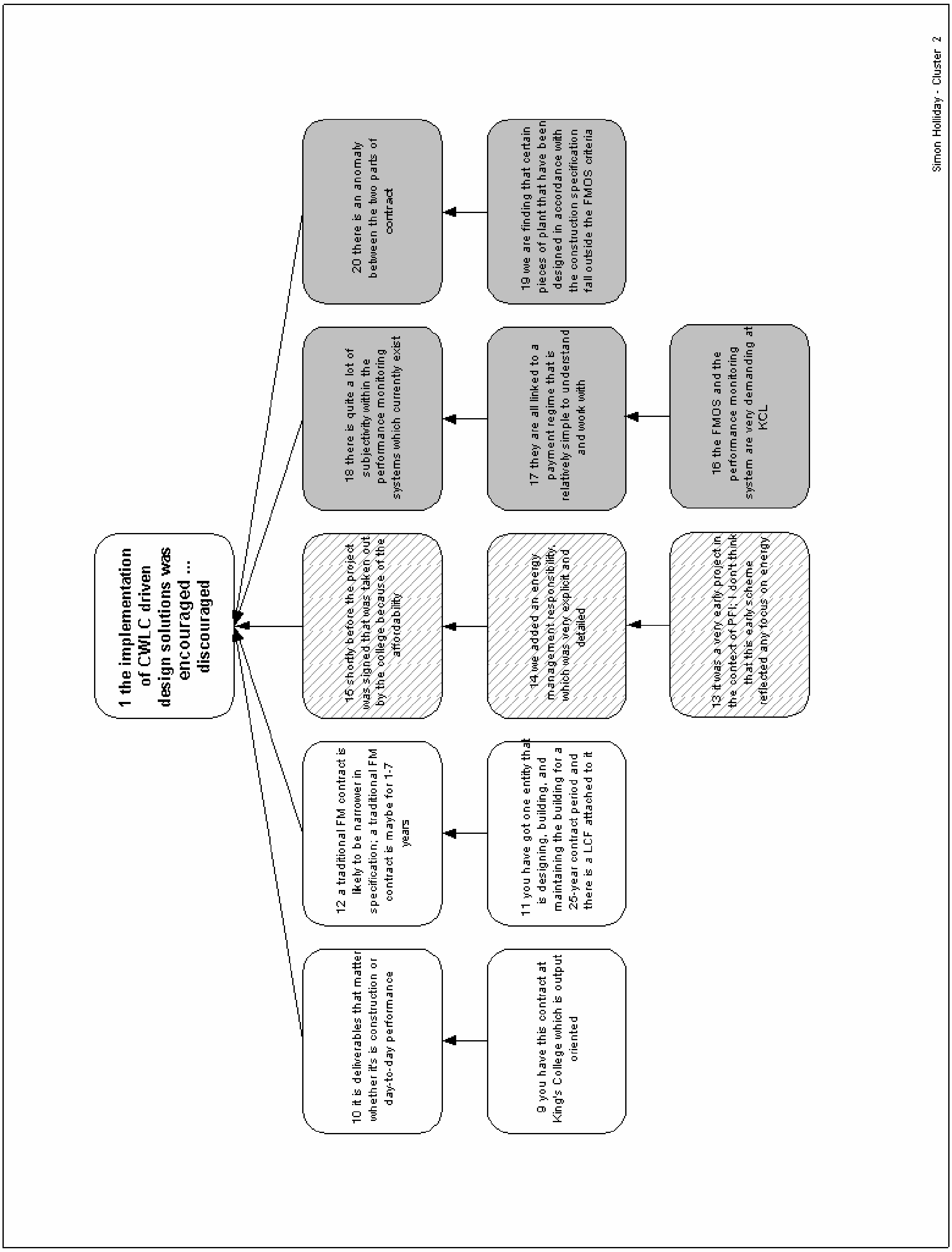

Figure A3.14. Holliday storyline map Cluster 2.

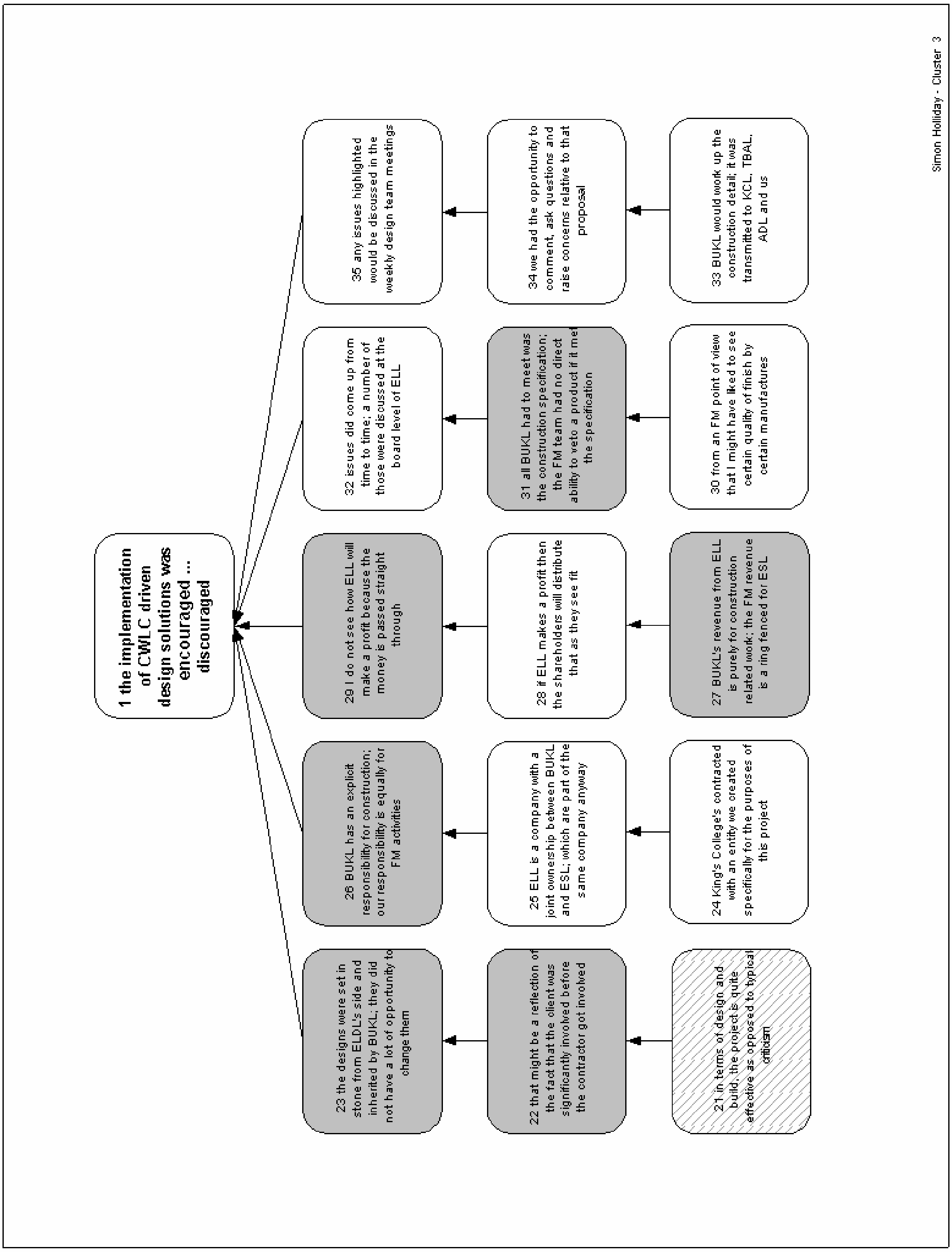

Figure A3.15. Holliday storyline map Cluster 3.

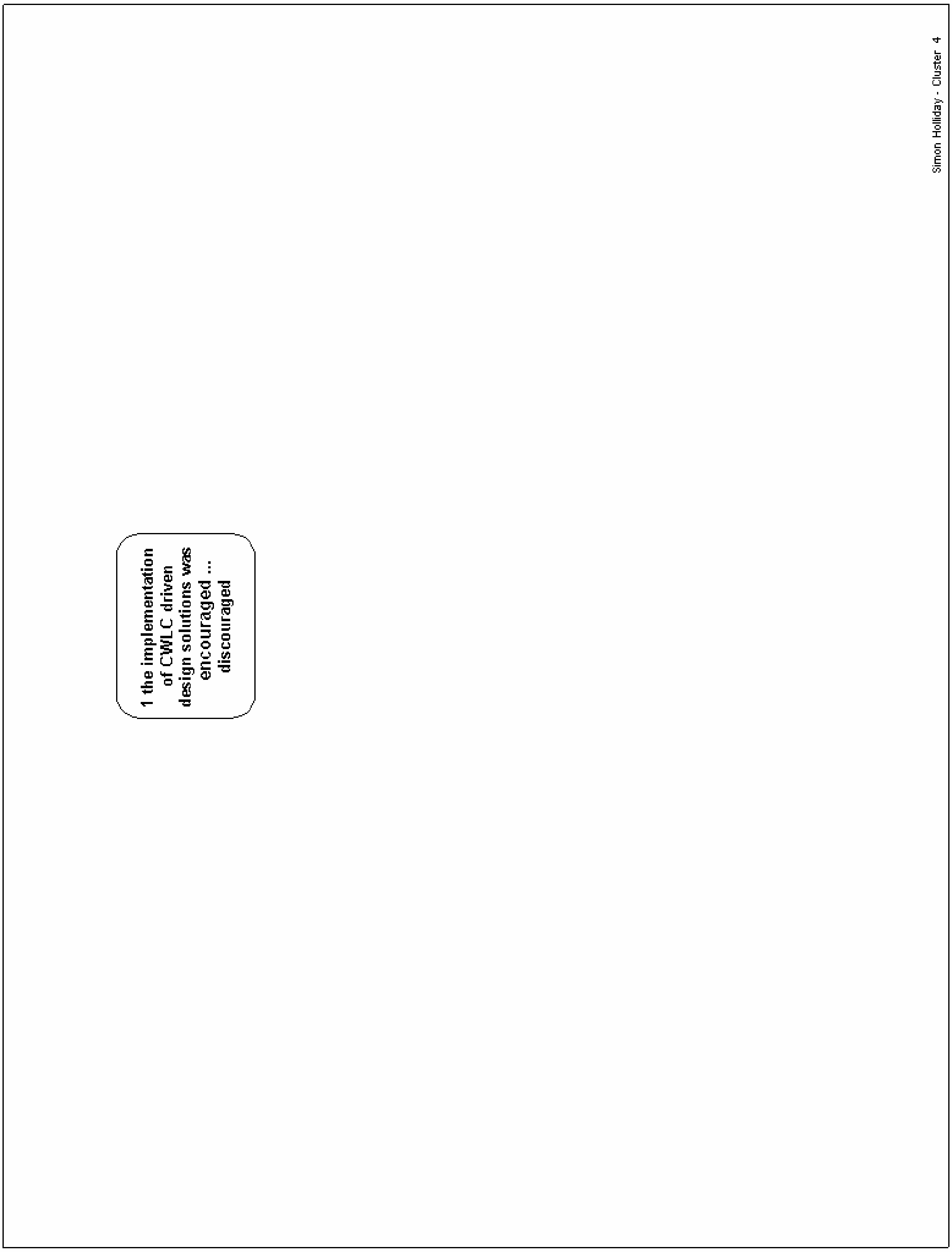

Figure A3.16. Holliday storyline map Cluster 4.

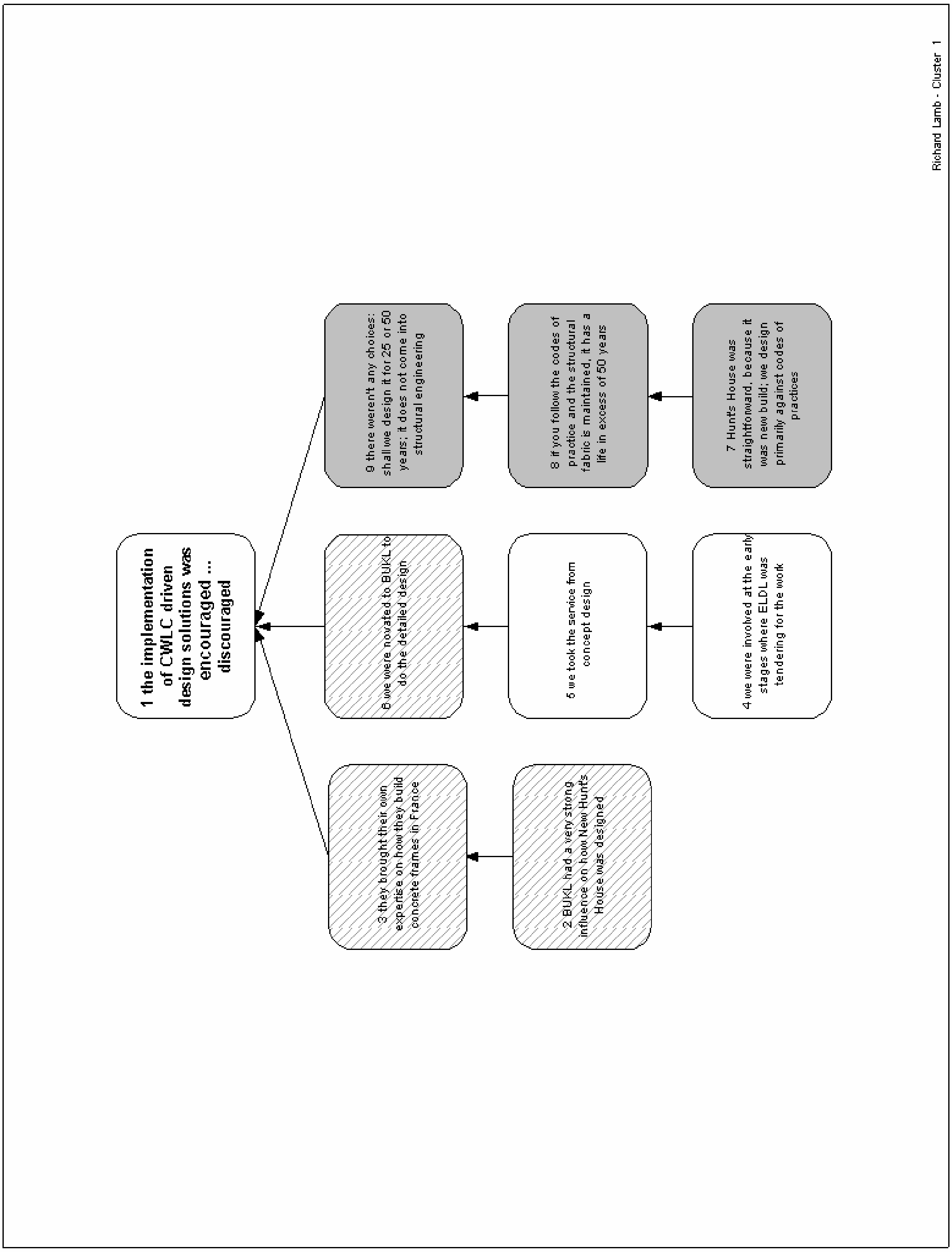

Figure A3.17. Lamb storyline map Cluster 1.

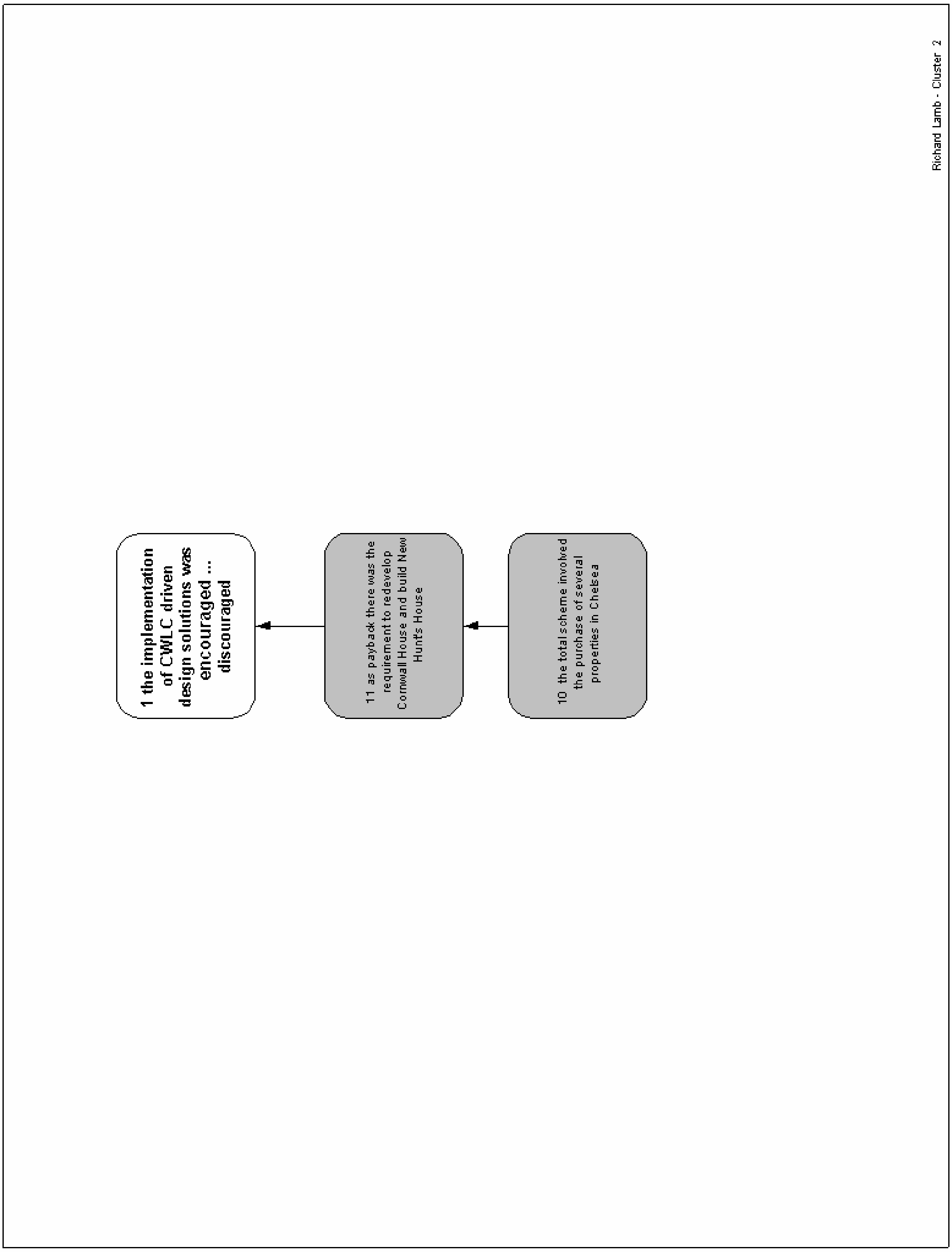

Figure A3.18. Lamb storyline map Cluster 2.

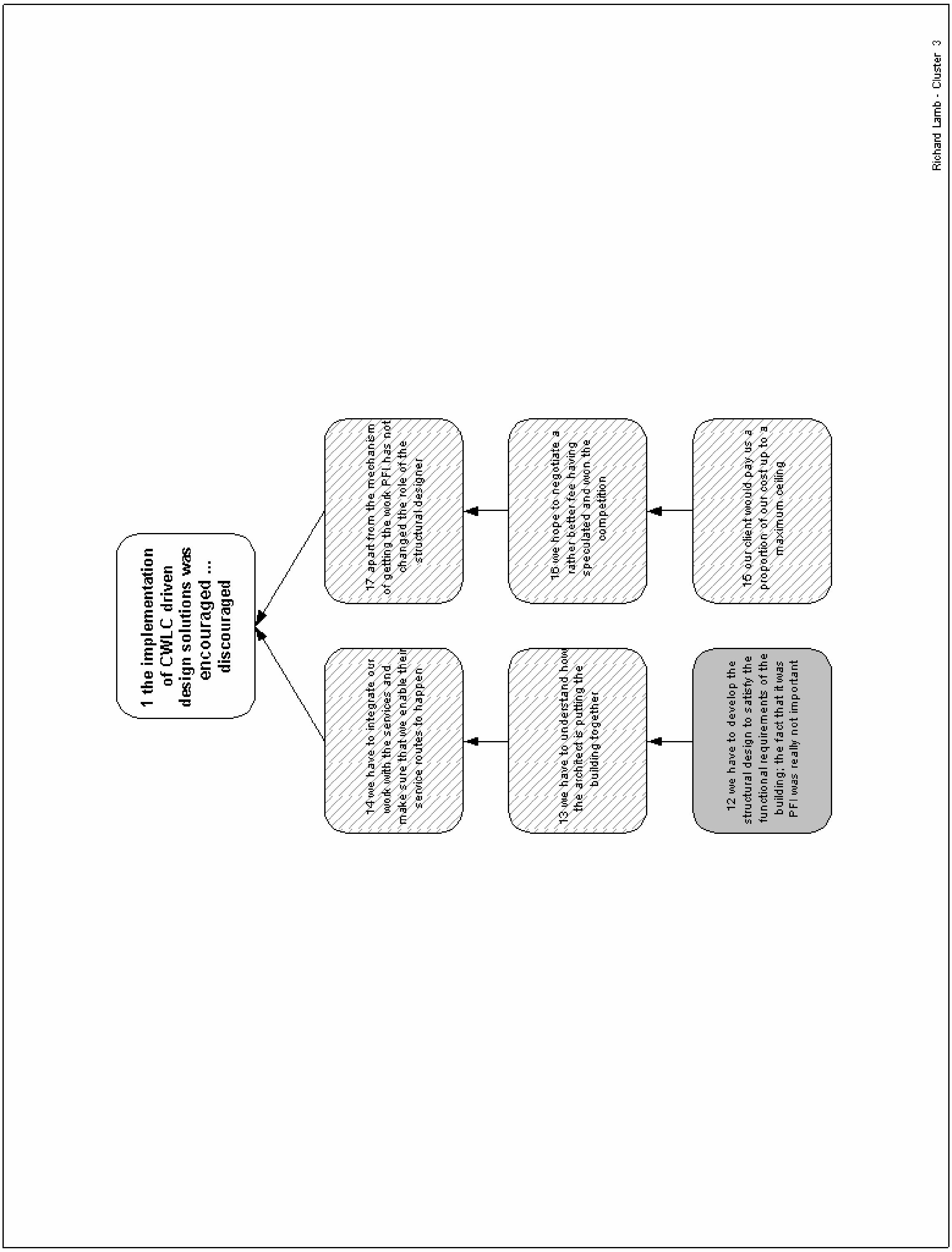

Figure A3.19. Lamb storyline map Cluster 3.

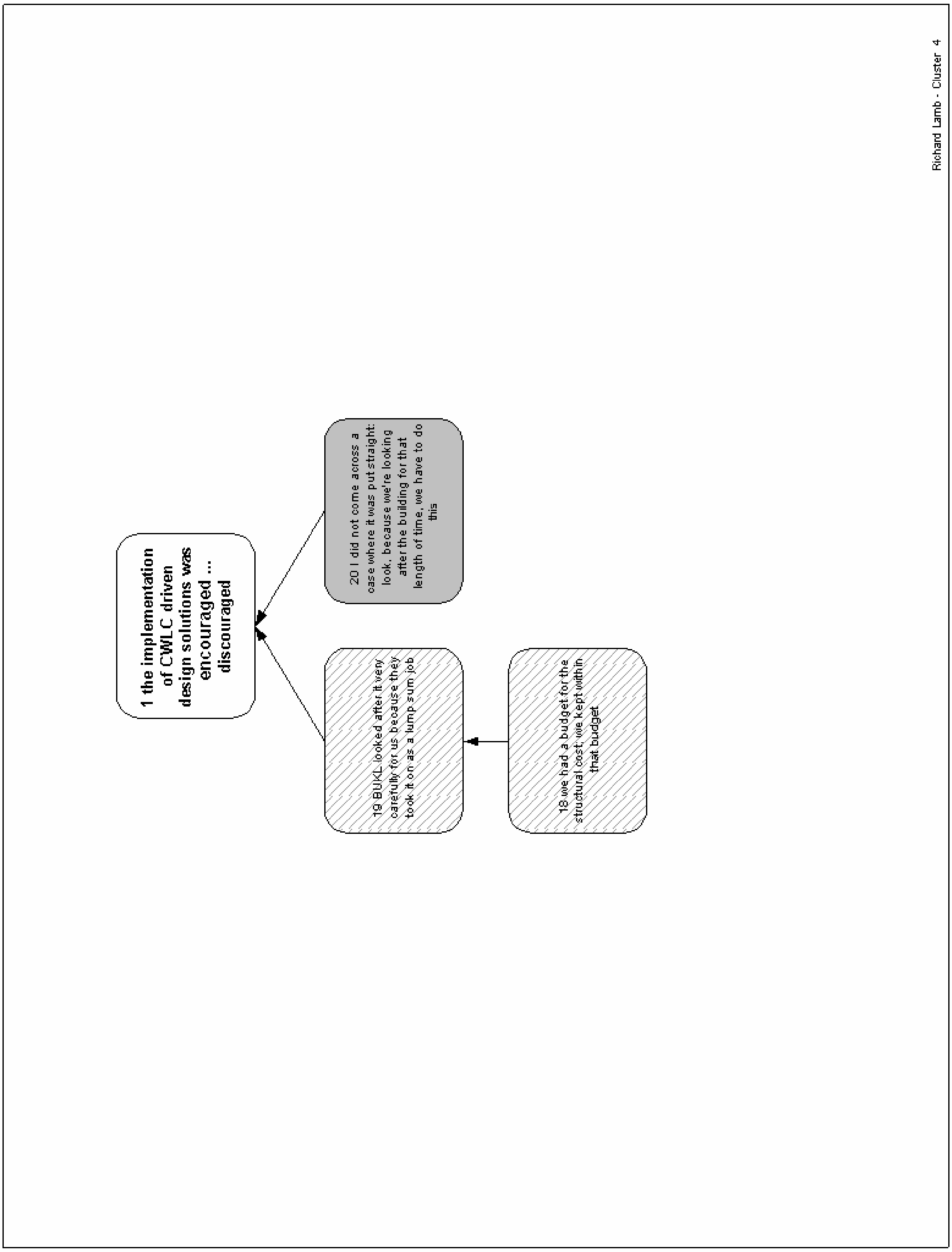

Figure A3.20. Lamb storyline map Cluster 4.

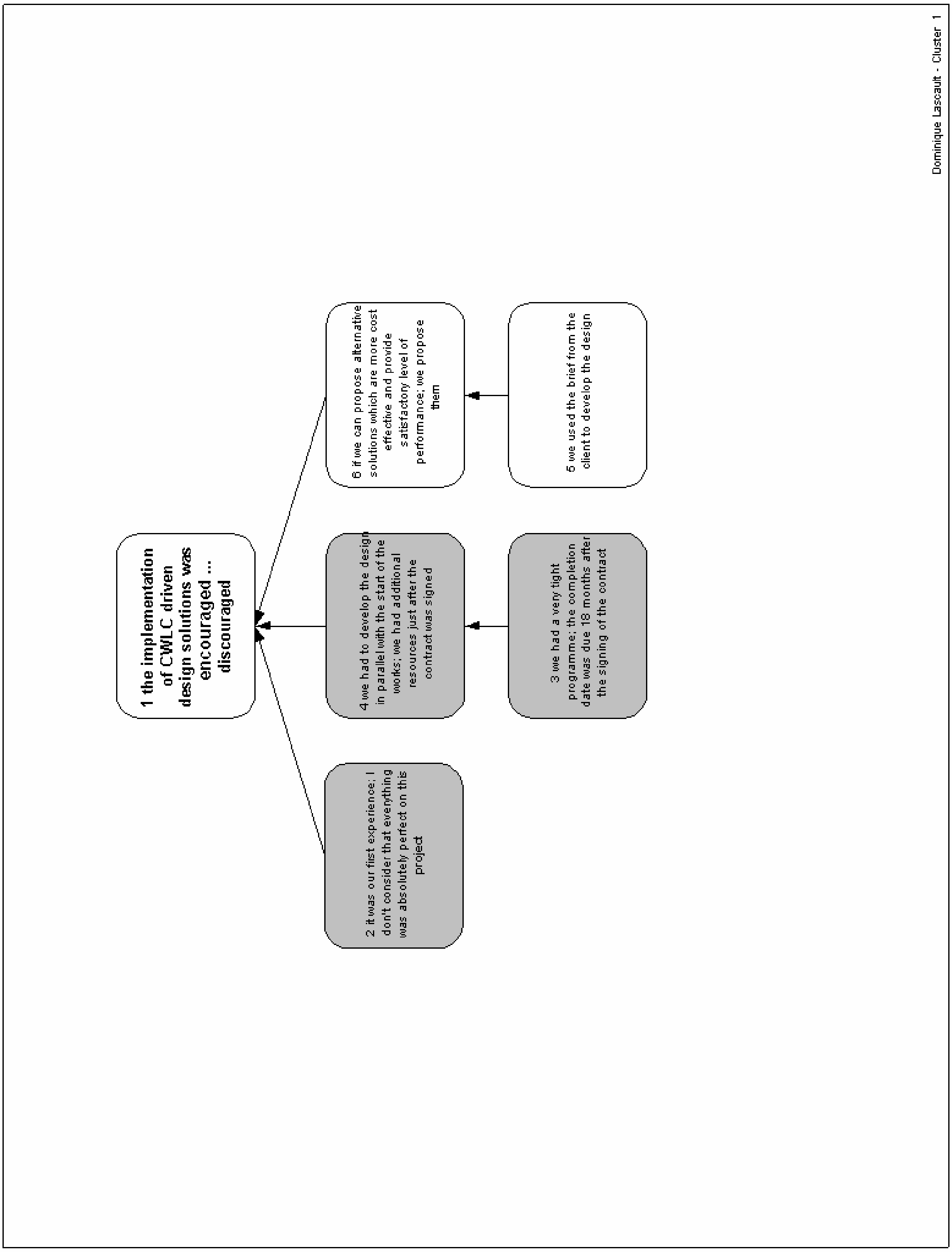

Figure A3.21. Lascault storyline map Cluster 1.

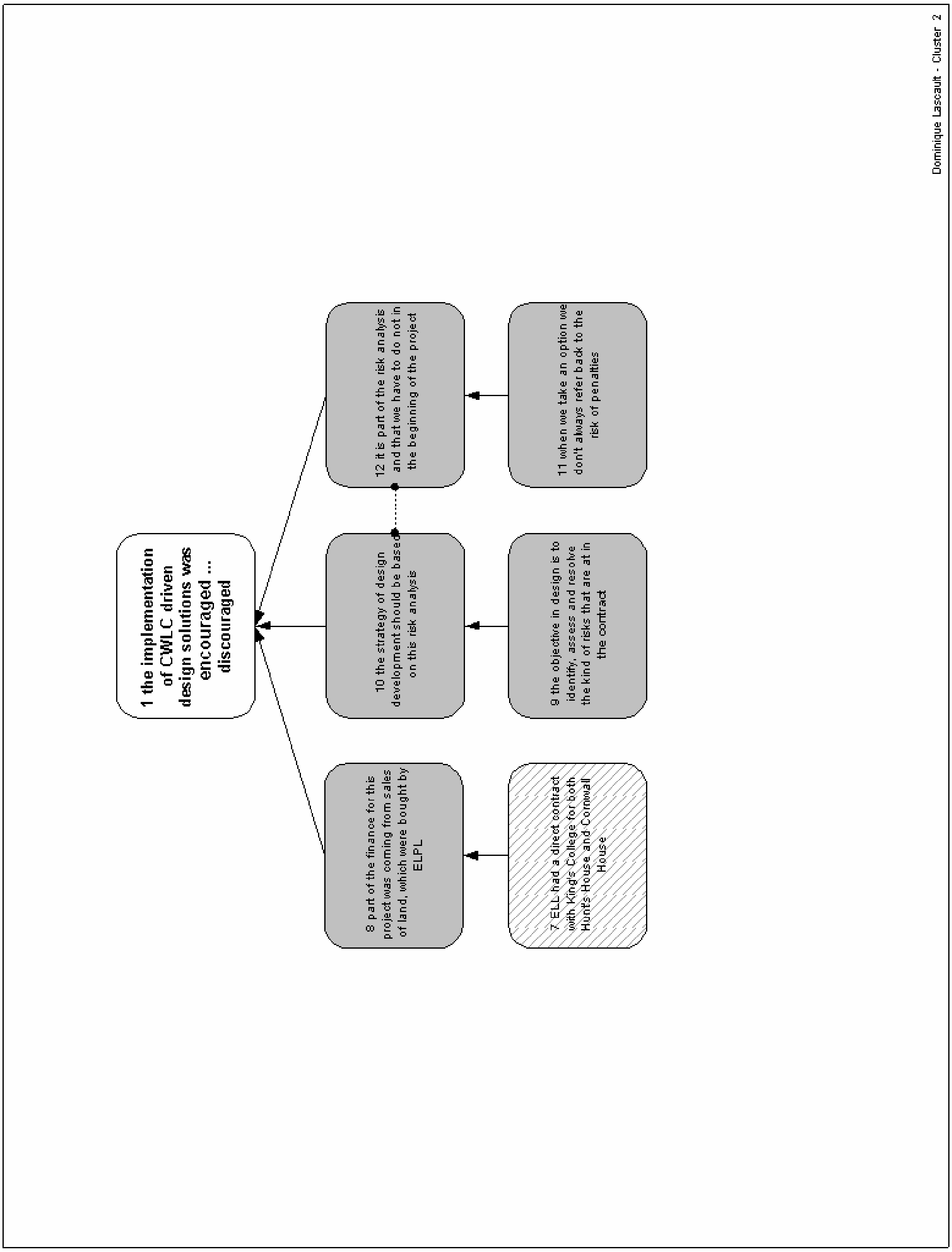

Figure A3.22. Lascault storyline map Cluster 2.

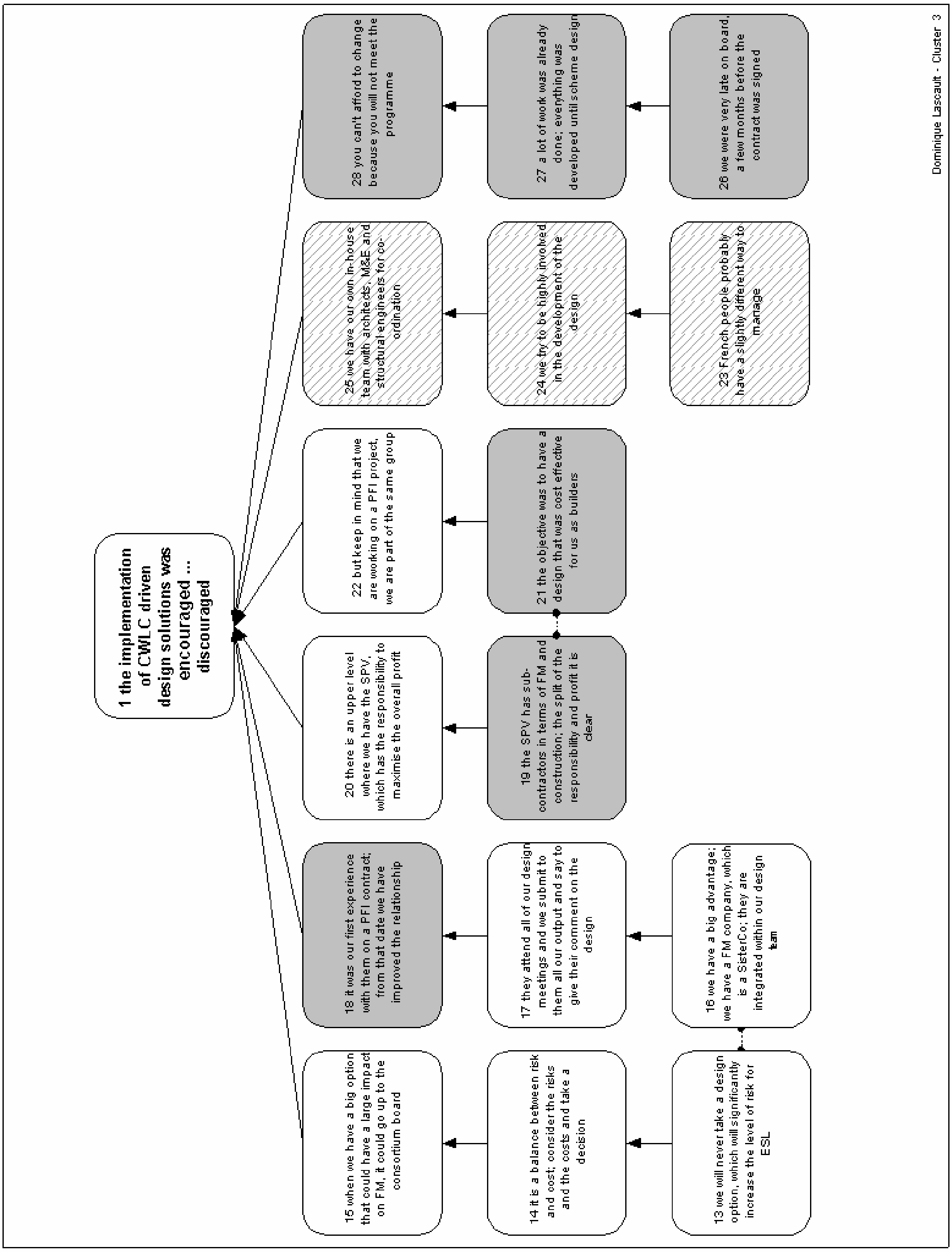

Figure A3.23. Lascault storyline map Cluster 3.

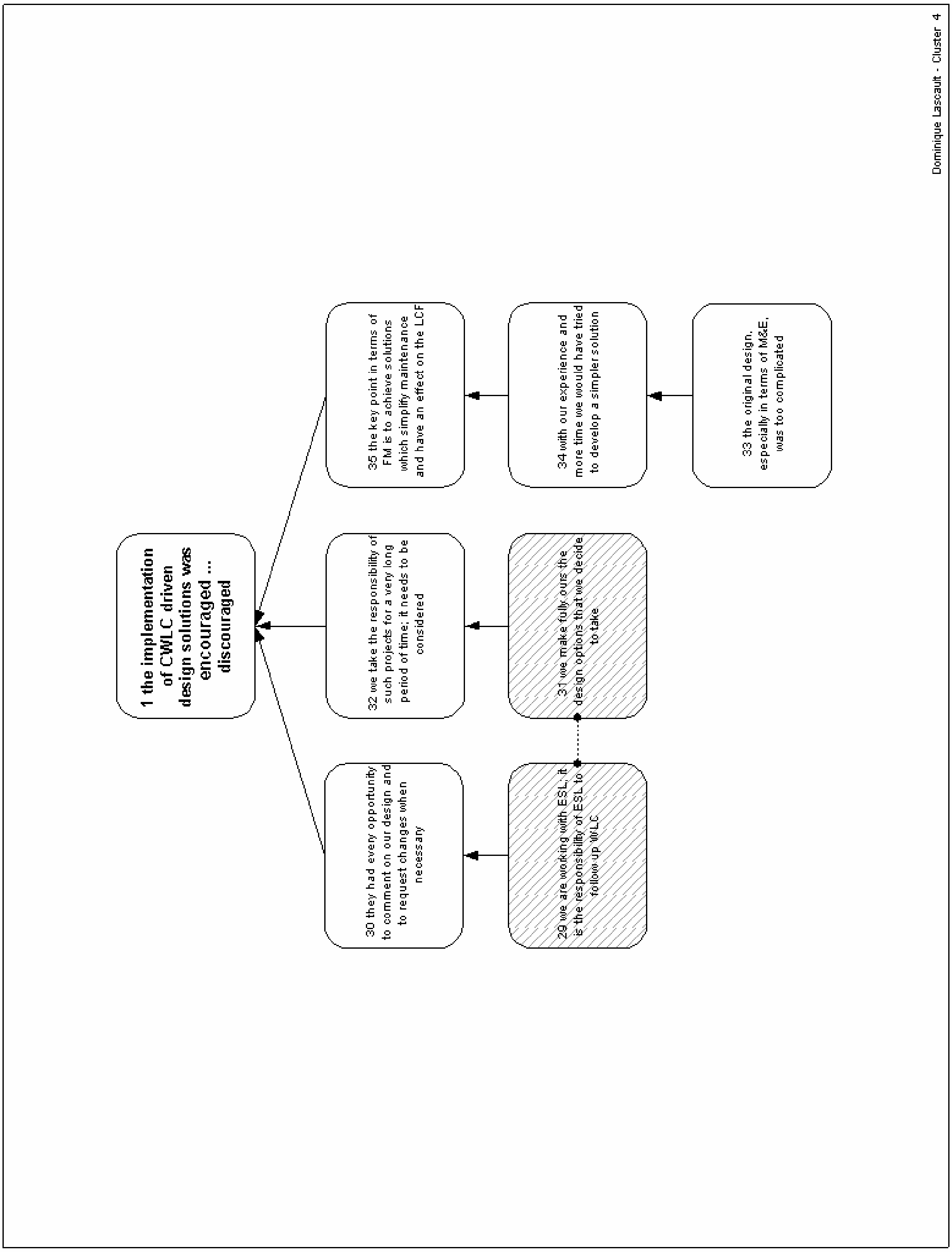

Figure A3.24. Lascault storyline map Cluster 4.

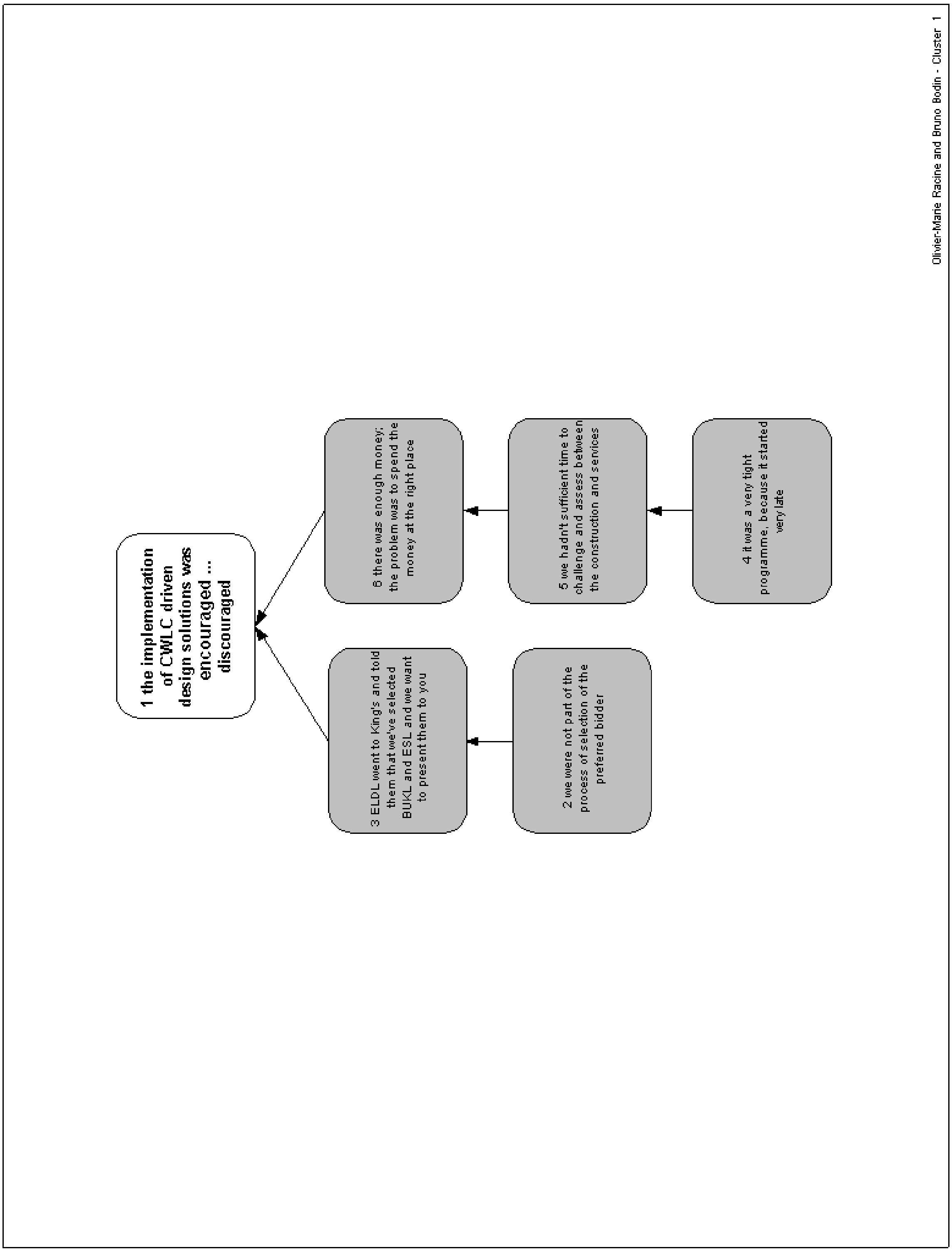

Figure A3.25. Racine and Bodin storyline map Cluster 1.

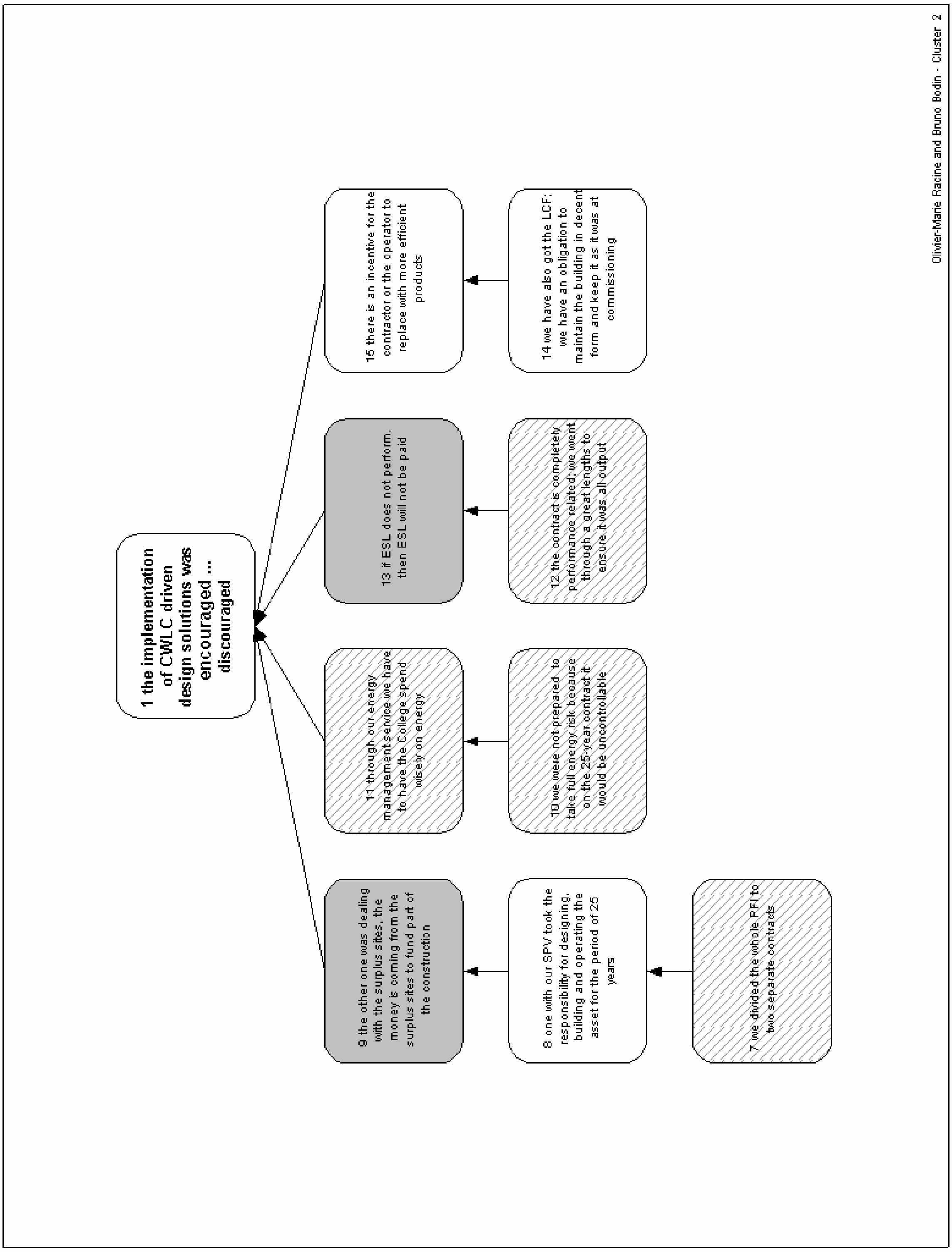

Figure A3.26. Racine and Bodin storyline map Cluster 2.

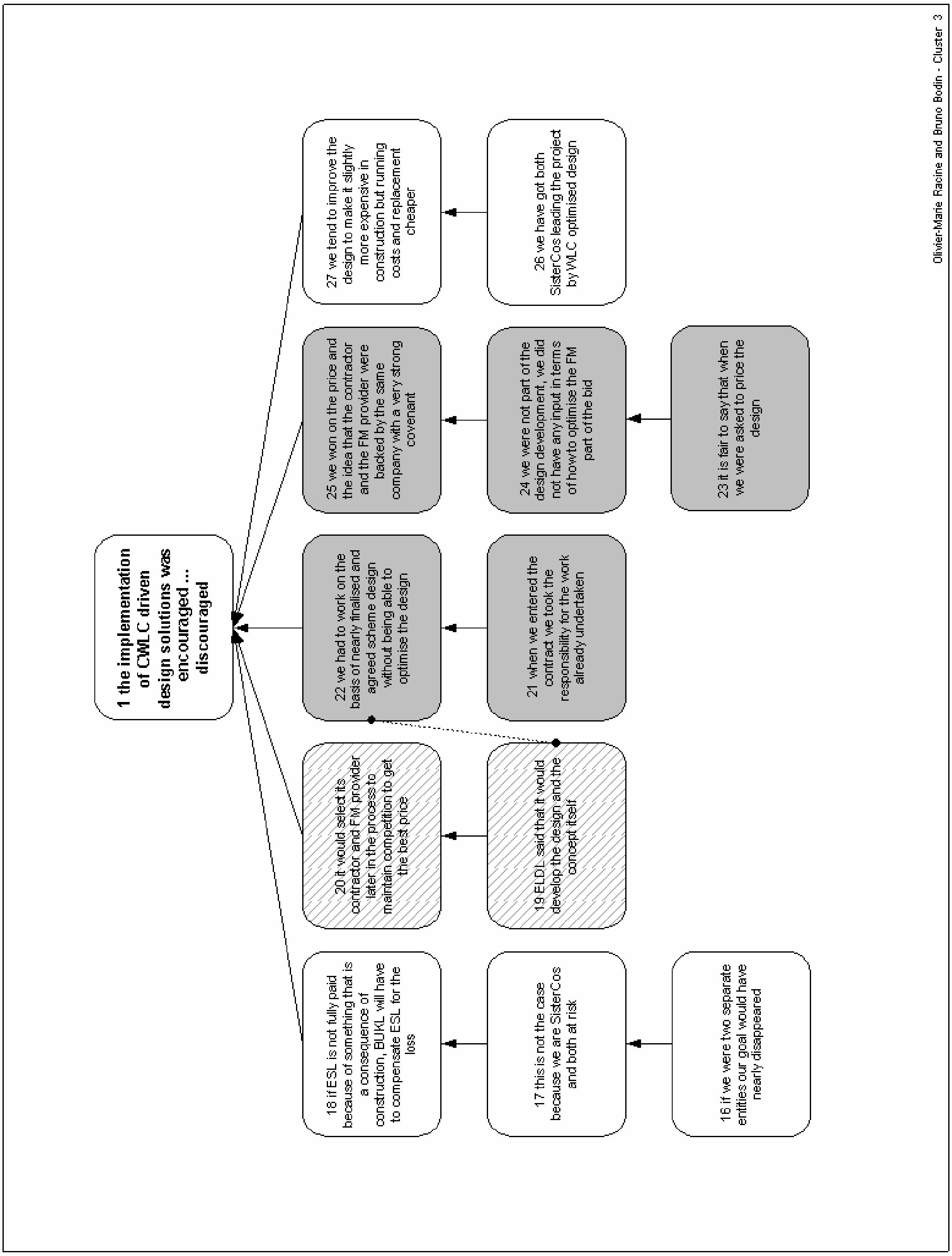

Figure A3.27. Racine and Bodin storyline map Cluster 3.

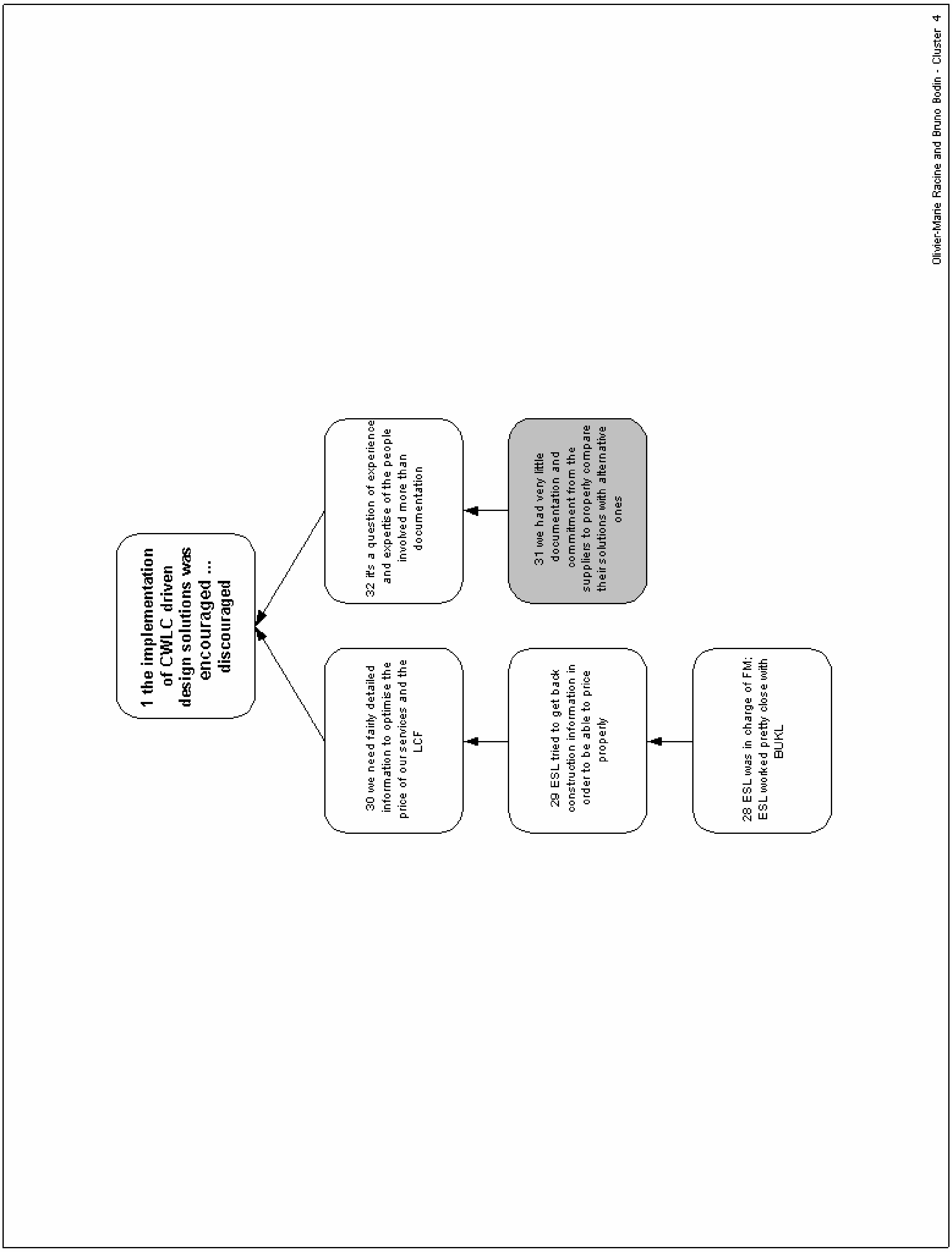

Figure A3.28. Racine and Bodin storyline map Cluster 4.

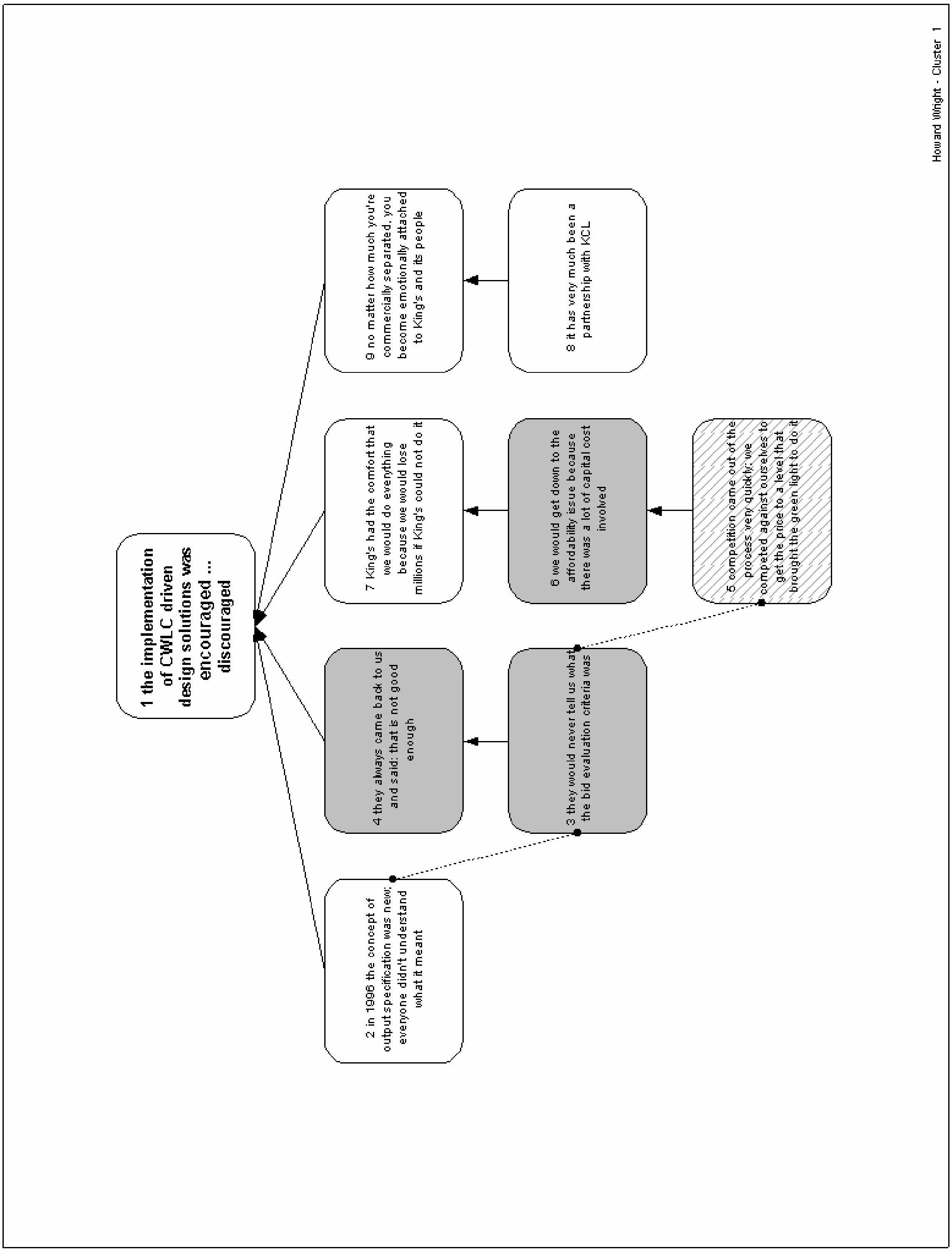

Figure A3.29. Wright storyline map Cluster 1.

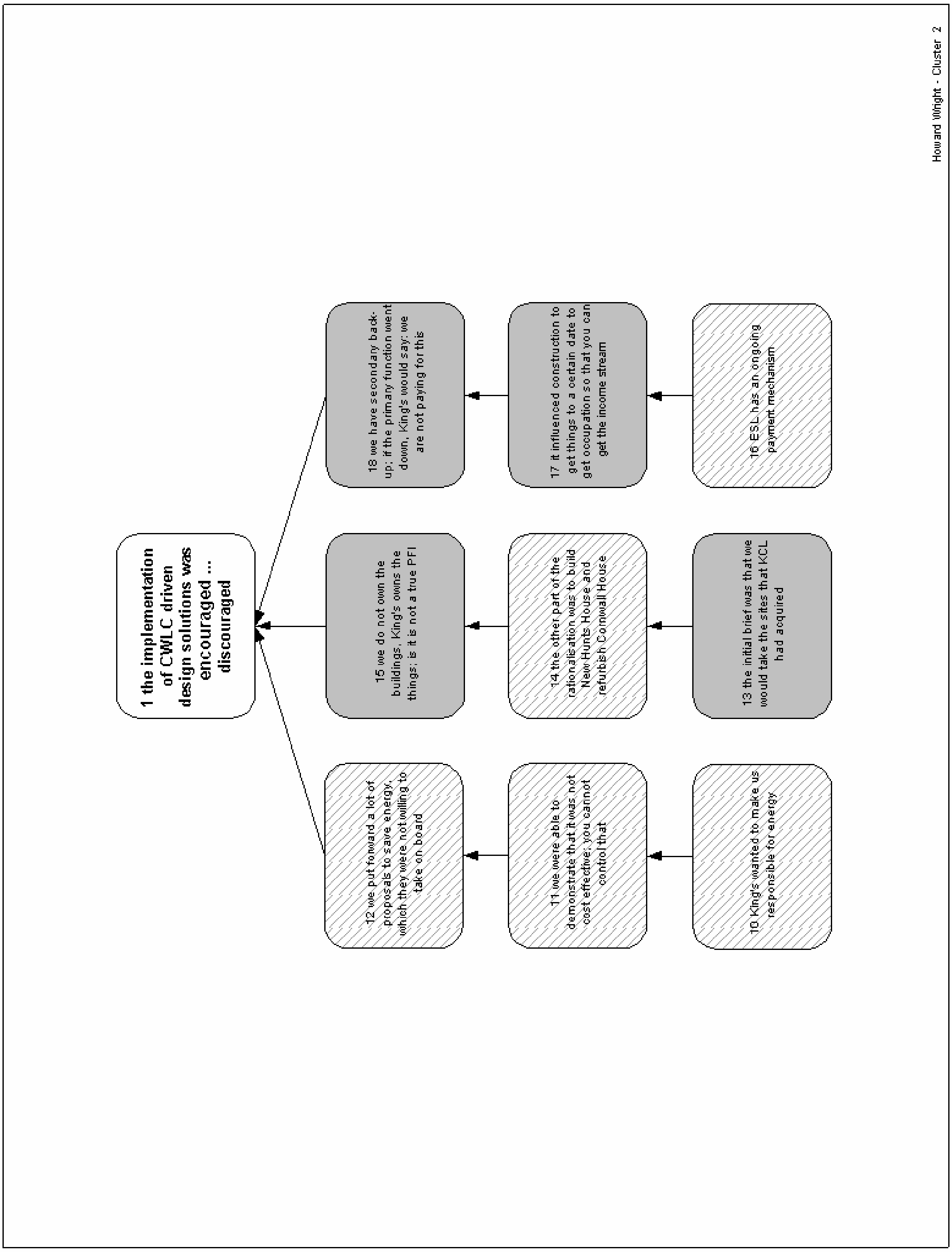

Figure A3.30. Wright storyline map Cluster 2.

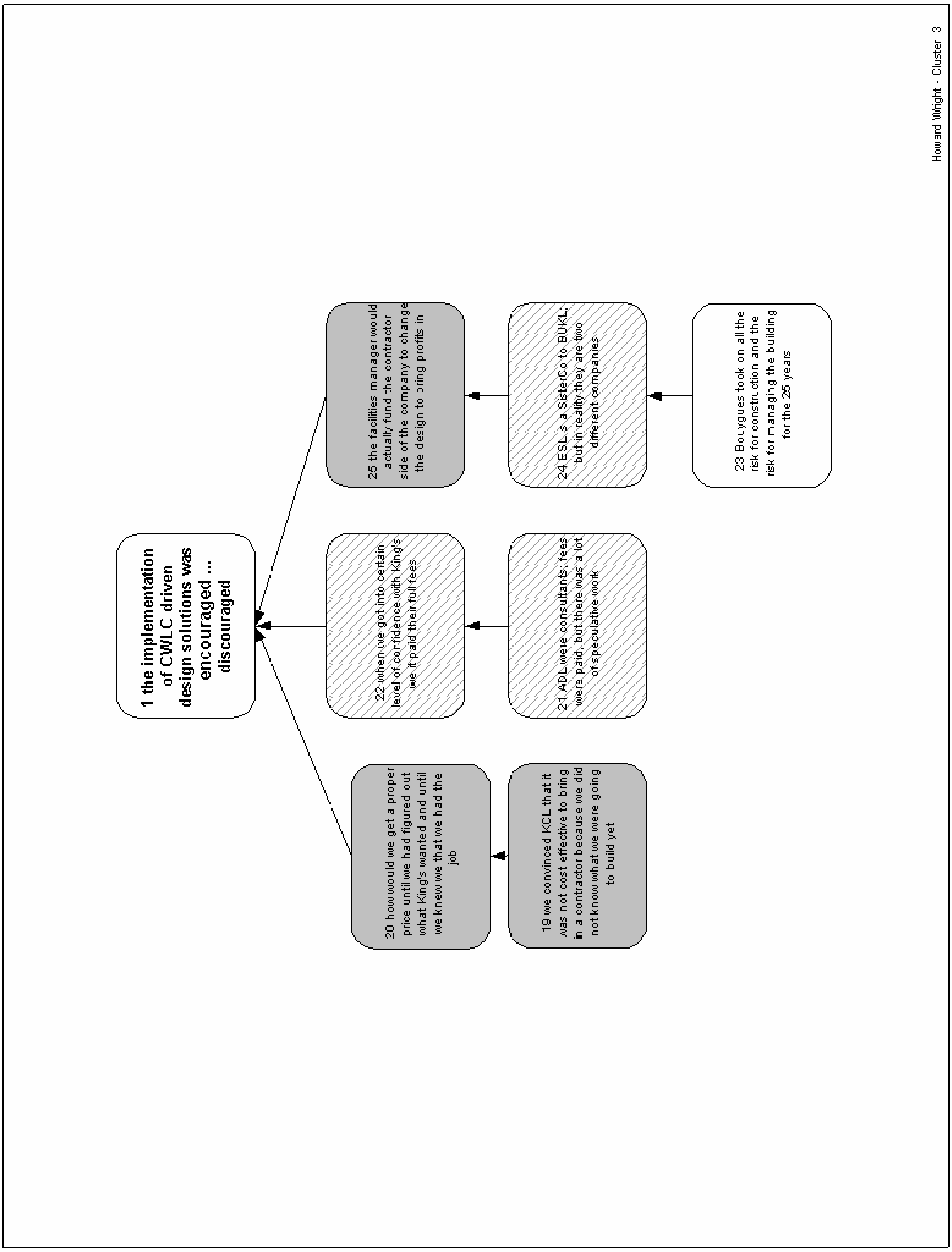

Figure A3.31. Wright storyline map Cluster 3.

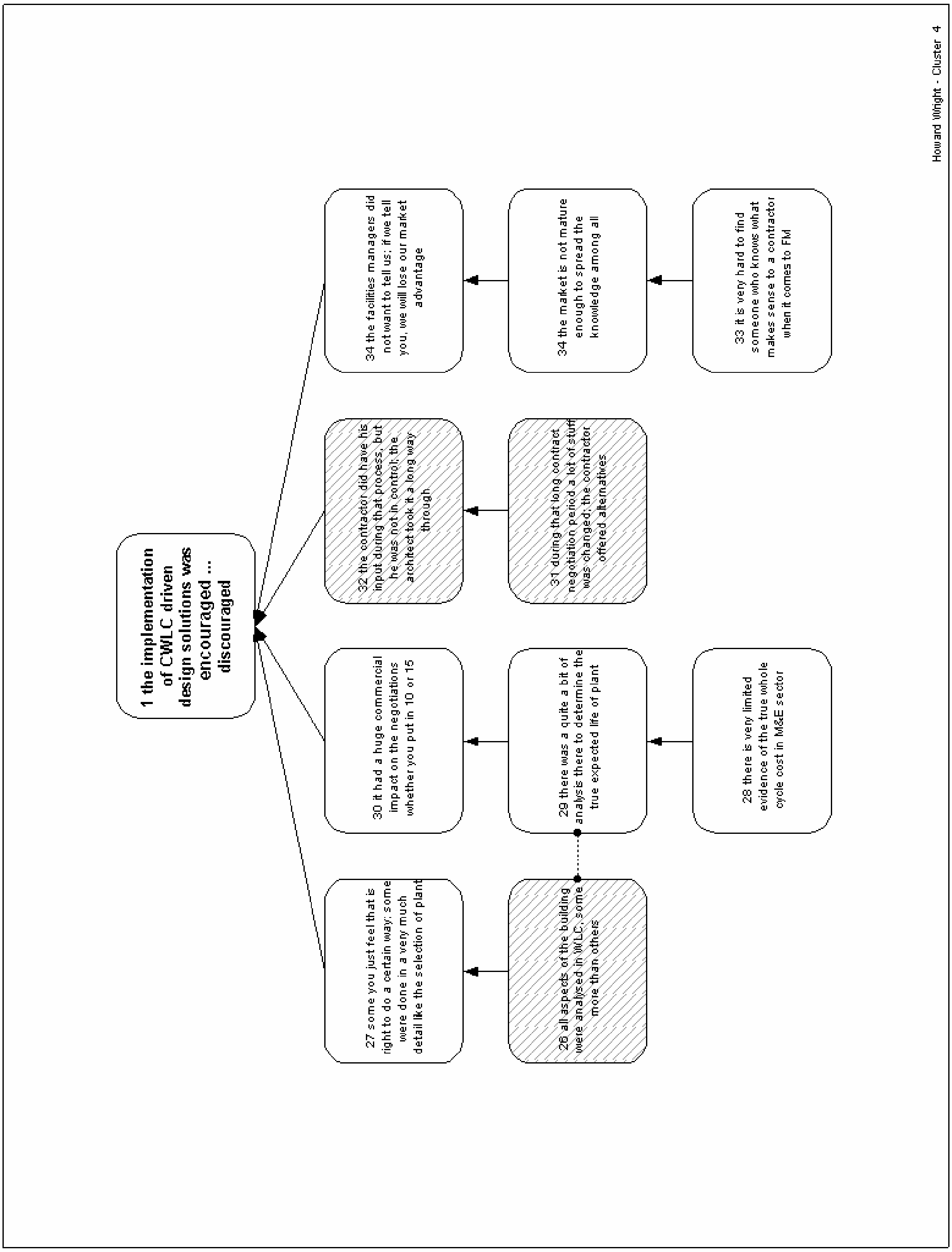

Figure A3.32. Wright storyline map Cluster 4.

APPENDIX IV

Actor	Cluster	7(PA)/1	7(PA)/2	7(PA)/3	7(PA)/4	7(PA)/5	7(PA)/6	7(PA)/7	7(PA)/8
Box	1		6,7						
	2			10,11					22,23
	3								
	4								
Cross	1	2,3	4,5,6						
	2								8,9
	3	14,15,19,20				16,17,18			
	4								
Green	1	2,3							
	2			7					
	3	8,9,10,11,12,13				14,15			
	4								
Holliday	1	2,3							
	2		9,10						13,14,15
	3	21,22,23							
	4								

Figure A4.1. Links between storyline maps and perception analysis boxes – part I.

Actor	Cluster	7(PA)/9	7(PA)/10	7(PA)/11	7(PA)/12	7(PA)/13	7(PA)/14	7(PA)/15
Box	1	2,3,4			5			8,9
	2		15,16,17,18,20, 21	12,13,14				
	3					24,25,26,27	28,29,30	
	4			31,32,33			34,35,36,37,38	
Cross	1	7						
	2		10					
	3			21,22		11,12,13		
	4						23,24,25,26,27, 28	
Green	1						4,5,6	
	2							
	3					16,17,18,19,20, 21,22,23		
	4						24,25,26,27,28	
Holliday	1	7,8			4,5,6			
	2		16,17,18	11,12		19,20		
	3					24,25,26,27,28, 29,30,31,32	33,34,35	
	4							

Figure A4.2. Links between storyline maps and perception analysis boxes – part II.

Actor	Cluster	7(PA)/1	7(PA)/2	7(PA)/3	7(PA)/4	7(PA)/5	7(PA)/6	7(PA)/7	7(PA)/8
Lascault	1	4,5,6					7,8,9		
	2			10,11					
	3					15,16,17	12,13,14		
	4								
Lamb	1		5,6						
	2			7,8					
	3								
	4								
Racine&Bodin	1	2,3							
	2			7,9					10,11
	3	19,20,21,22,23, 24,25							
	4							31,32	
Wright	1		2,3,4		2,3,4				
	2			13,14,15					10,11,12
	3	19,20				21,22			
	4	31,32						26,27,28,29,30, 33,34,35	

Figure A4.3. Links between storyline maps and perception analysis boxes – part III.

Actor	Cluster	7(PA)/9	7(PA)/10	7(PA)/11	7(PA)/12	7(PA)/13	7(PA)/14	7(PA)/15
Lascault	1					2,3		
	2							
	3							
	4						18,19,20	
Lamb	1				3,4	2		
	2		11,12			9,10		
	3				26,27,28	14,15,16,17,18, 19,20,21,22	23,24,25	
	4					33,34,35	29,30,21,32	
Racine&Bodin	1				4,5,6			
	2		12,13	8,14,15				
	3					16,17,18,26,27		
	4						31,32	
Wright	1	5,6,9						8,9
	2		16,17,18					
	3					23,24,25		
	4							

Figure A4.4. Links between storyline maps and perception analysis boxes – part IV.

APPENDIX V

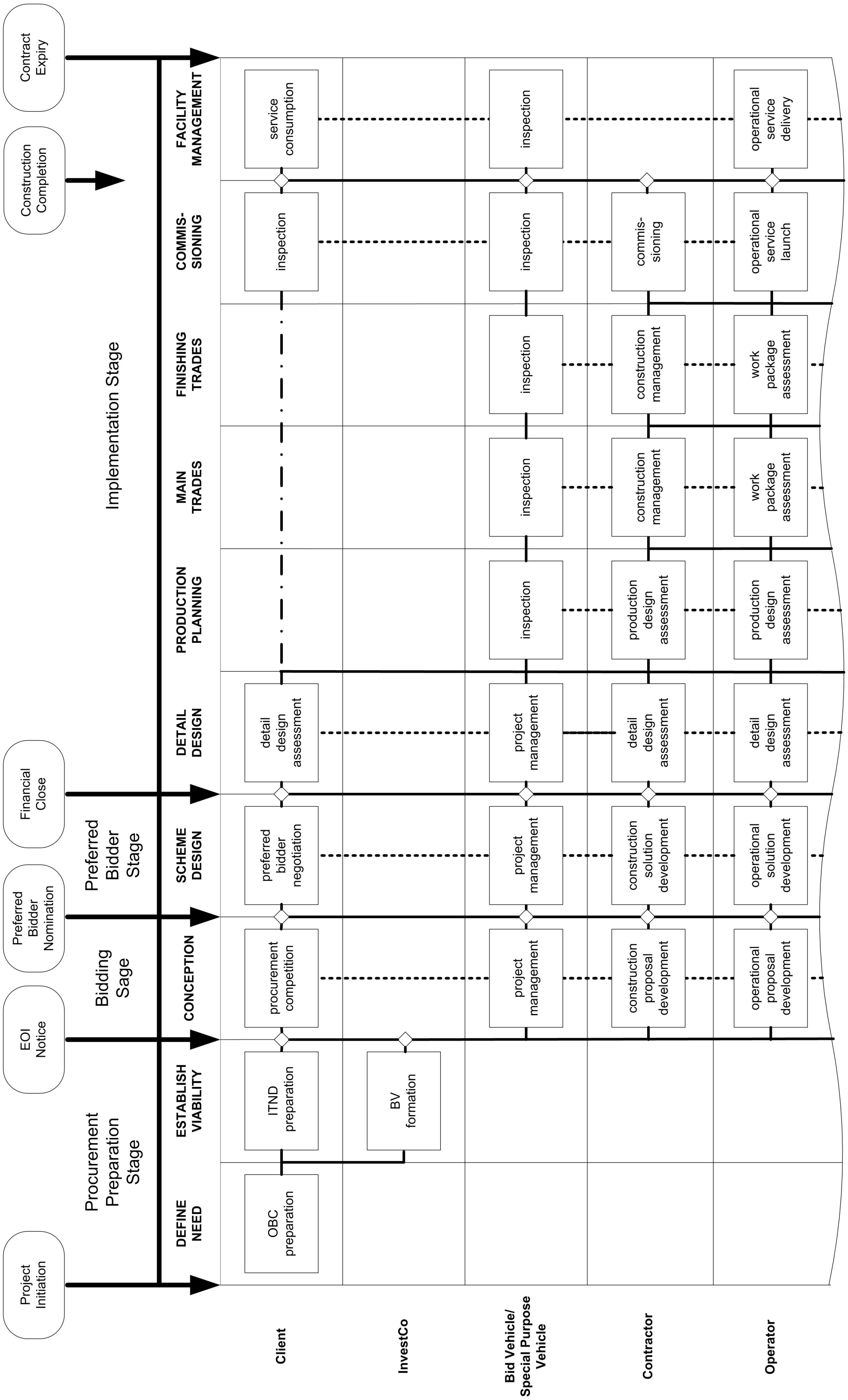

Figure A5.1. UCLH Gower Street Redevelopment process protocol map – Part I.

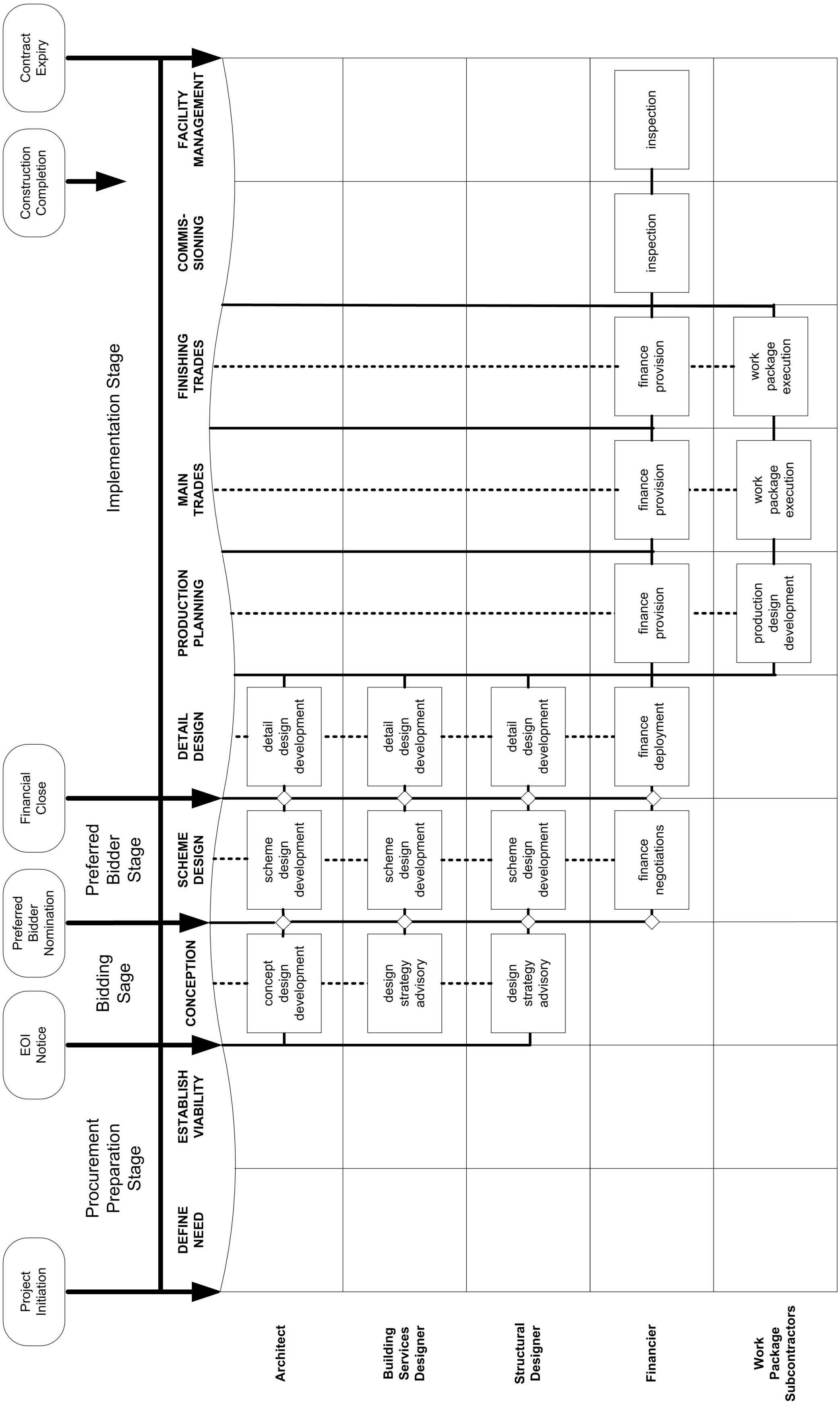

Figure A5.2. UCLH Gower Street Redevelopment process protocol map – Part II.

APPENDIX VI

Procurement Preparation Stage		
Client - UCLH		
Role	***PFI Procurement***	***Traditional Construction & Service Procurement***
Developer	- develop OBC (case for PFI procurement) - develop ITND - develop PSC project	- develop FBC (case for traditional procurement) - obtain finance for design and construction - develop Invitation to Tender Documentation
Designer	- procure concept design solution for PSC project	- procure architectural concept, scheme & detail design solutions - procure building services scheme & detail design solutions - procure structural scheme & detail design solutions
Builder	- procure capital cost estimate for PSC project	- procure capital cost estimate
Operator	- procure operational cost estimate for PSC project	
Owner		
User		

Figure A6.1. Client actor-role matrix part I.

Bidding Stage		
Client - UCLH		
Role	***PFI Procurement***	***Traditional Construction & Service Procurement***
Developer	- prequalify ProjectCos to bid for the project - issue ITND to ProjectCos - evaluate SPS submission - appoint preferred bidder	- preselect contractors to bid for the project - issue Invitation to Tender documentation to contractors
Designer	- evaluate concept design solution (part of SPS)	
Builder	- evaluate (concept) construction solution (part of SPS)	- evaluate tenders - appoint contractor
Operator	- evaluate (concept) operational solution (part of SPS)	
Owner		
User	- evaluate (concept) spatial design solution (part of SPS)	

Figure A6.2. Client actor-role matrix part II.

Preferred Bidder Stage		
Client - UCLH		
Role	***PFI Procurement***	***Traditional Construction & Service Procurement***
Developer	- assess and agree SPS and UP - develop FBC (case for DBFO contract award) - award DBFO contract	
Designer	- assess and agree engineering scheme design solution	
Builder	- assess and agree (scheme) construction solution	
Operator	- assess and agree (scheme) operational solution	
Owner		
User	- assess and agree spatial scheme design solution	

Figure A6.3. Client actor-role matrix part III.

Implementation Stage		
Client - UCLH		
Role	***PFI Procurement***	***Traditional Construction & Service Procurement***
Developer		
Designer		
Builder	- approve commissioning	- procure construction monitoring - approve commissioning
Operator		- procure operational services
Owner	- accept operational service provision	- own facility - procure major maintenance and replacement
User	- assess and agree spatial detail design solution - consume accommodation service - provide core services in new facilities	- provide core services in new facilities

Figure A6.4. Client actor-role matrix part IV.

Procurement Preparation Stage		
Investment Company - AMEC/BPGL/APIL/BBCPL/IIL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- monitor market for opportunities in PFI - monitor UCLH's progress in procurement - establish BV	
Designer		
Builder		
Operator		
Owner		
User		

Figure A6.5. InvestCo actor-role matrix part I.

Bidding Stage		
Investment Company - AMEC/BPGL/APIL/BBCPL/IIL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- supply project management resources to BV	
Designer	- supply design management resources to BV	
Builder	- supply construction management resources to BV	
Operator	- supply facilities management resources to BV	
Owner		
User		

Figure A6.6. InvestCo actor-role matrix part II.

Preferred Bidder Stage		
Investment Company - AMEC/BPGL/APIL/BBCPL/IIL		
Role	PFI Development	Traditional Construction & Operational Service Development
Developer	- supply project management resources to BV - establish SPV	
Designer	- supply design management resources to BV	
Builder	- supply construction management resources to BV	
Operator	- supply facilities management resources to BV	
Owner		
User		

Figure A6.7. InvestCo actor-role matrix part III.

Implementation Stage		
Investment Company - AMEC/BPGL/APIL/BBCPL/IIL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- supply project management resources to SPV	
Designer	- supply design management resources to SPV	
Builder	- supply construction management resources to SPV	
Operator	- supply facilities management resources to SPV	
Owner	- invest equity in SPV - receive dividends - manage SPV	
User		

Figure A6.8. InvestCo actor-role matrix part IV.

Procurement Preparation Stage		
Bid Vehicle/Special Purpose Vehicle - HMG/HMU		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- monitor UCLH's progress in procurement - formulate bidding strategy	
Designer	- establish relationship with architect	
Builder	- establish relationship with contractor	
Operator	- establish relationship with operator	
Owner		
User		

Figure A6.9. BV/SPV actor-role matrix part I.

Bidding Stage		
Bid Vehicle/Special Purpose Vehicle - HMG/HMU		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- assemble ProjectCo - prequalify to bid for the project - manage (concept) SPS development - obtain advise on project financing - submit SPS	
Designer	- procure architectural concept design solution - obtain advise on and develop building services strategy - obtain advise on and develop structural strategy	
Builder	- procure (concept) construction solution	
Operator	- procure (concept) operational solution	
Owner		
User		

Figure A6.10. BV/SPV actor-role matrix part II.

Preferred Bidder Stage		
Bid Vehicle/Special Purpose Vehicle - HMG/HMU		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- manage (scheme) SPS development - obtain advise on WLC and price SPS - novate architect to contractor - obtain project finance	
Designer	- procure architectural scheme design solution	
Builder	- procure (scheme) construction solution	
Operator	- procure (scheme) operational solution	
Owner	- develop LCF (major maintenance and replacement)	
User		

Figure A6.11. BV/SPV actor-role matrix part III.

Implementation Stage		
Bid Vehicle/Special Purpose Vehicle - HMG/HMU		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer	- repay project finance with interest	
Designer	- assess and approve detail design solution	
Builder	- award and manage DB contract - assess and approve (detail) construction solution	
Operator	- award and manage operation contract - assess and approve (detail) operational solution	
Owner	- own project facility - deliver accommodation service - manage LCF (major maintenance and replacement)	
User		

Figure A6.12. BV/SPV actor-role matrix part IV.

Procurement Preparation Stage		
Contractor - HCTJV (ACL/MHL) / BCJV (ACPL/BBCL/HYL)		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer		
Builder		- monitor market for construction opportunities
Operator		
Owner		
User		

Figure A6.13. Contractor actor-role matrix part I.

Bidding Stage		
Contractor - HCTJV (ACL/MHL) / BCJV (ACPL/BBCL/HYL)		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide feedback on architectural concept design solution - provide feedback on building services strategy - provide feedback on structural strategy	
Builder	- prequalify to bid for the project as part of ProjectCo - develop (concept) construction solution - bid for the project as part of ProjectCo	- bid for construction
Operator	- provide feedback on the (concept) operational solution	
Owner		
User		

Figure A6.14. Contractor actor-role matrix part II.

Preferred Bidder Stage		
	Contractor - HCTJV (ACL/MHL) / BCJV (ACPL/BBCL/HYL)	
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide feedback on architectural scheme design solution - take ownership of architectural scheme design solution - procure building services scheme design solution - procure structural scheme design solution	
Builder	- develop (scheme) construction solution	
Operator	- provide feedback on (scheme) operational solution	
Owner	- provide feedback on LCF (major maintenance and replacement)	
User		

Figure A6.15. Contractor actor-role matrix part III.

Implementation Stage		
Contractor - HCTJV (ACL/MHL) / BCJV (ACPL/BBCL/HYL)		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide feedback on architectural detail design solution - provide feedback on building services detail design solution - provide feedback on structural detail design solution - develop building services production design	
Builder	- develop (detail) construction solution - procure work package subcontracts, products and labour - manage construction - construct - commission	- manage construction - procure subcontracts - construct - commission
Operator	- provide feedback on (detail) operational solution	
Owner		
User		

Figure A6.16. Contractor actor-role matrix part IV.

Procurement Preparation Stage		
Operator - BPFML/IFML		
Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer		
Designer		
Builder		
Operator		- monitor market for operation opportunities
Owner		
User		

Figure A6.17. Operator actor-role matrix part I.

Bidding Stage		
Operator - BPFIML/IFML		
Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer		
Designer	- provide feedback on architectural concept design solution - provide feedback on building services strategy - provide feedback on structural strategy	
Builder	- provide feedback on (concept) construction solution	
Operator	- prequalify to bid for the project as part of ProjectCo - develop (concept) operational solution - bid for the project as part of ProjectCo	- monitor market for operation opportunities
Owner		
User		

Figure A6.18. Operator actor-role matrix part II.

Preferred Bidder Stage		
Operator - BPFIML/IFML		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide feedback on architectural scheme design solution - provide feedback on building services scheme design solution - provide feedback on structural scheme design solution	
Builder	- provide feedback on (scheme) construction solution	
Operator	- develop (scheme) operational solution	- monitor market for operation opportunities
Owner	- provide feedback on LCF (major maintenance and replacement)	
User		

Figure A6.19. Operator actor-role matrix part III.

Implementation Stage		
Operator - BPFML/IFML		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide feedback on architectural detail design solution - provide feedback on building services detail design solution - provide feedback on structural detail design solution	
Builder	- provide feedback on (detail) construction solution - provide feedback on subcontractor, supplier and product selection	
Operator	- develop (detail) operational solution - manage and deliver operational service provision - procure operational service subcontracts	- bid for operation contracts - provide operational services
Owner		
User		

Figure A6.20. Operator actor-role matrix part IV.

Procurement Preparation Stage		
Architect - LDL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- monitor market for design opportunities in PFI	- monitor market for design opportunities - develop architectural concept, scheme & detail design solutions - coordinate buildings services scheme & detail design solution - coordinate structural scheme & detail design solution
Builder		
Operator		
Owner		
User		

Figure A6.21. Architect actor-role matrix part I.

Bidding Stage		
Architect - LDL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- prequalify to bid for the project as part of ProjectCo - develop architectural concept design solution - provide feedback on building services strategy - provide feedback on structural strategy - bid for the project as part of ProjectCo	
Builder	- provide feedback on the (concept) construction solution	
Operator	- provide feedback on the (concept) operational solution	
Owner		
User		

Figure A6.22. Architect actor-role matrix part II.

Preferred Bidder Stage		
	Architect - LDL	
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop architectural scheme design solution - coordinate building services scheme design solution - coordinate structural scheme design solution	
Builder	- provide feedback on (scheme) construction solution	
Operator	- provide feedback on (scheme) operational solution	
Owner	- provide feedback on LCF (major maintenance and replacement)	
User		

Figure A6.23. Architect actor-role matrix part III.

Implementation Stage		
Architect - LDL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop architectural detail design solution - coordinate building services detail design solution - coordinate structural detail design solution	
Builder	- provide feedback on (detail) construction solution	- monitor construction
Operator	- provide feedback on (detail) operational solution	
Owner		
User		

Figure A6.24. Architect actor-role matrix part IV.

Procurement Preparation Stage		
Building Services Designer - DSSRL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- monitor market for design opportunities in PFI	- monitor market for design opportunities - develop building services scheme & detail design solutions - provide feedback on architectural scheme & detail design solutions - provide feedback on structural scheme & detail design solutions
Builder		
Operator		
Owner		
User		

Figure A6.25. Building services designer actor-role matrix part I.

Bidding Stage		
Building Services Designer - DSSRL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide advise on building services strategy - provide feedback on architectural concept design solution - provide feedback on structural strategy	
Builder	- provide feedback on the (concept) construction solution	
Operator	- provide feedback on the (concept) operational solution	
Owner		
User		

Figure A6.26. Building services designer actor-role matrix part II.

Preferred Bidder Stage		
Building Services Designer - DSSRL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop building services scheme design solution - provide feedback on architectural scheme design solution - provide feedback on structural scheme design solution	
Builder	- provide feedback on (scheme) construction solution	
Operator	- provide feedback on (scheme) operational solution	
Owner	- provide feedback on LCF (major maintenance and replacement)	
User		

Figure A6.27. Building services designer actor-role matrix part III.

Implementation Stage		
Building Services Designer - DSSRL		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop building services detail design solution - provide feedback on architectural detail design solution - provide feedback on structural detail design solution	
Builder	- provide feedback on (detail) construction solution	- monitor construction
Operator	- provide feedback on (detail) operational solution	
Owner		
User		

Figure A6.28. Building services designer actor-role matrix part IV.

Procurement Preparation Stage		
Structural Designer - CNML		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- monitor market for design opportunities in PFI	- monitor market for design opportunities - develop structural scheme & detail design solutions - provide feedback on architectural scheme & detail design solutions - provide feedback on building services scheme & detail design solutions
Builder		
Operator		
Owner		
User		

Figure A6.29. Structural designer actor-role matrix part I.

Bidding Stage		
Structural Designer - CNML		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- provide advice on structural strategy - provide feedback on architectural concept design solution - provide feedback on building services strategy	
Builder	- provide feedback on the (concept) construction solution	
Operator	- provide feedback on the (concept) operational solution	
Owner		
User		

Figure A6.30. Structural designer actor-role matrix part II.

Preferred Bidder Stage		
Structural Designer - CNML		
Role	***PFI Development***	***Traditional Construction & Operational Service Development***
Developer		
Designer	- develop structural scheme design solution - provide feedback on architectural scheme design solution - provide feedback on building services scheme design solution	
Builder	- provide feedback on (scheme) construction solution	
Operator	- provide feedback on (scheme) operational solution	
Owner	- provide feedback on LCF (major maintenance and replacement)	
User		

Figure A6.31. Structural designer actor-role matrix part III.

Implementation Stage

Structural Designer - CNML

Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer		
Designer	- develop structural detail design solution - provide feedback on architectural detail design solution - provide feedback on building services detail design solution	
Builder	- provide feedback on (detail) construction solution	- monitor construction
Operator	- provide feedback on (detail) operational solution	
Owner		
User		

Figure A6.32. Structural designer actor-role matrix part IV.

Procurement Preparation Stage		
Financier - ANTS		
Role	PFI Development	Traditional Construction & Operational Service Development
Developer	- monitor market for financing opportunities in PFI	
Designer		
Builder		
Operator		
Owner		
User		

Figure A6.33. Financier actor-role matrix part I.

Bidding Stage		
Financier - ANTS		
Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer	- monitor market for financing opportunities in PFI	
Designer		
Builder		
Operator		
Owner		
User		

Figure A6.34. Financier actor-role matrix part II.

Preferred Bidder Stage		
Financier - ANTS		
Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer	- negotiate and agree terms of project financing	
Designer	- procure due diligence of engineering scheme design solution	
Builder	- procure due diligence of (scheme) construction solution	
Operator	- procure due diligence of operation solution	
Owner	- procure due diligence of LCF	
User	- procure due diligence of spatial scheme design solution	

Figure A6.35. Financier actor-role matrix part III.

Implementation Stage		
Financier - ANTS		
Role	*PFI Development*	*Traditional Construction & Operational Service Development*
Developer		
Designer	- procure engineering detail design development monitoring	
Builder	- procure construction monitoring	
Operator		
Owner	- deploy finance - procure spatial detail design development monitoring - obtain finance repayment with interest	
User		

Figure A6.36. Financier actor-role matrix part IV.

APPENDIX VII

Interviewees

Name:	Steve Blunt
Organisation:	BCJV (HYL)
Role:	Building Services Design Manager
Involvement:	May 2000 to date
Key responsibilities:	Management of building services design
Name:	John Brierley
Organisation:	IFML
Role:	New Build Manager
Involvement	January 2001 to date
Key responsibilities:	Management of operational solution development
Name:	Roger Colman
Organisation:	LDL
Role:	Design Team Leader
Involvement	July 2000 to date
Key responsibilities:	Management of architectural design
Name:	Roger Dolan
Organisation:	HMU (BPGL/IIL)
Role:	Operations Director
Involvement	April 1997 to date
Key responsibilities:	Management of BV
	Management of SPV
Name:	Bill Doughty
Organisation:	ANTS
Role:	Head of Infrastructure Finance
Involvement	late 1997 to date
Key responsibilities:	Management of project finance
Name:	Chris Field
Organisation:	HMU (AMEC plc/APIL)
Role:	General Manager
Involvement	July 2000 to date
Key responsibilities:	Management of SPV

Name:	Stuart Fraser
Organisation:	BCJV (self-employed)
Role:	Project Director
Involvement	July 2000 to end of case study research in December 2002
Key responsibilities:	Management of contractor

Name:	Claire Hird
Organisation:	CBL
Role:	Executive Director/Project Manager
Involvement	mid 1999 to end of case study research in December 2002
Key responsibilities:	Management of technical due diligence Construction monitoring

Name:	Alan Jeeves
Organisation:	BCJV (MHL/ACPL)
Role:	Operations Director
Involvement	early 1998 to end of case study research in December 2002
Key responsibilities:	Management of design Management of quality

Name:	Huw Lloyd
Organisation:	HCTJV/BCJV (ACL/ACPL)
Role:	Bid Manager/Project Design Manager
Involvement	October 1995 to October 1996, and July 2000 to end of case study research in December 2002
Key responsibilities:	Management of bidding Management of design development

Name:	Sam MacKenzie
Organisation:	DLE
Role:	Partner
Involvement	late 1996 to July 2000
Key responsibilities:	Management of whole life costing

Name:	Bert McCabe
Organisation:	LDL
Role:	Director
Involvement	late 1995 to end of case study research in December 2002
Key responsibilities:	Management of project on senior level

Name:	Alan Seddon
Organisation:	BCJV (ACL/ACPL)
Role:	Project Director/Deputy Project Director/Commercial Director
Involvement	October 1996 to end of case study research in December 2002
Key responsibilities:	Management of contractor
	Commercial management
Name:	David Whittingham
Organisation:	DSSRL
Role:	Senior Partner/Design Team Leader
Involvement	June 1996 to end of case study research in December 2002
Key responsibilities:	Management of project on senior level
	Management of building services design
Name:	John Wilson
Organisation:	CNML
Role:	Executive Partner/Design Team Leader
Involvement	late 1999 to end of case study research in December 2002
Key responsibilities:	Management of project on senior level
	Management of structural design
Name:	Ian Wolstenholme
Organisation:	APIL
Role:	Commercial Director
Involvement	October 1995 to January 2000, and
	January 2001 to end of case study research in December 2002
Key responsibilities:	Management of bidding
	Management of equity investment

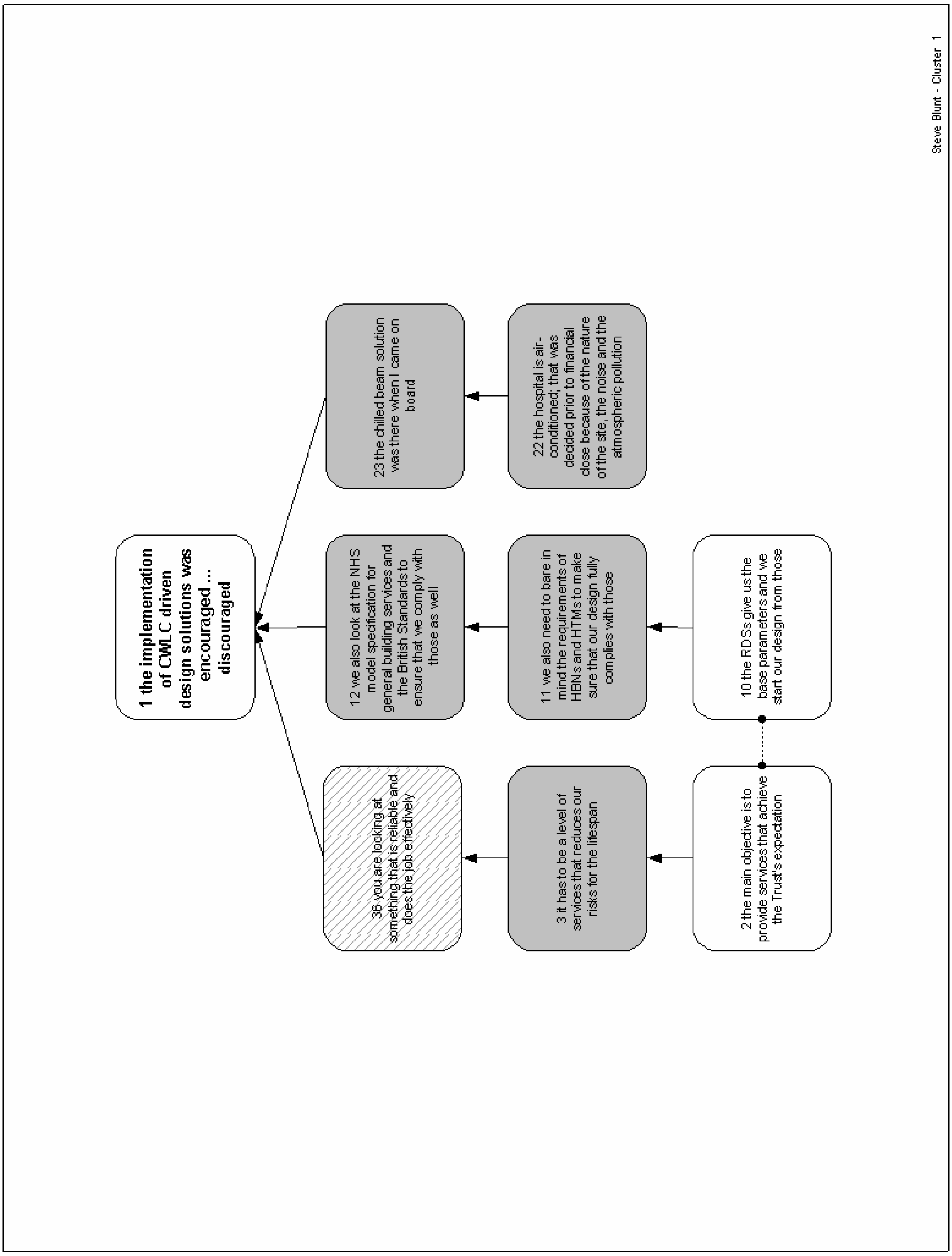

Figure A7.1. Blunt storyline map Cluster 1.

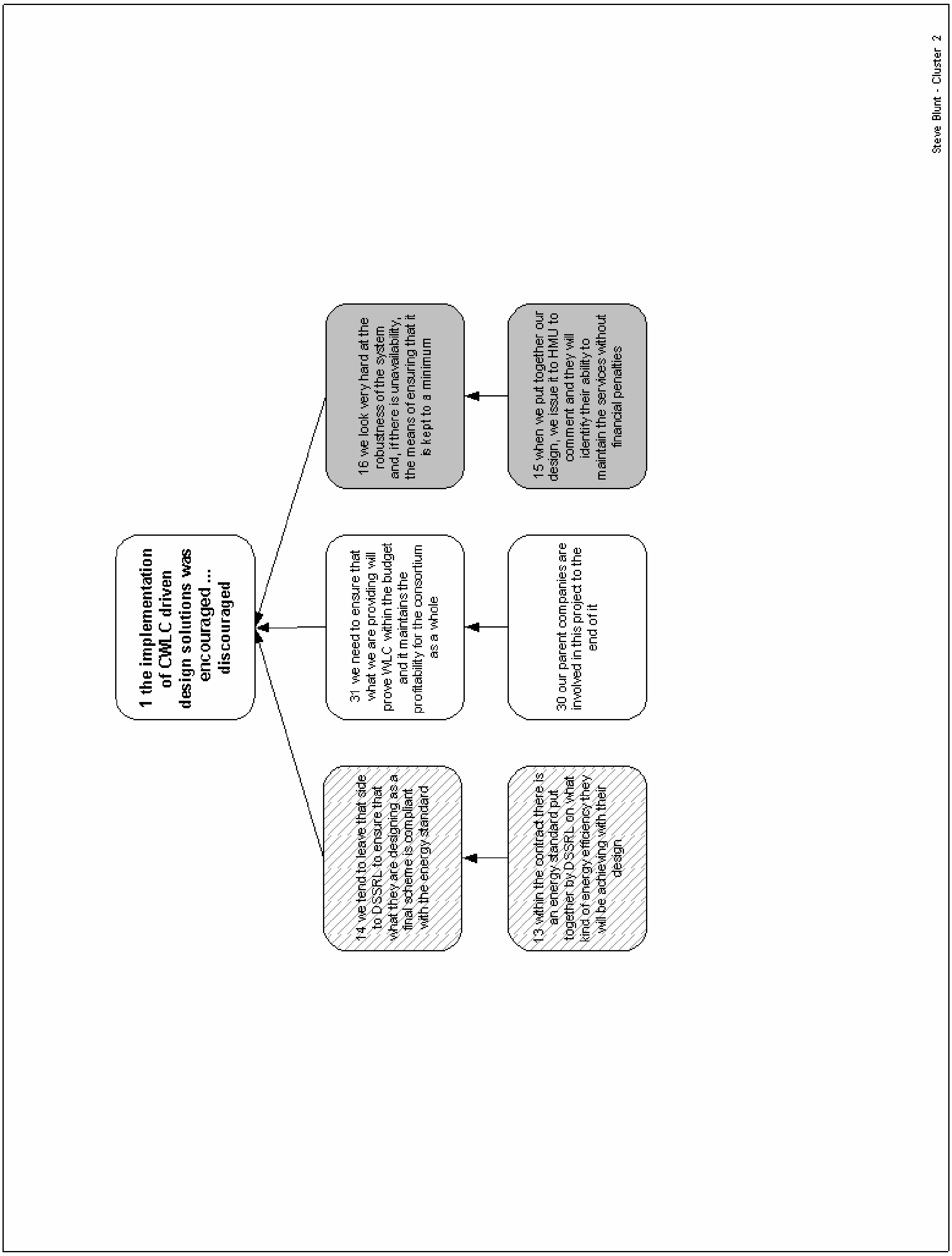

Figure A7.2. Blunt storyline map Cluster 2.

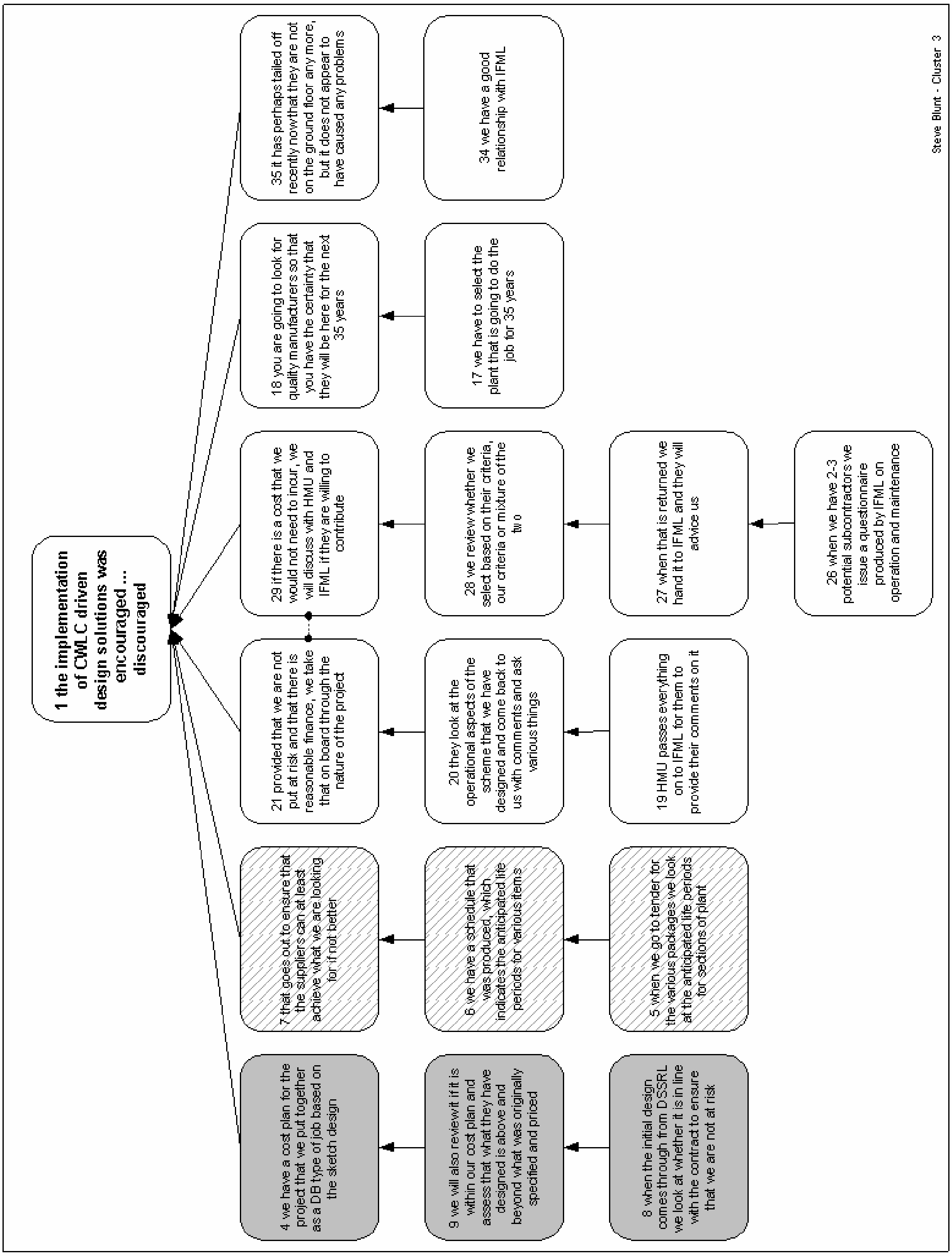

Figure A7.3. Blunt storyline map Cluster 3.

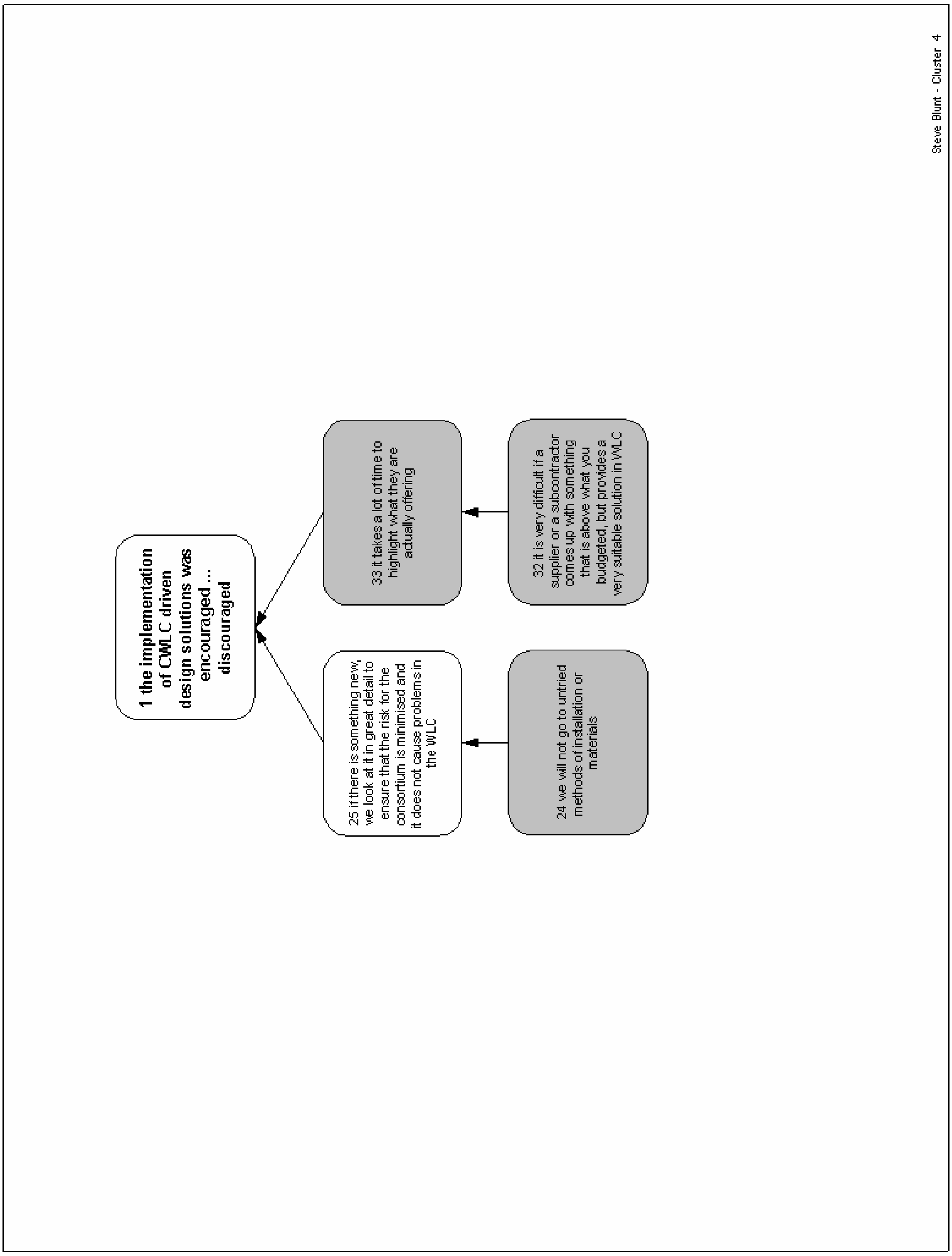

Figure A7.4. Blunt storyline map Cluster 4.

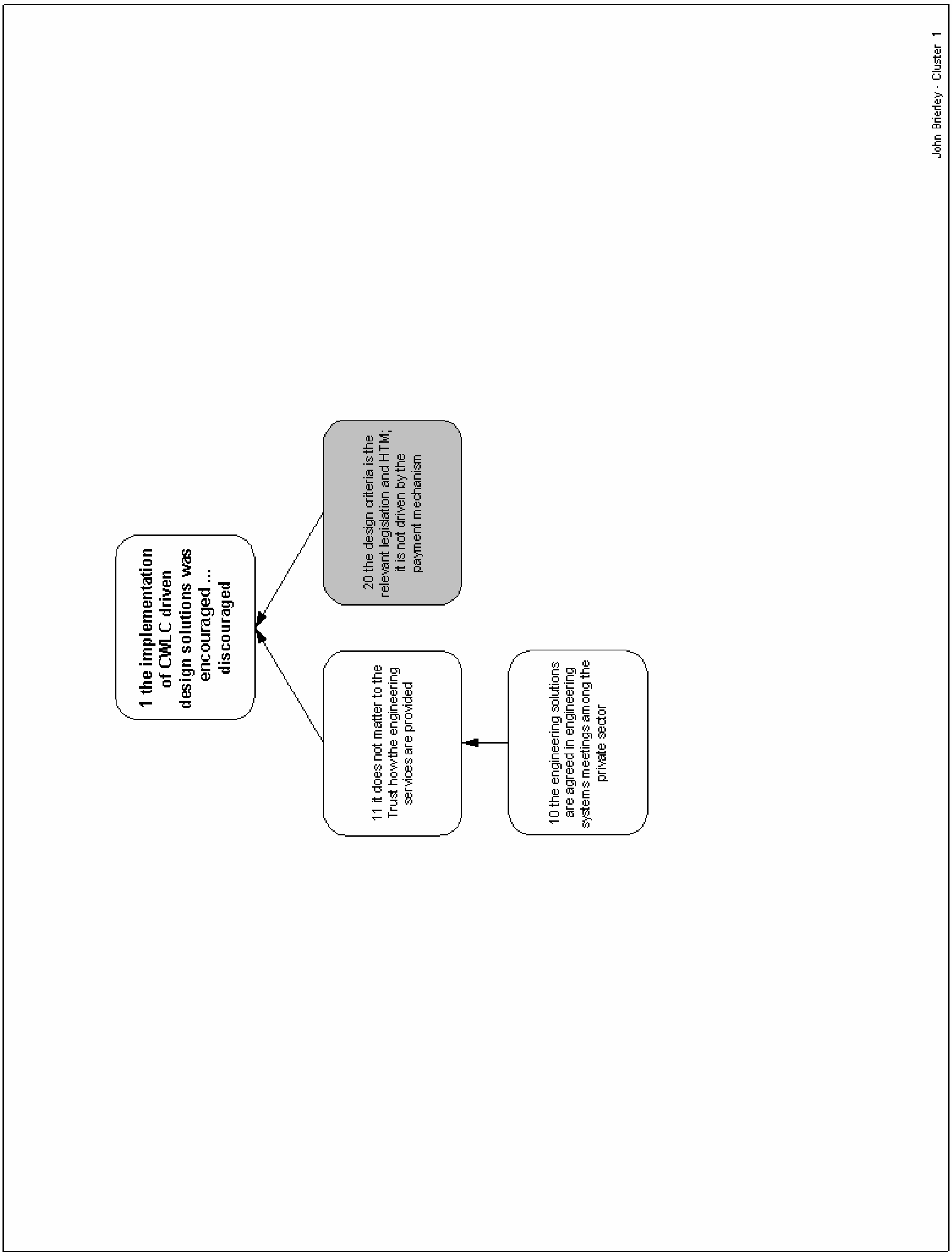

Figure A7.5. Brierley storyline map Cluster 1.

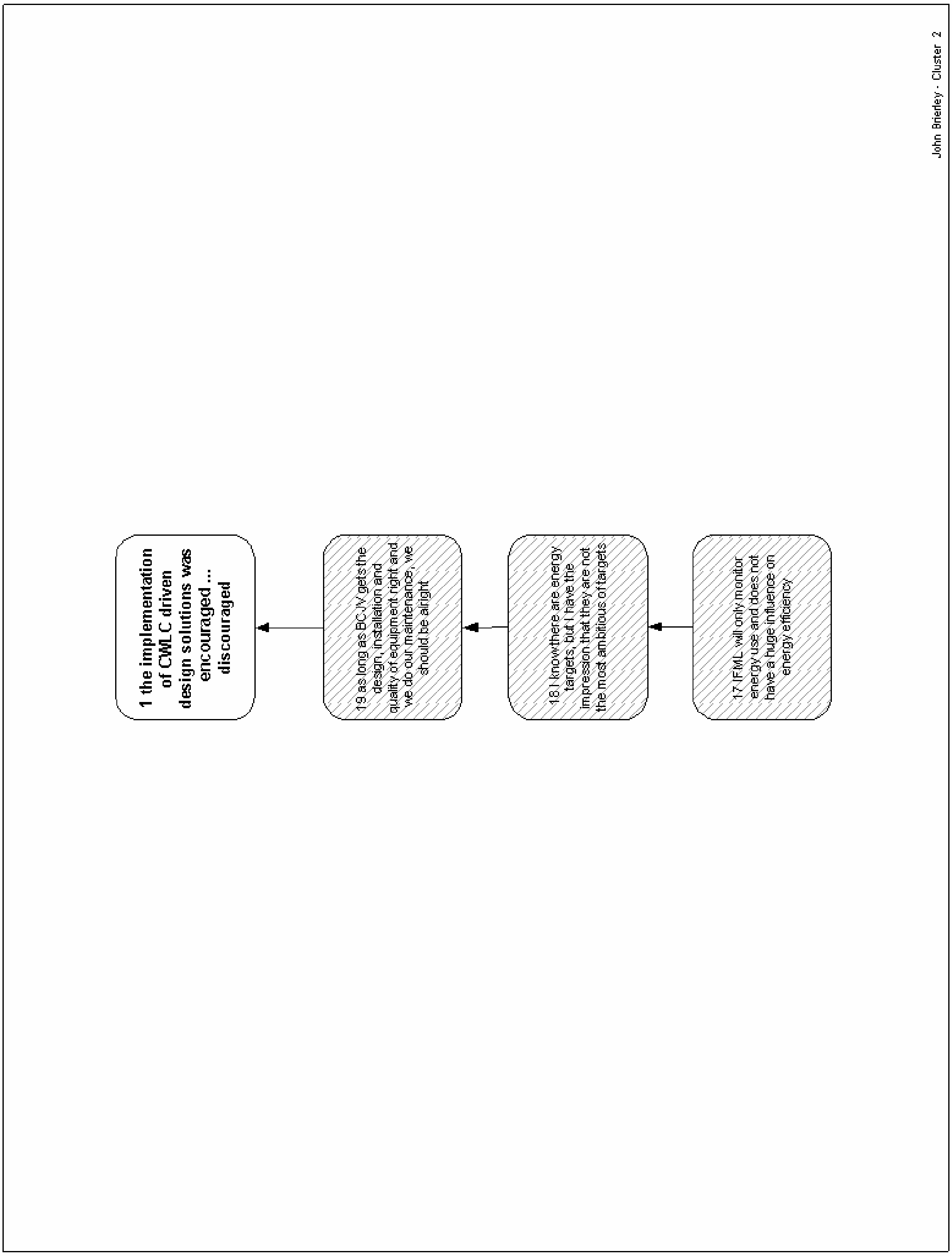

Figure A7.6. Brierley storyline map Cluster 2.

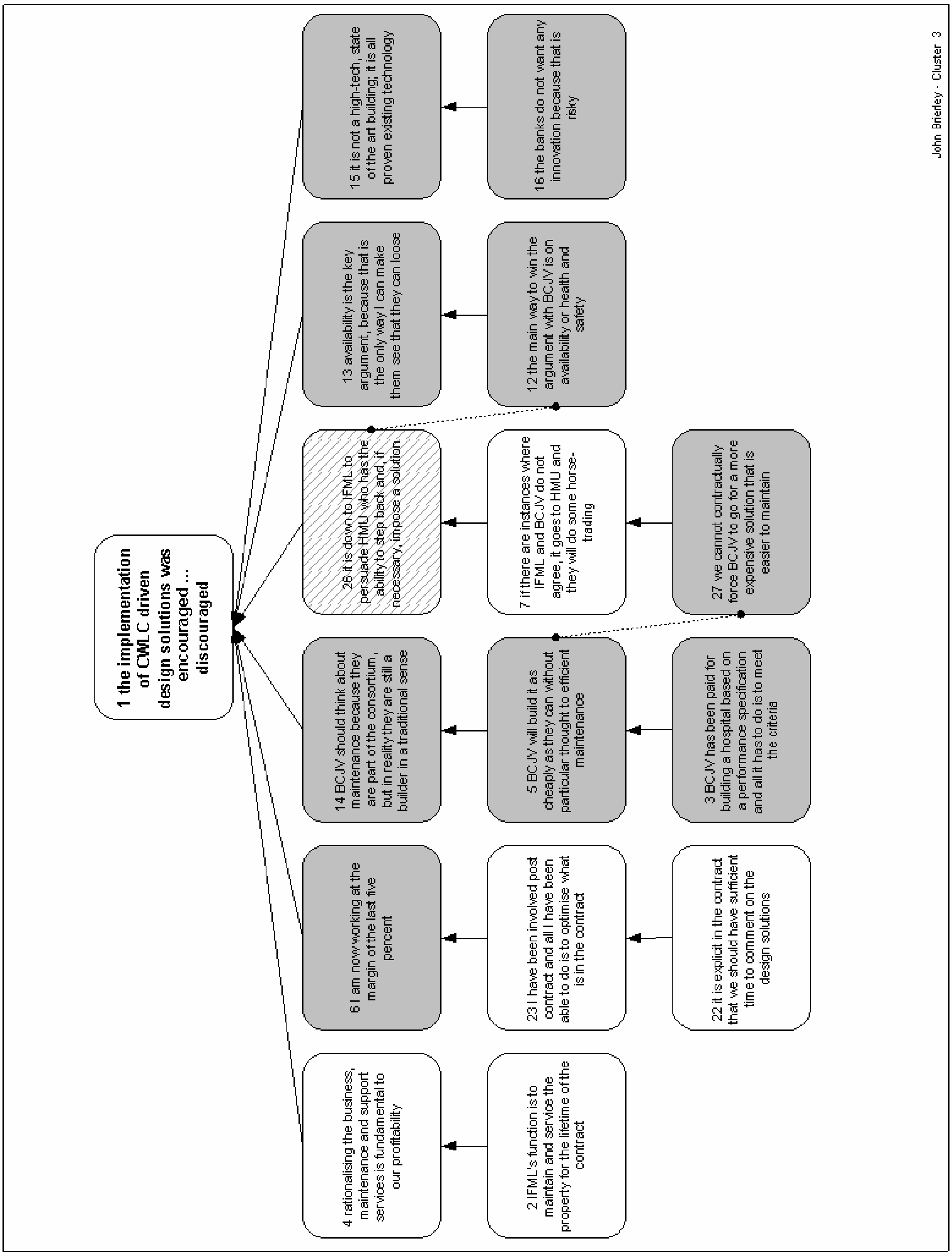

Figure A7.7. Brierley storyline map Cluster 3.

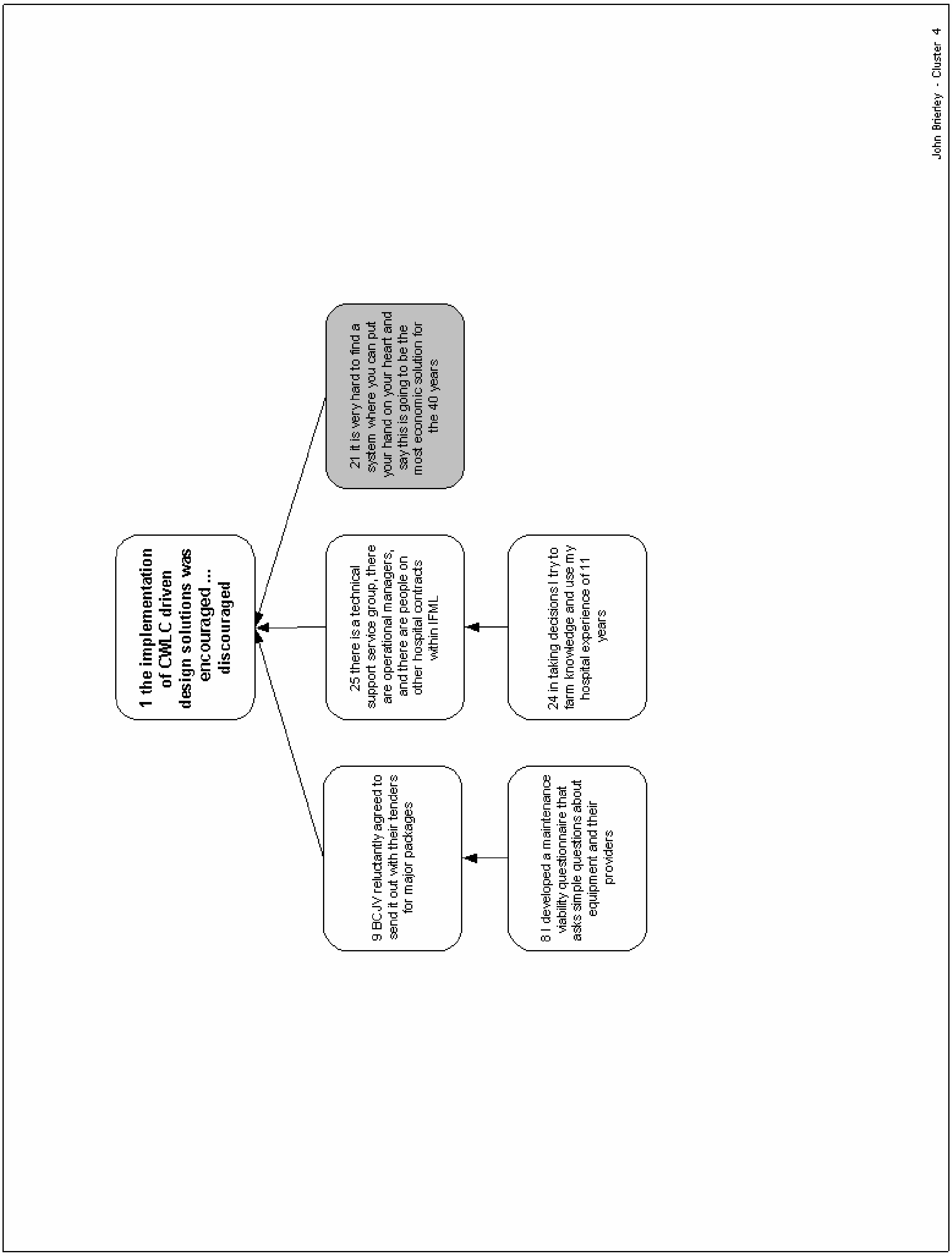

Figure A7.8. Brierley storyline map Cluster 4.

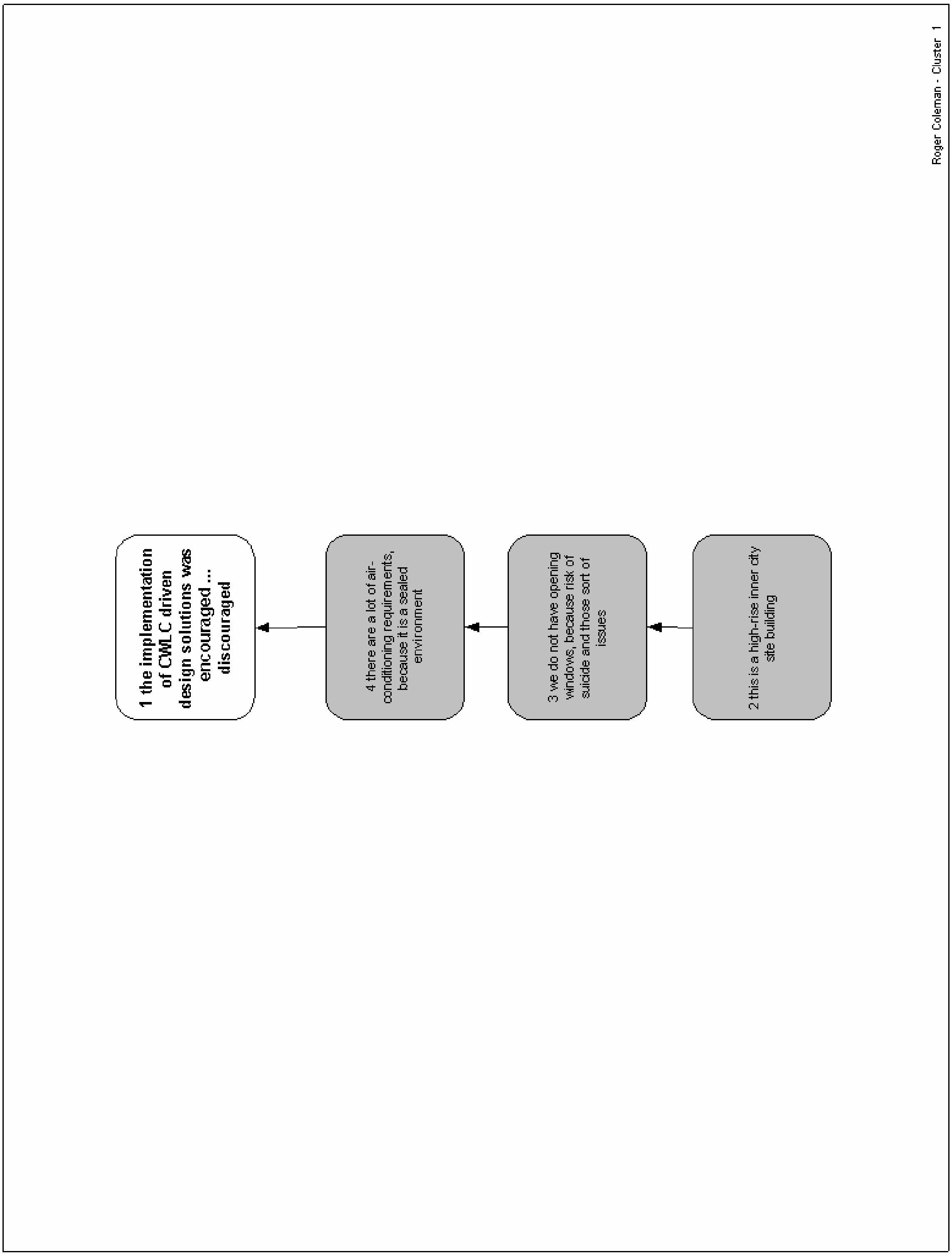

Figure A7.9. Coleman storyline map Cluster 1.

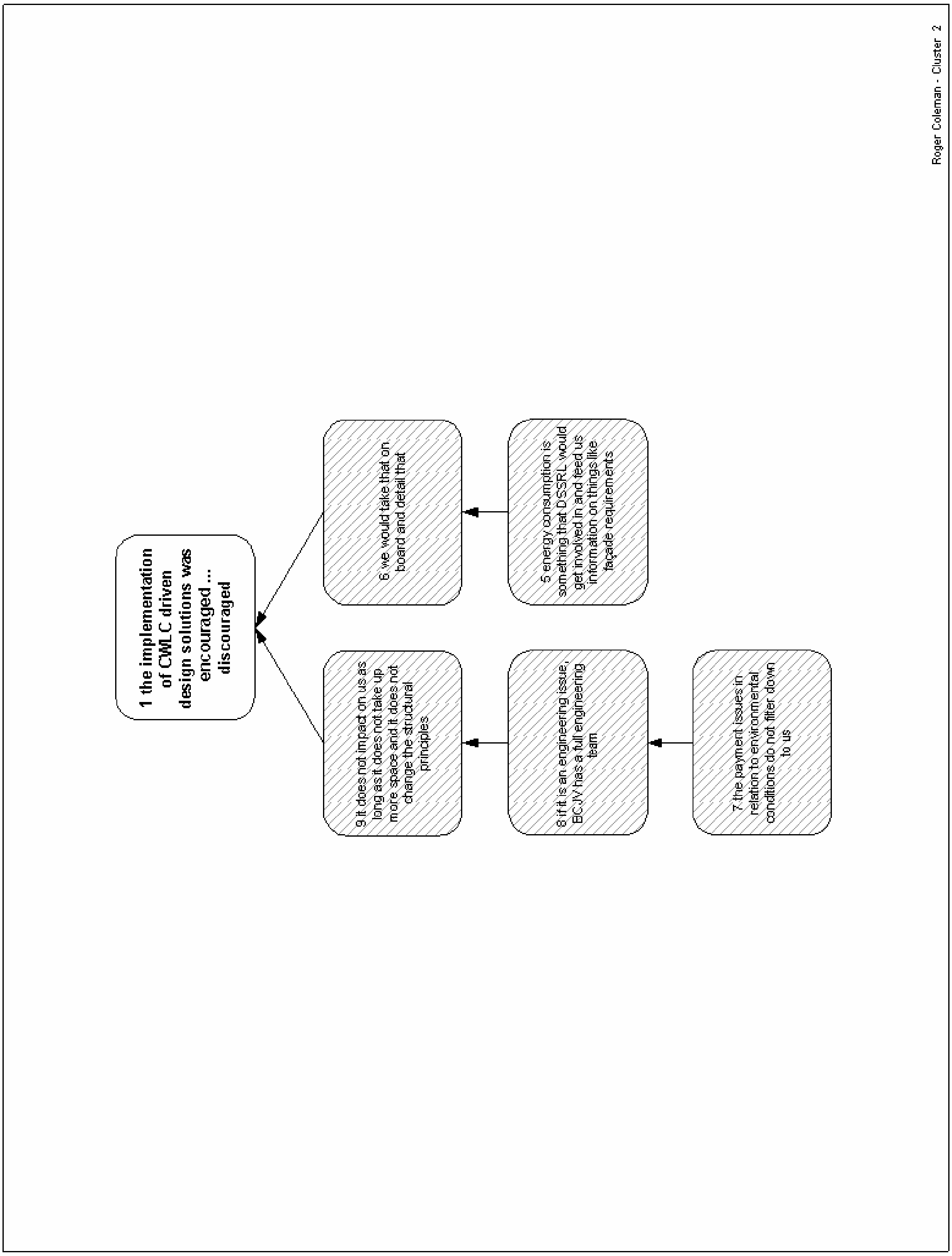

Figure A7.10. Coleman storyline map Cluster 2.

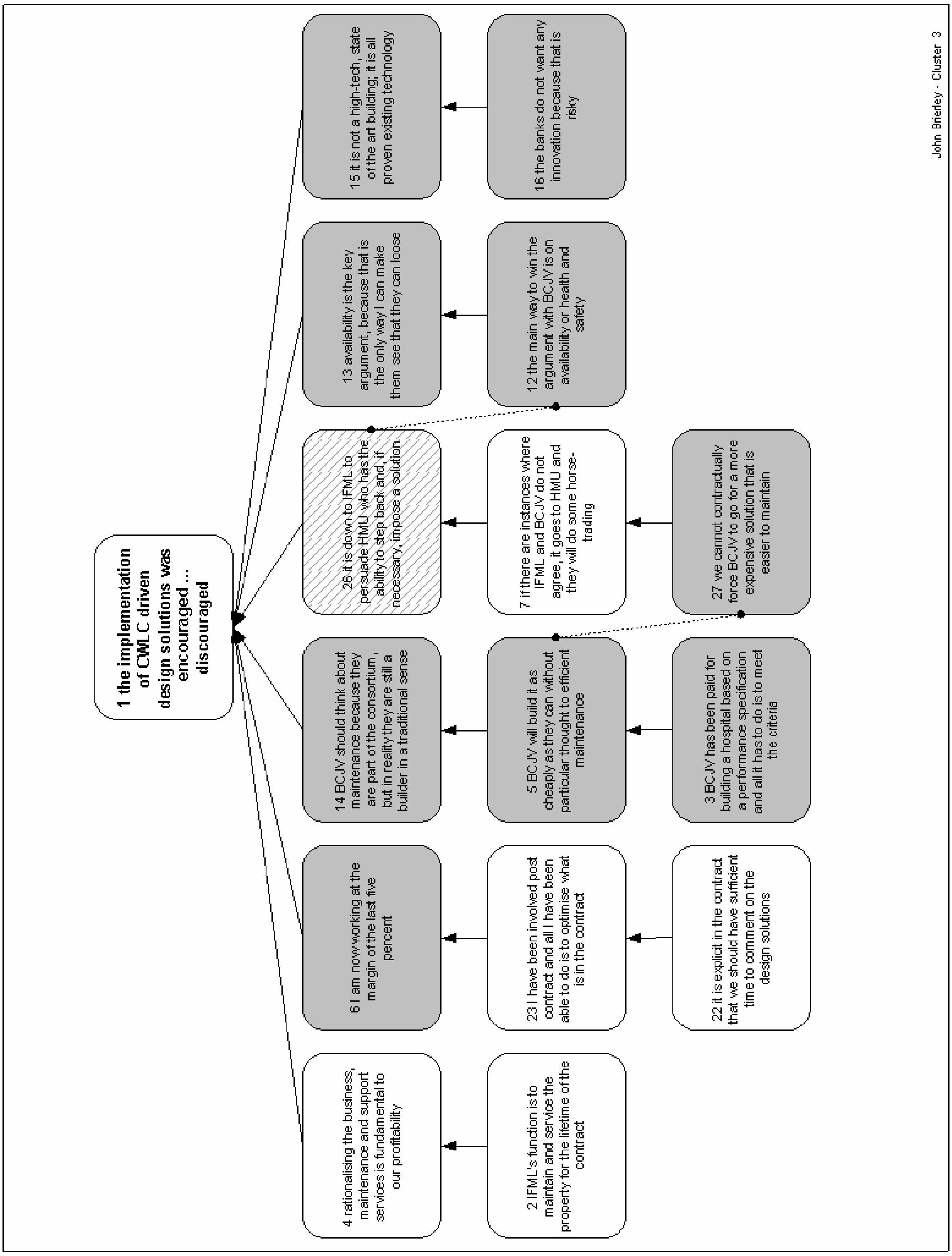

Figure A7.11. Coleman storyline map Cluster 3.

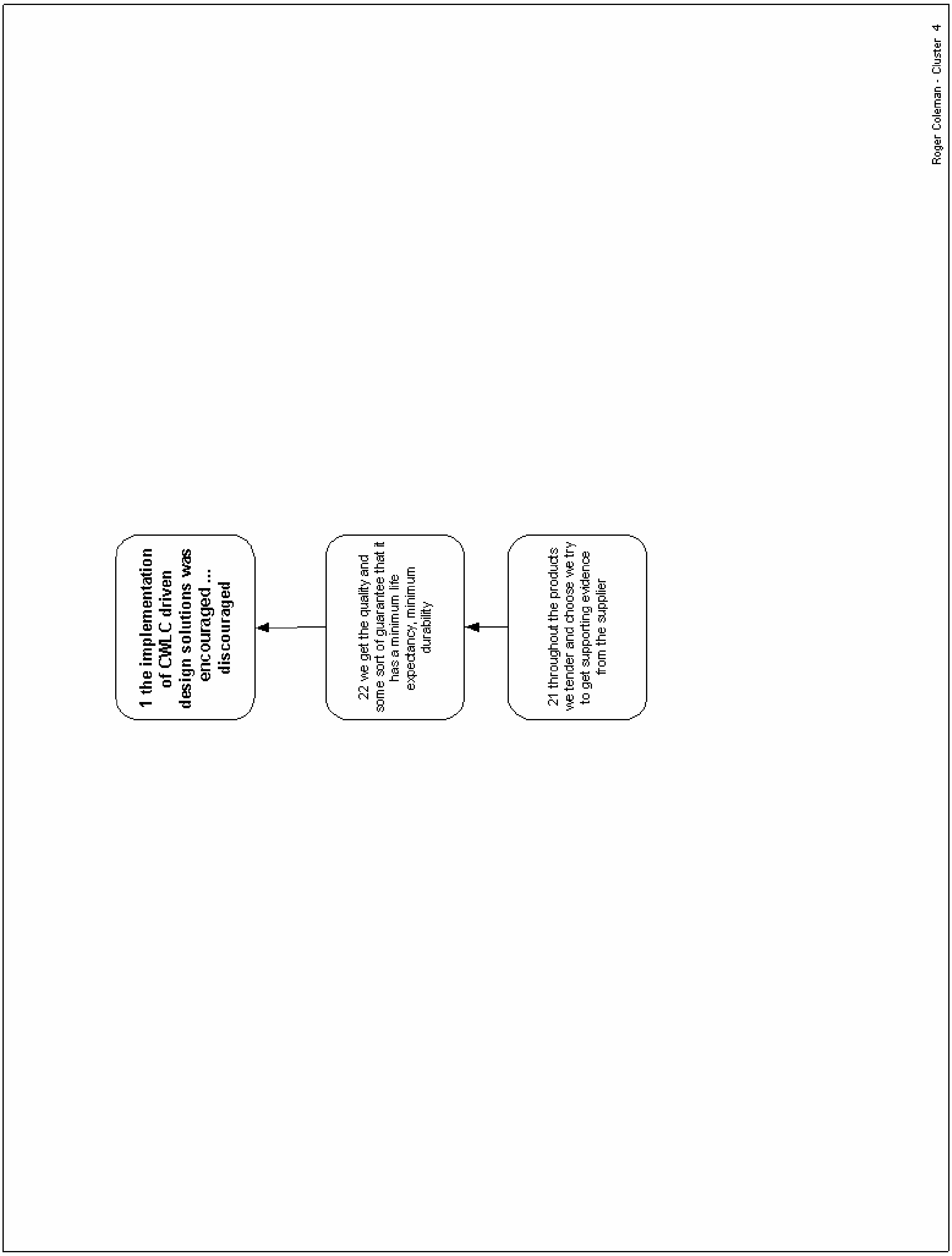

Figure A7.12. Coleman storyline map Cluster 4.

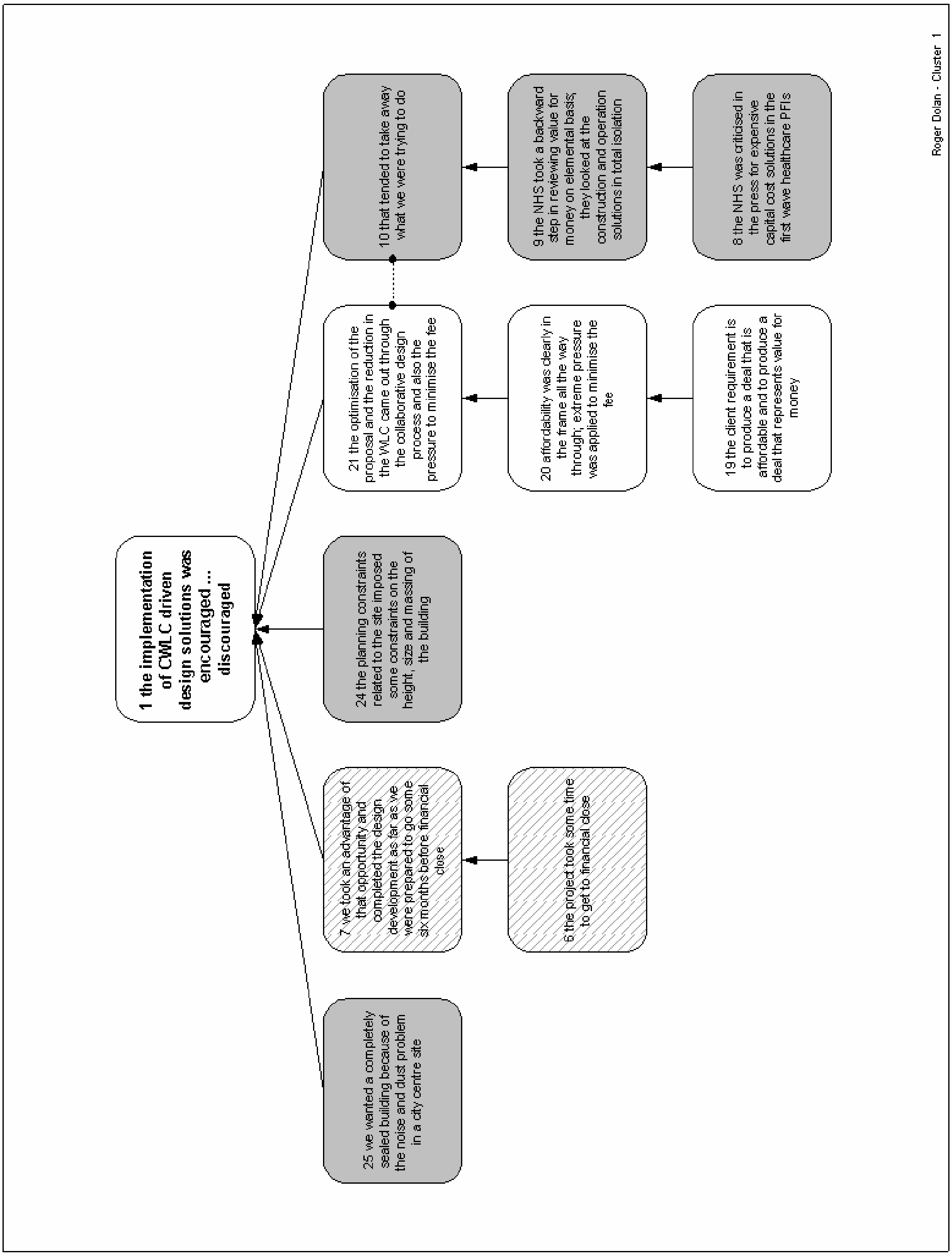

Figure A7.13. Dolan storyline map Cluster 1.

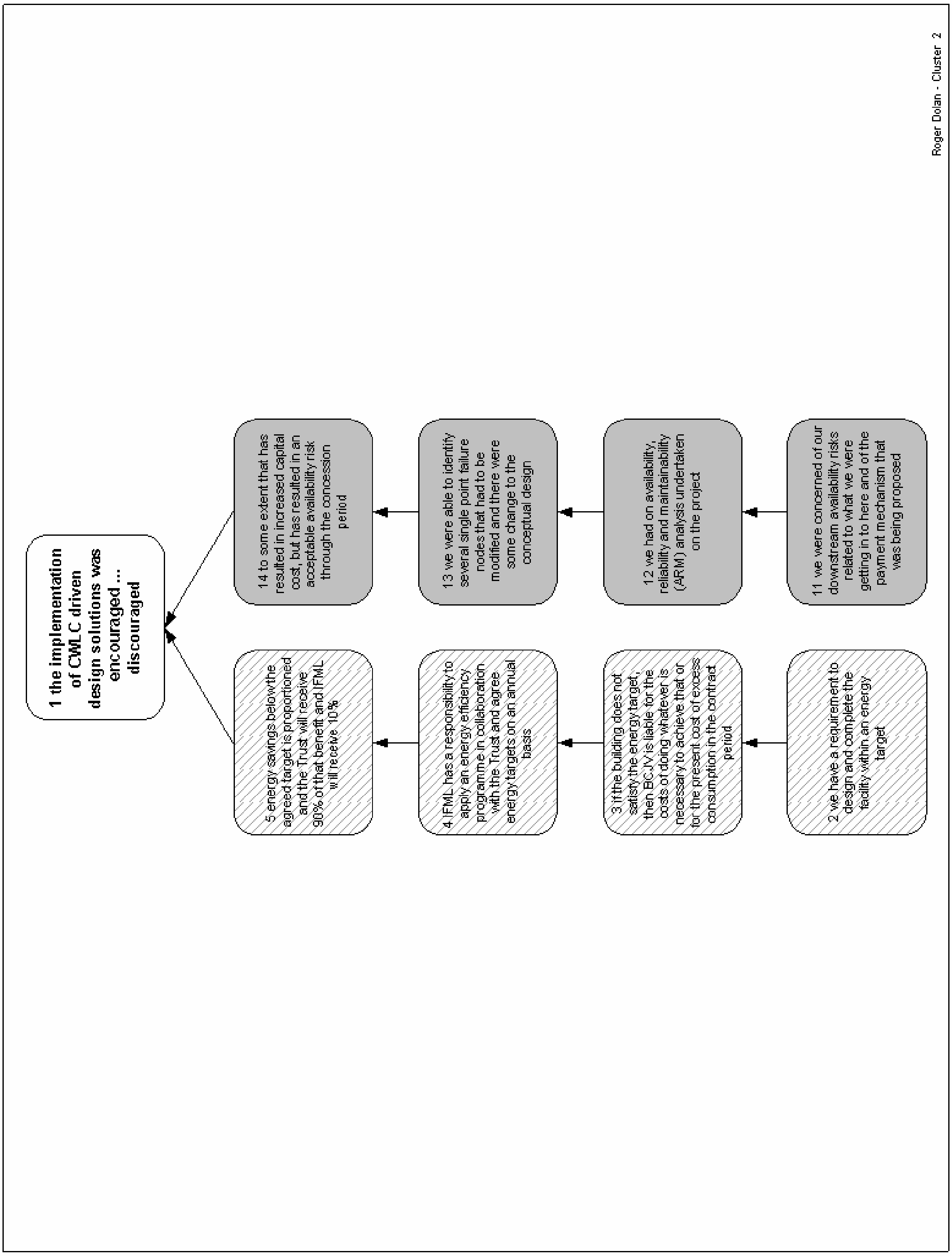

Figure A7.14. Dolan storyline map Cluster 2.

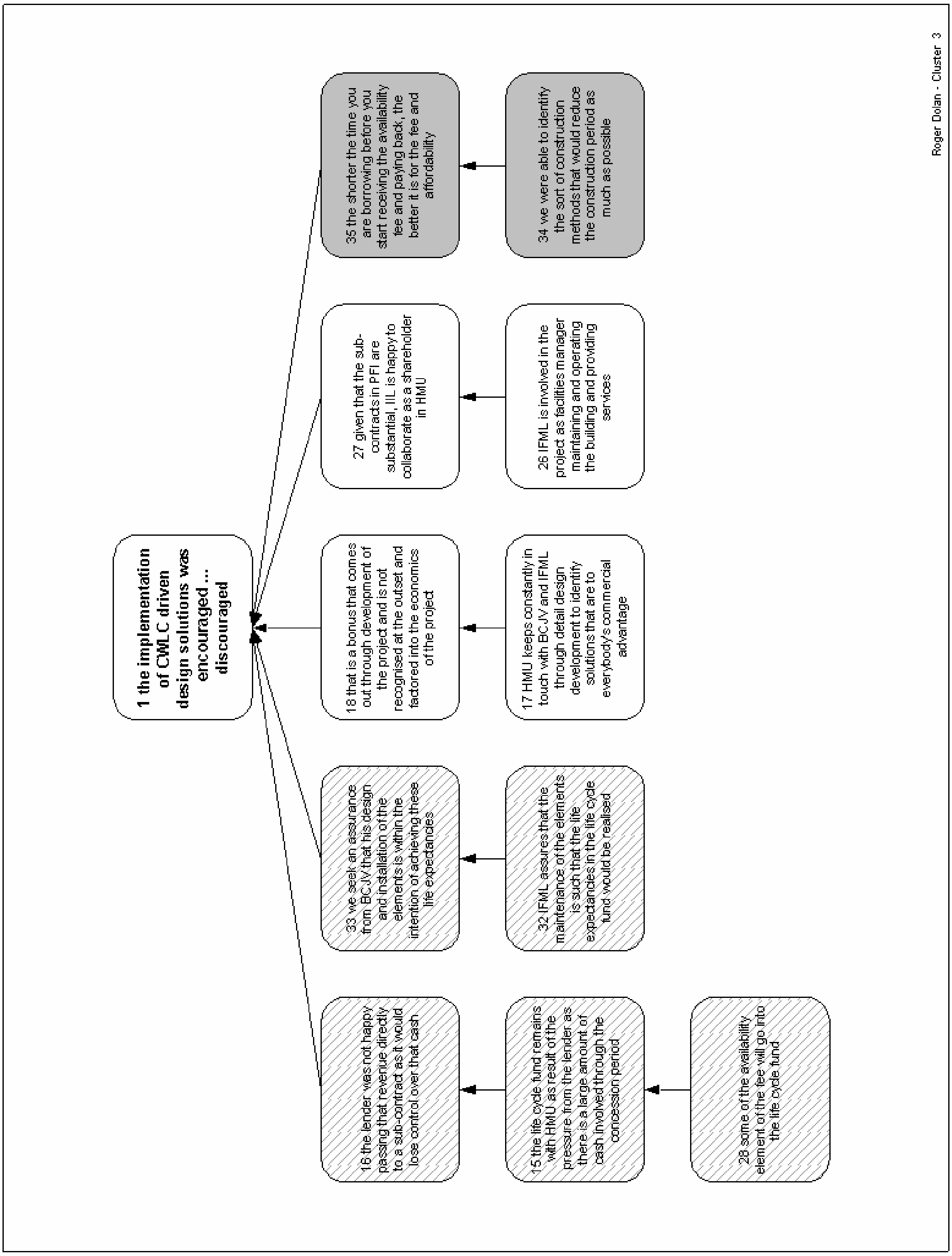

Figure A7.15. Dolan storyline map Cluster 3.

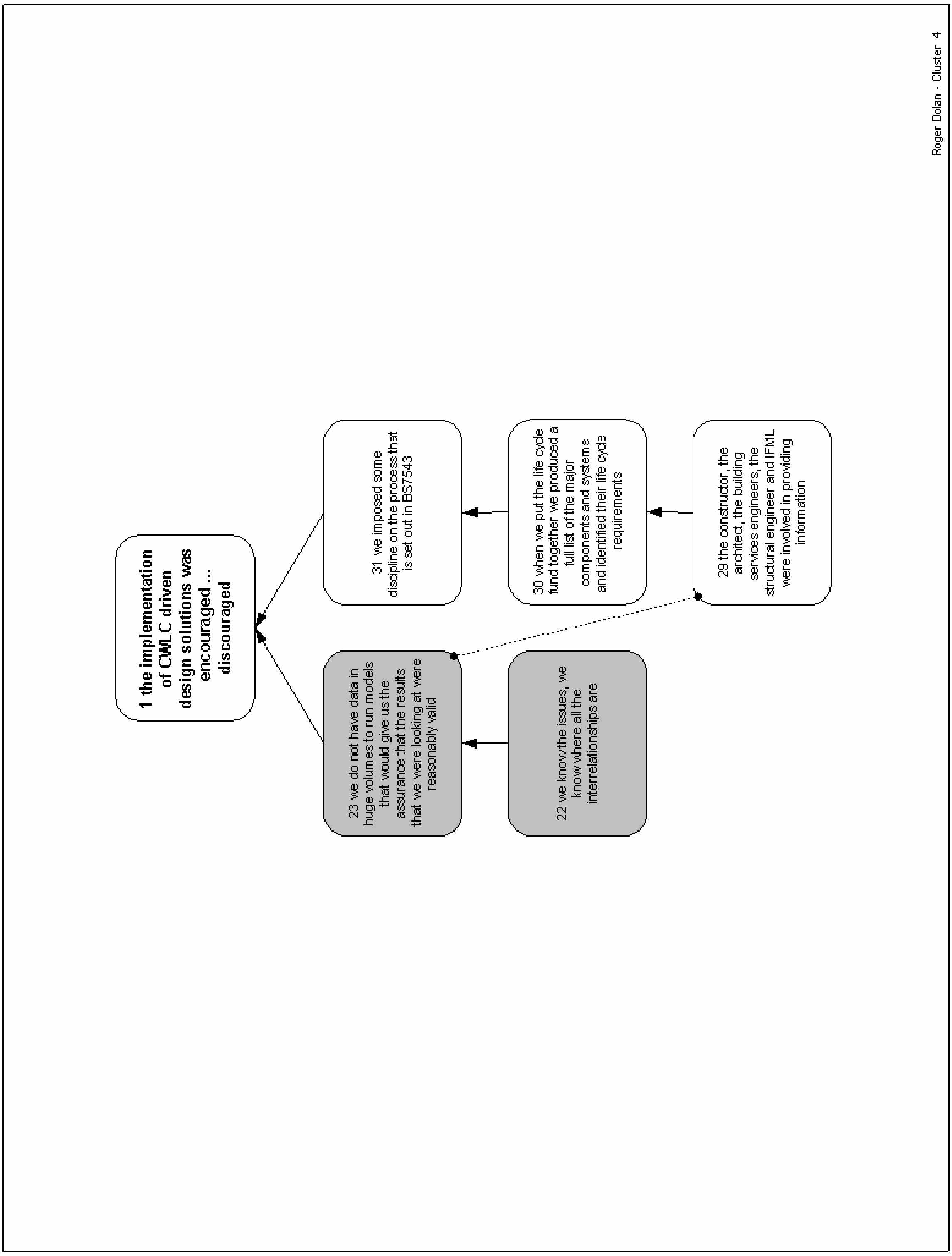

Figure A7.16. Dolan storyline map Cluster 4.

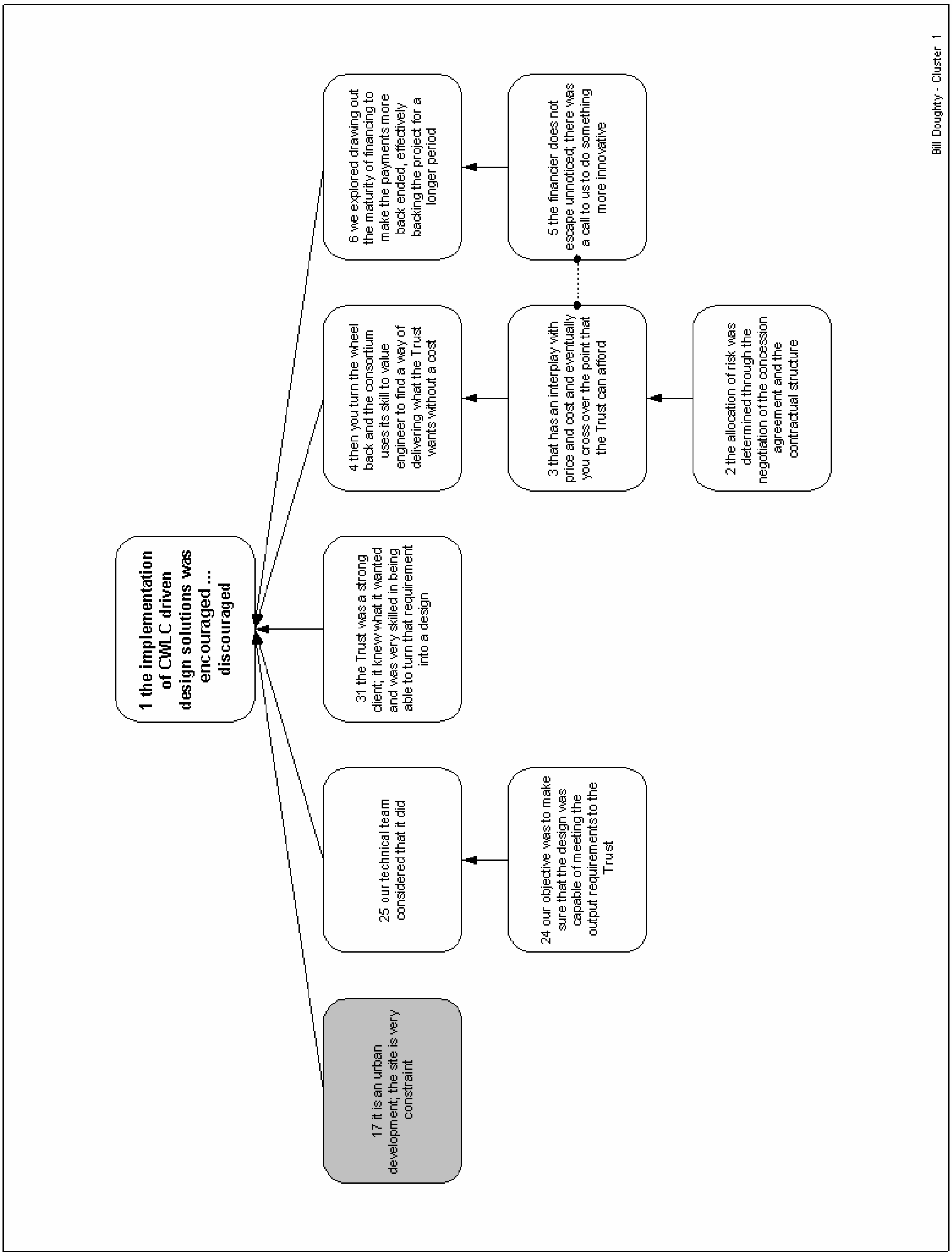

Figure A7.17. Doughty storyline map Cluster 1.

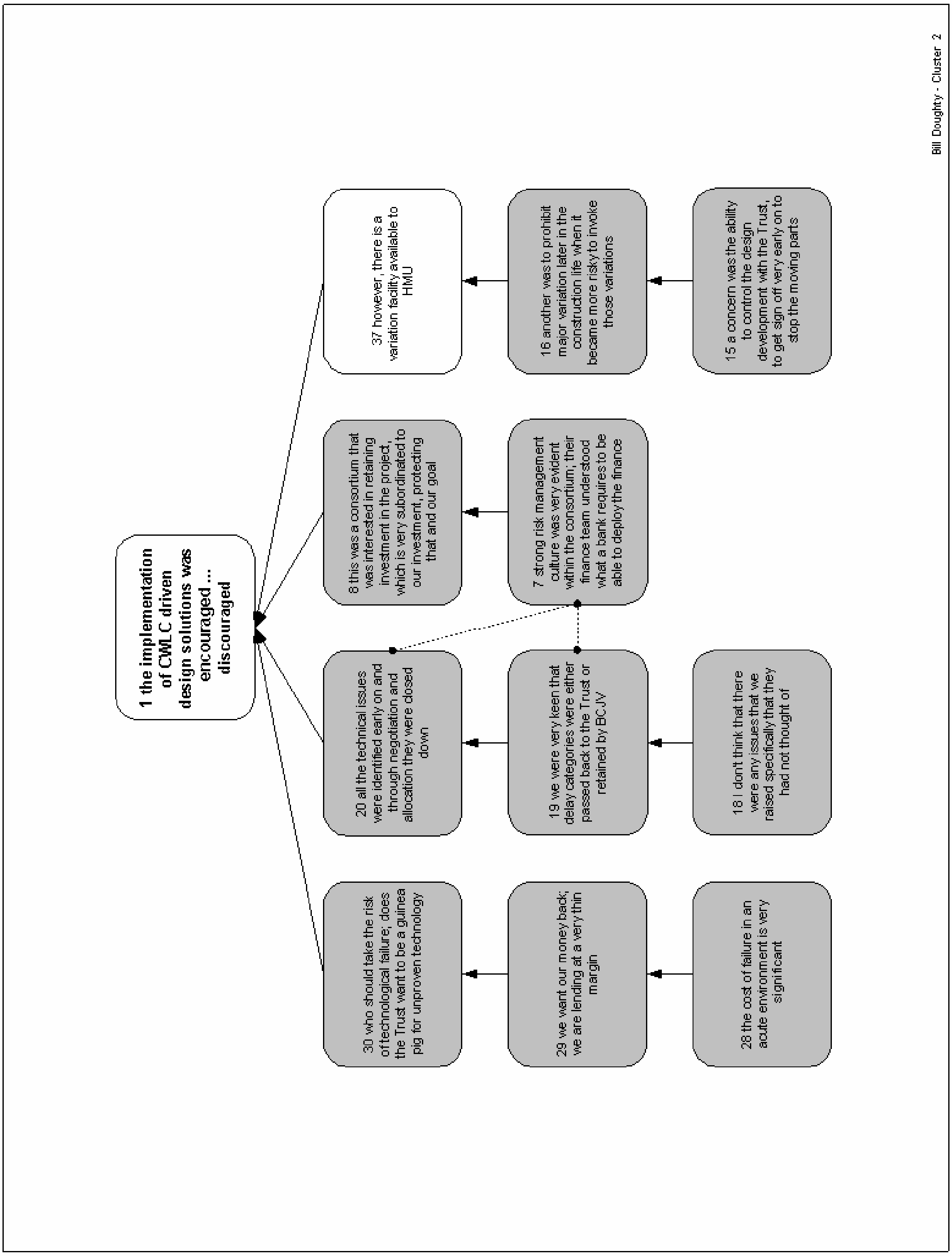

Figure A7.18. Doughty storyline map Cluster 2.

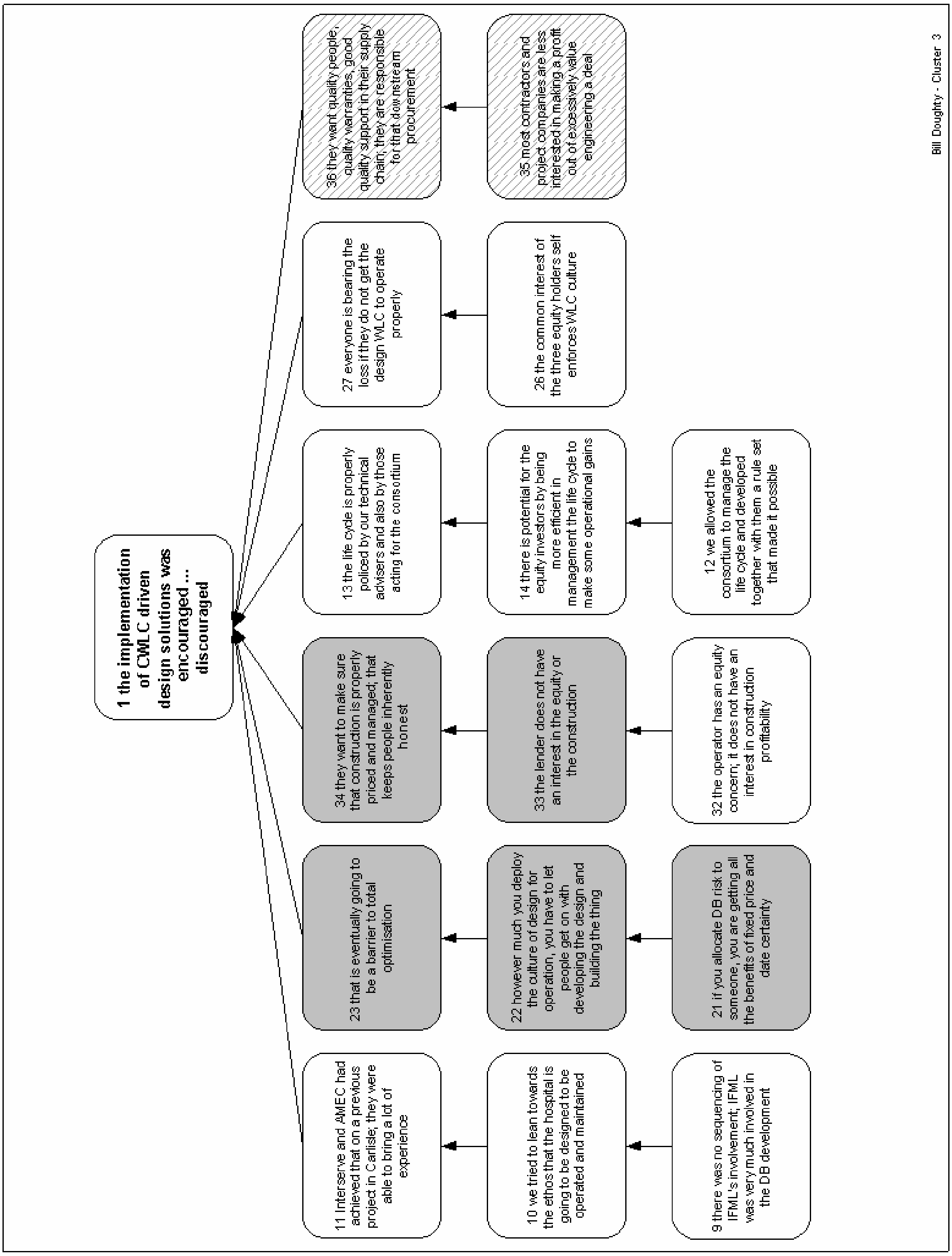

Figure A7.19. Doughty storyline map Cluster 3.

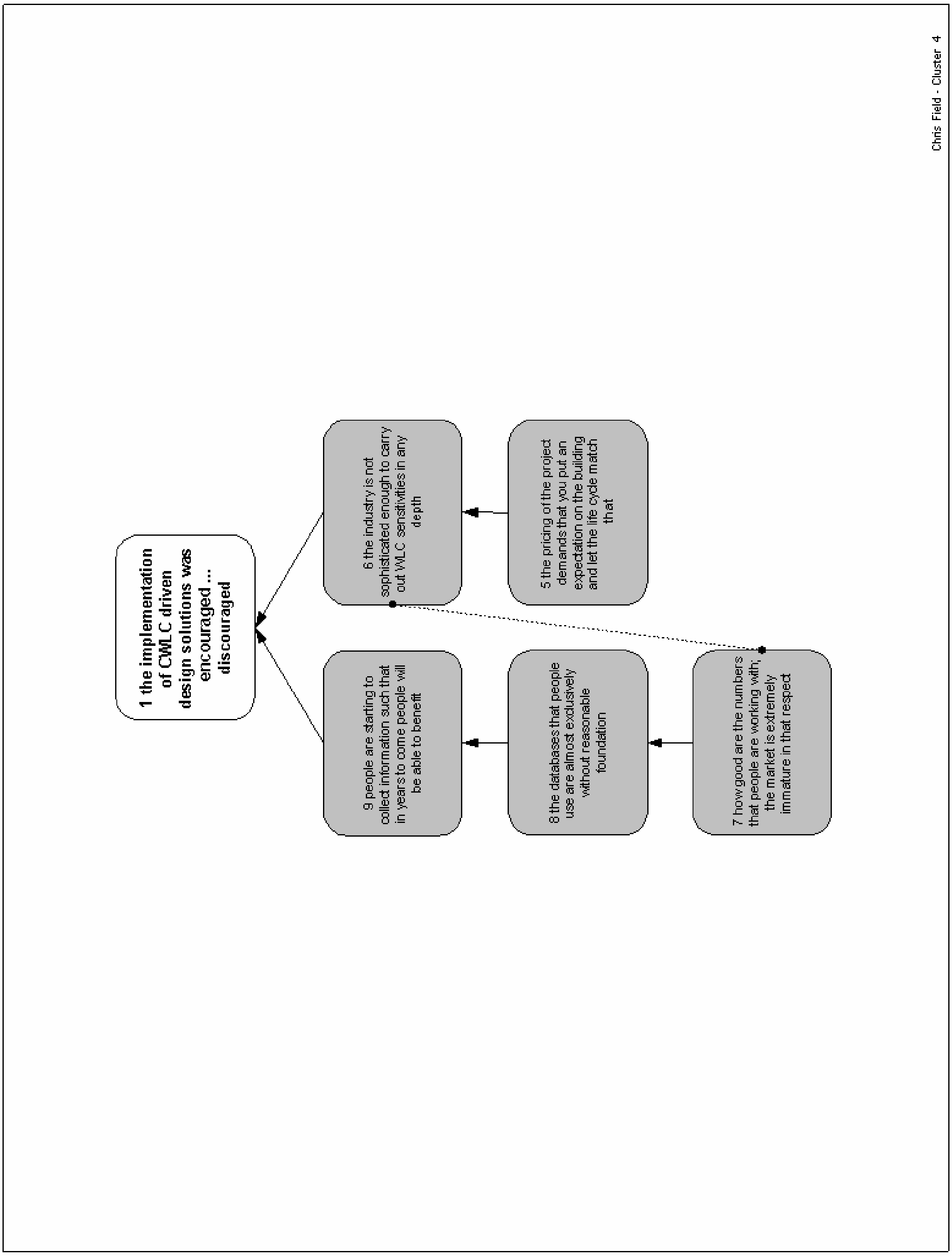

Figure A7.20. Doughty storyline map Cluster 4.

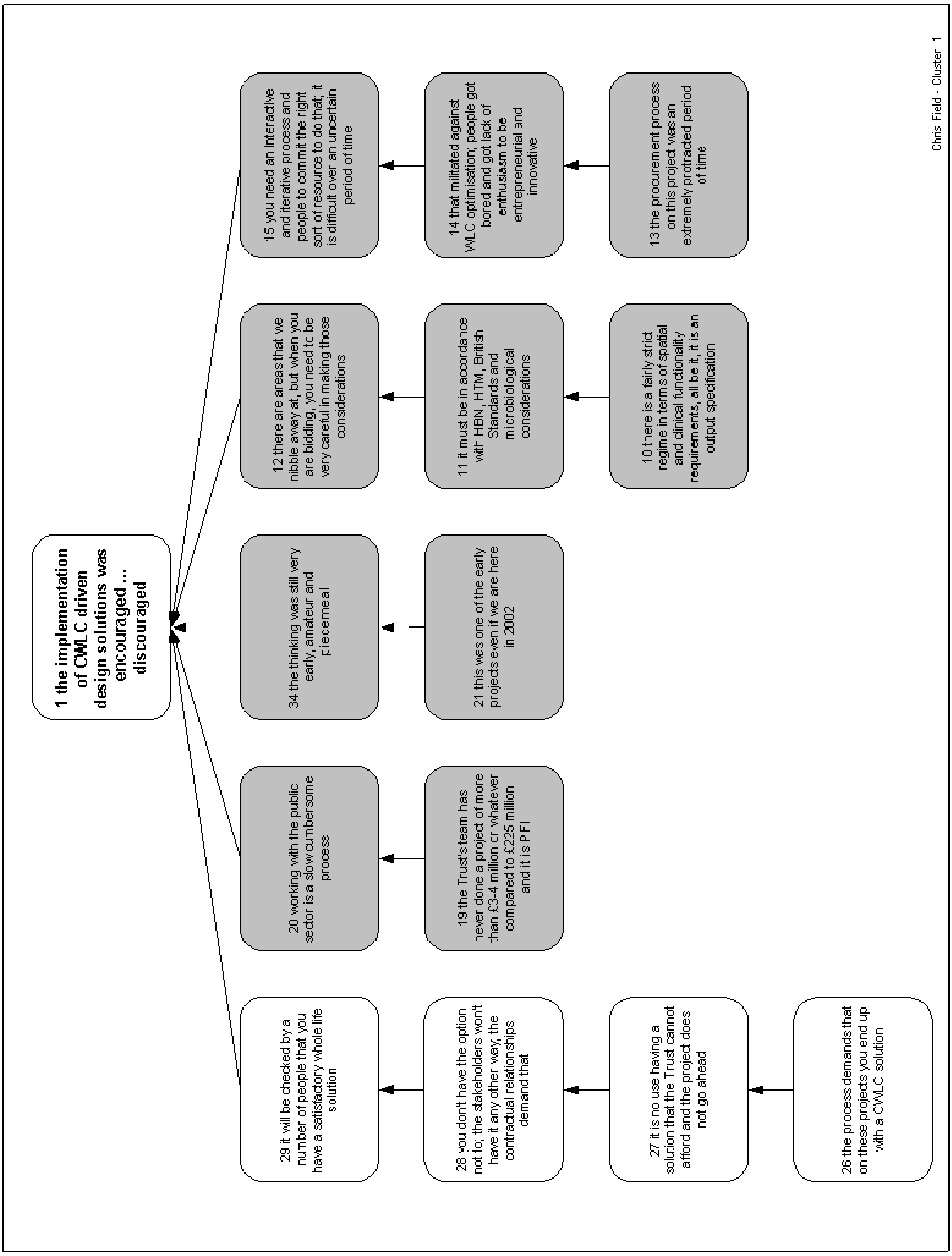

Figure A7.21. Field storyline map Cluster 1.

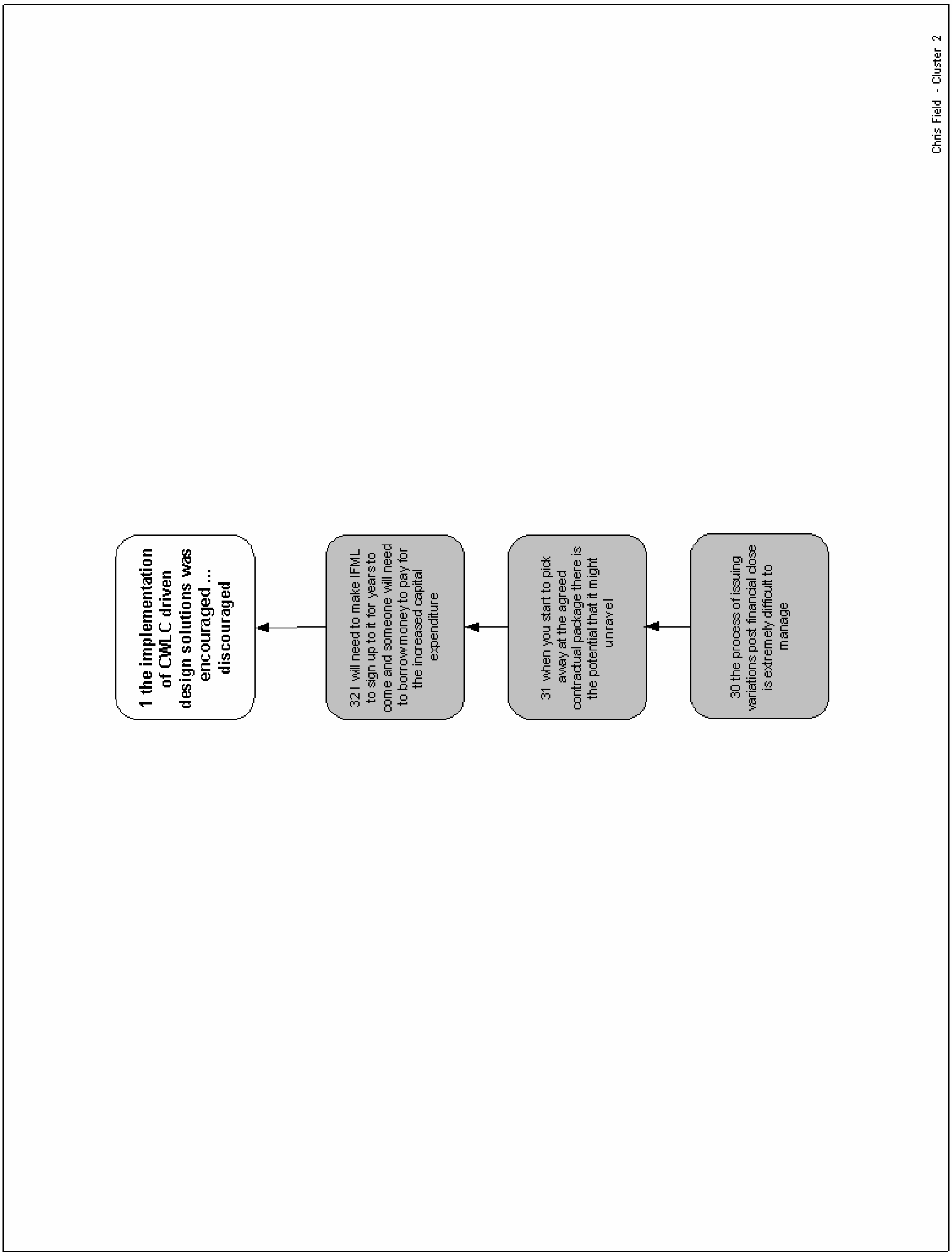

Figure A7.22. Field storyline map Cluster 2.

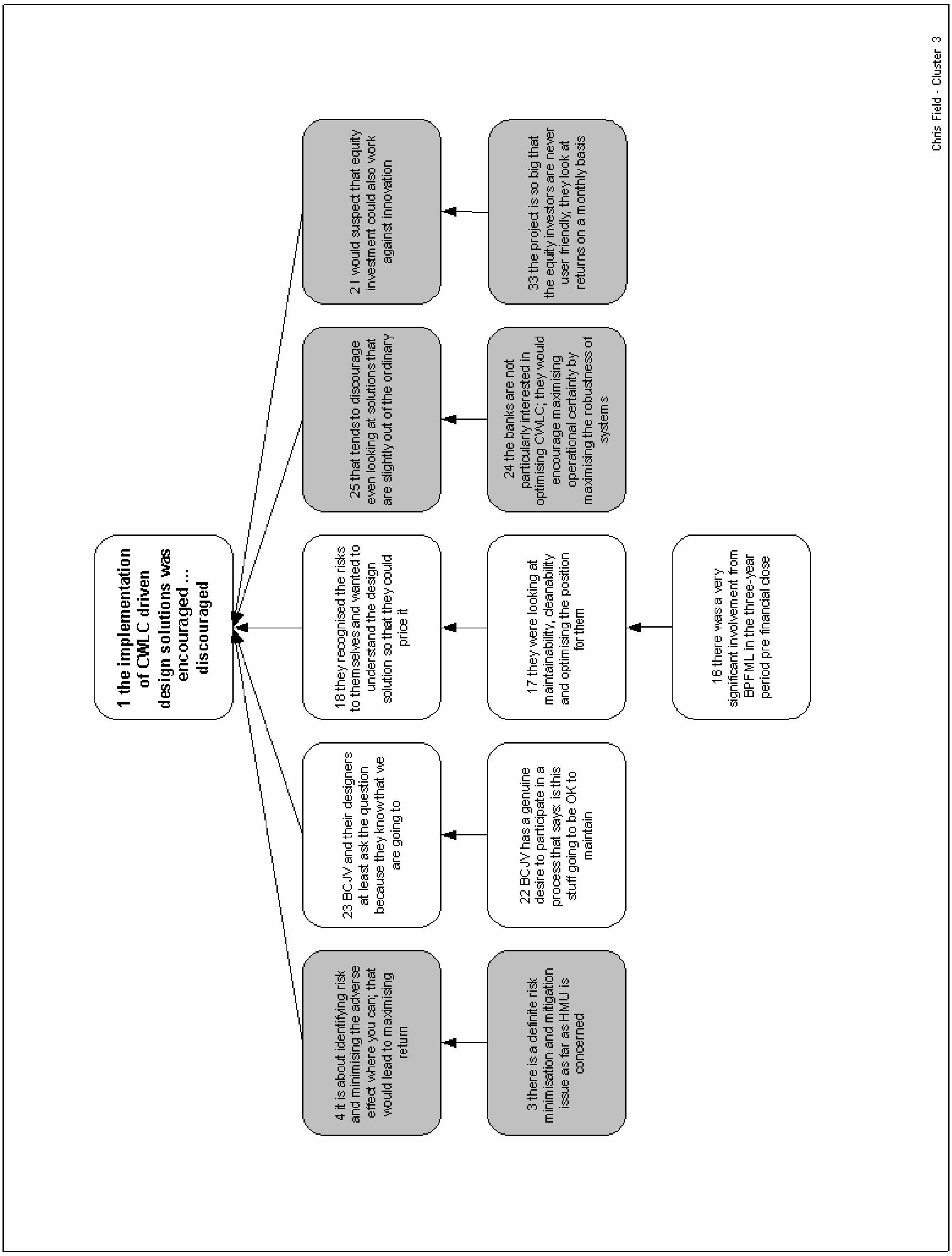

Figure A7.23. Field storyline map Cluster 3.

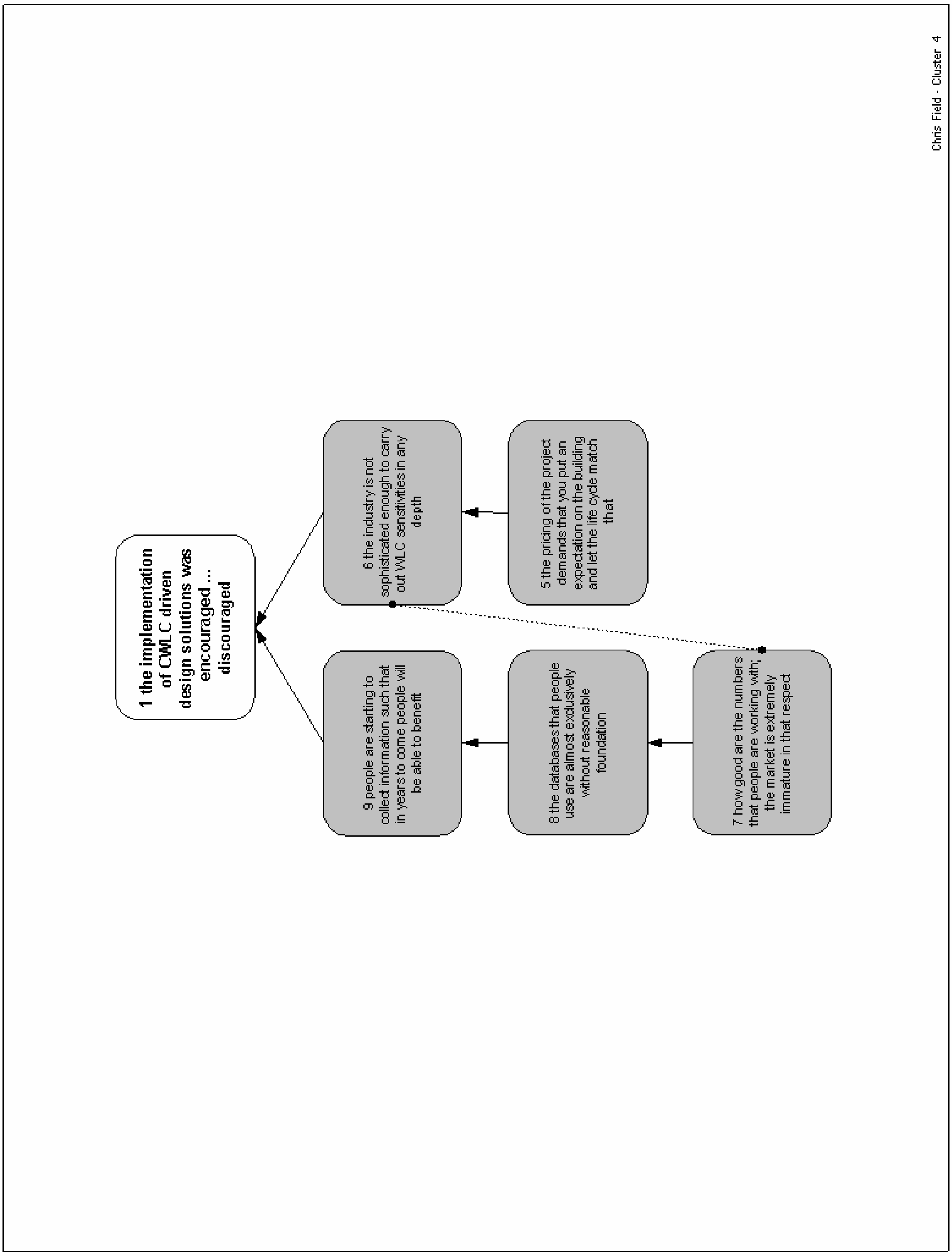

Figure A7.24. Field storyline map Cluster 4.

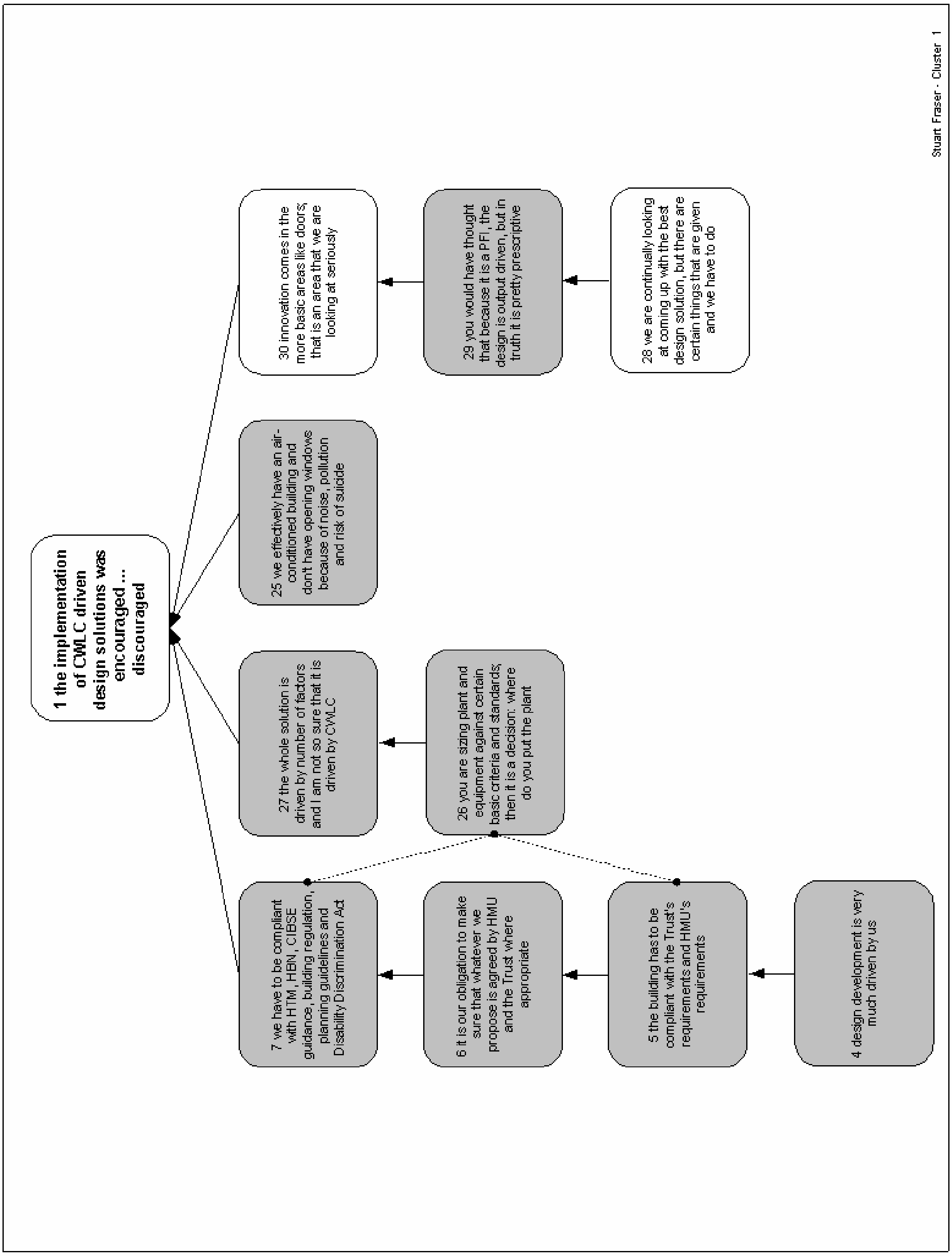

Figure A7.25. Fraser storyline map Cluster 1.

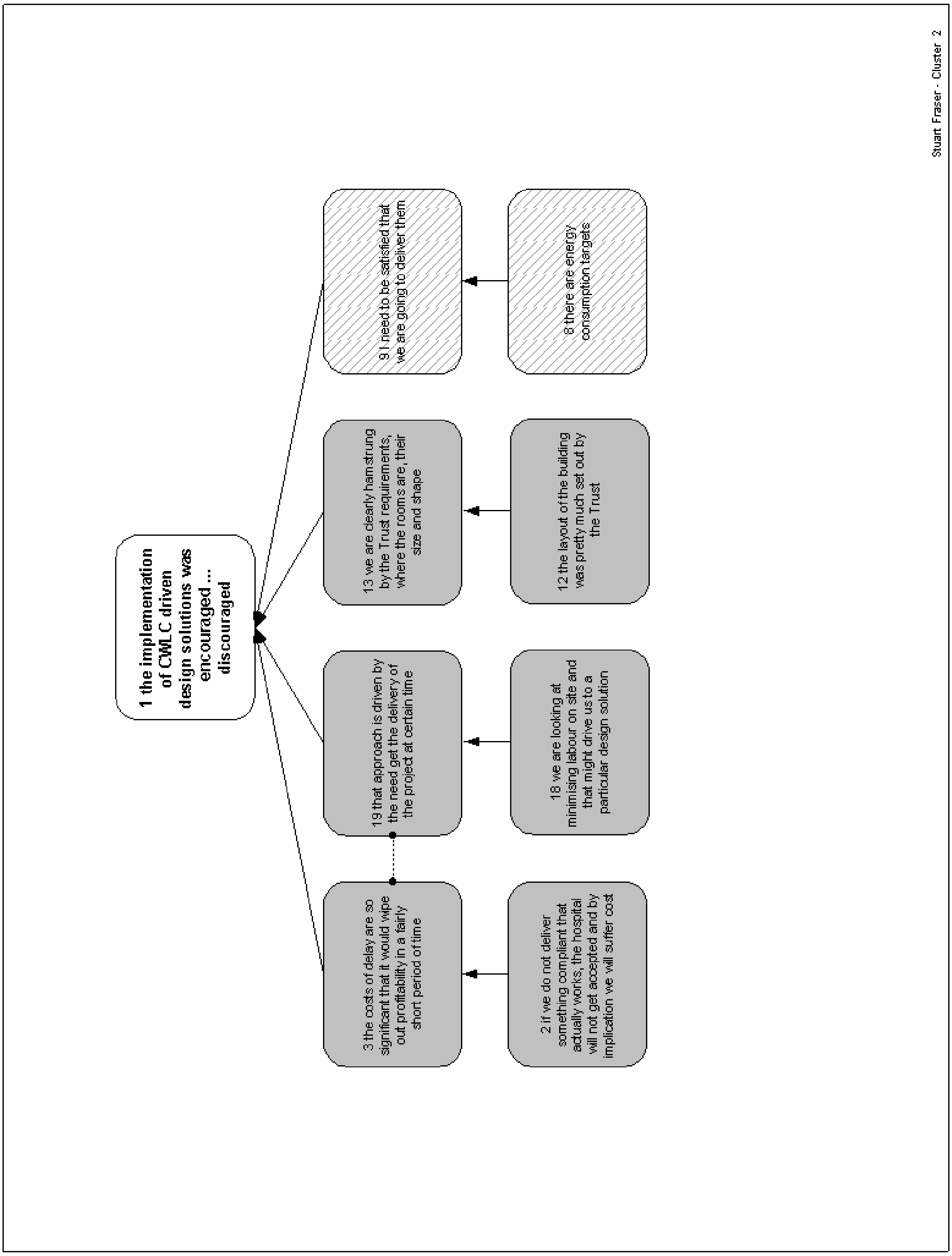

Figure A7.26. Fraser storyline map Cluster 2.

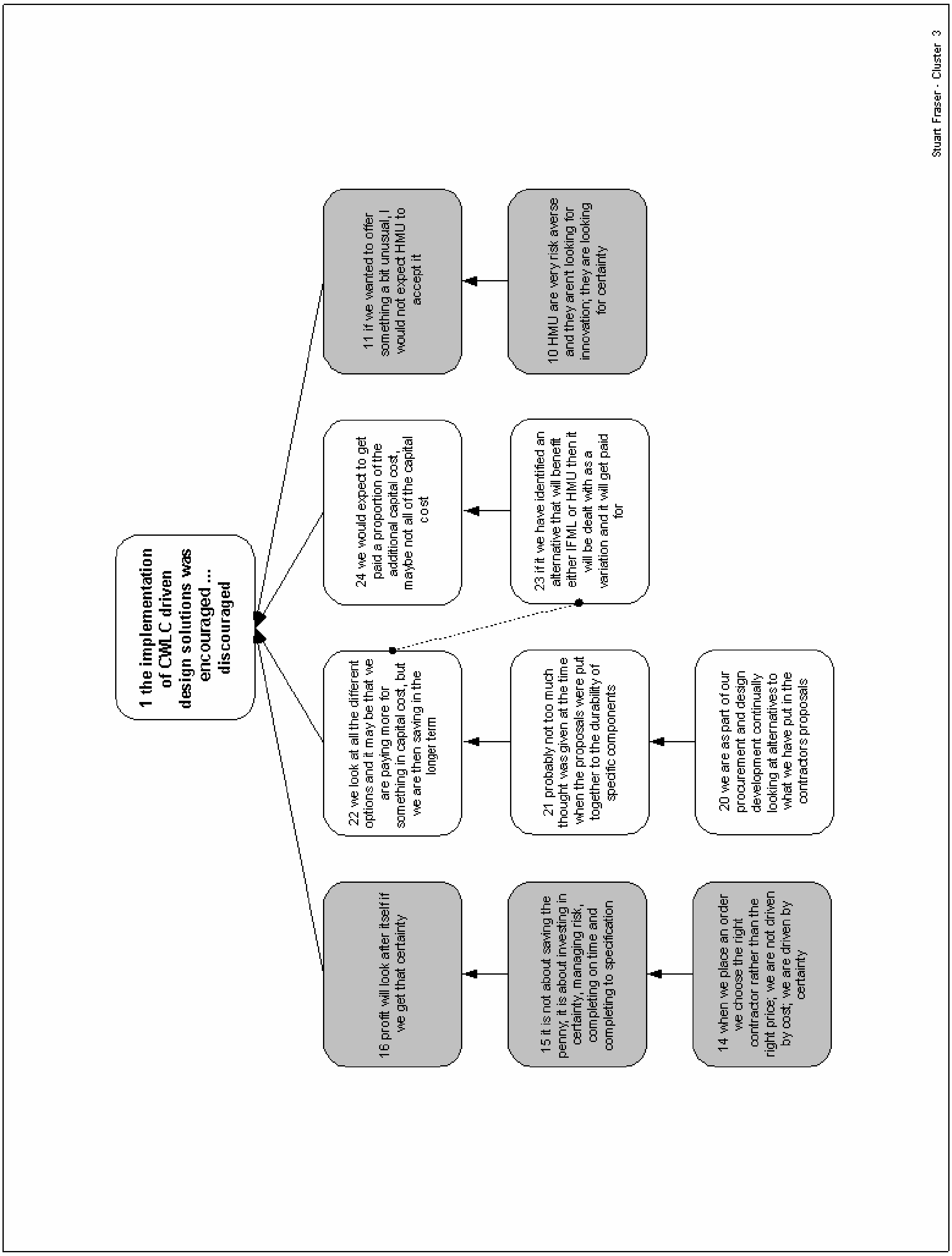

Figure A7.27. Fraser storyline map Cluster 3.

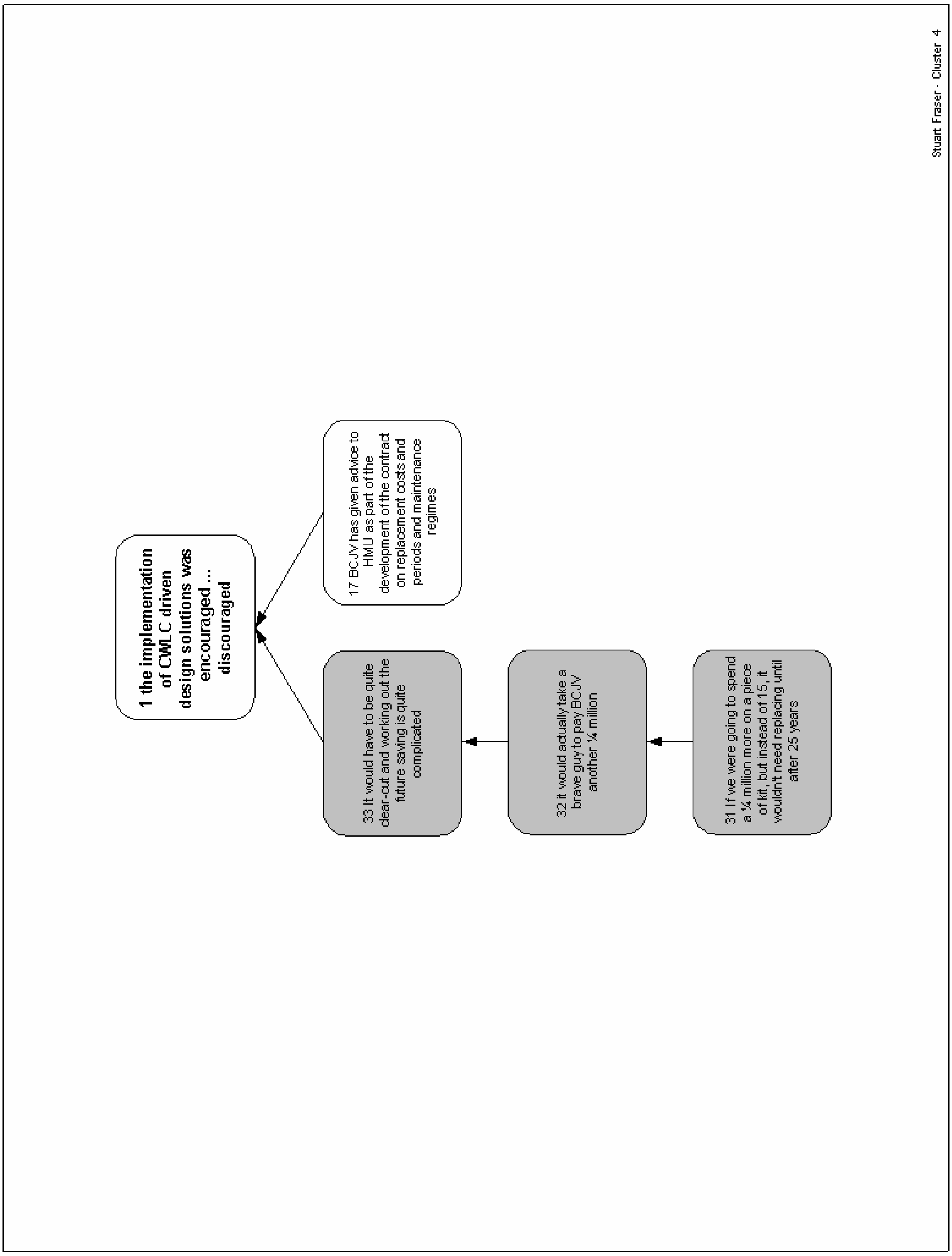

Figure A7.28. Fraser storyline map Cluster 4.

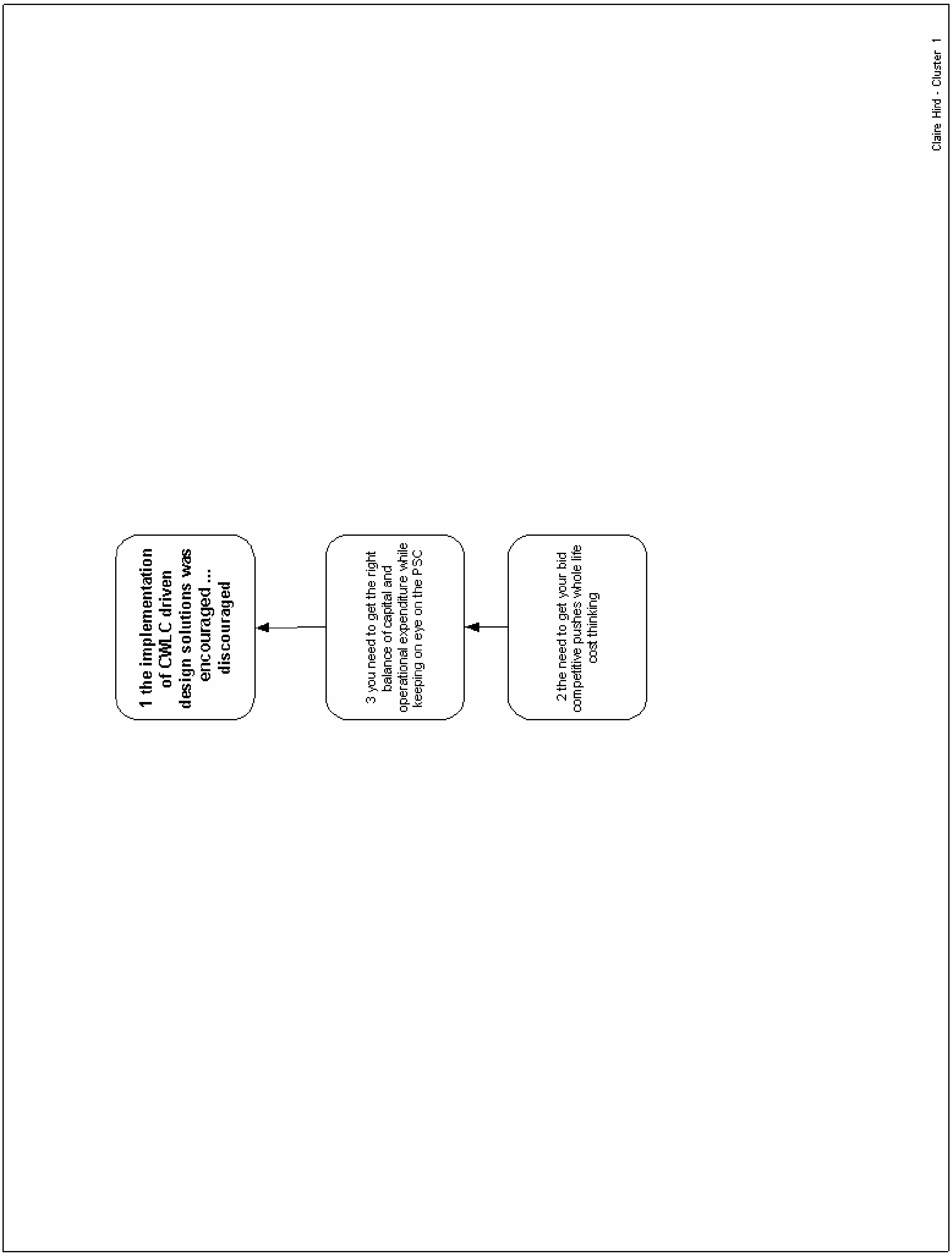

Figure A7.29. Hird storyline map Cluster 1.

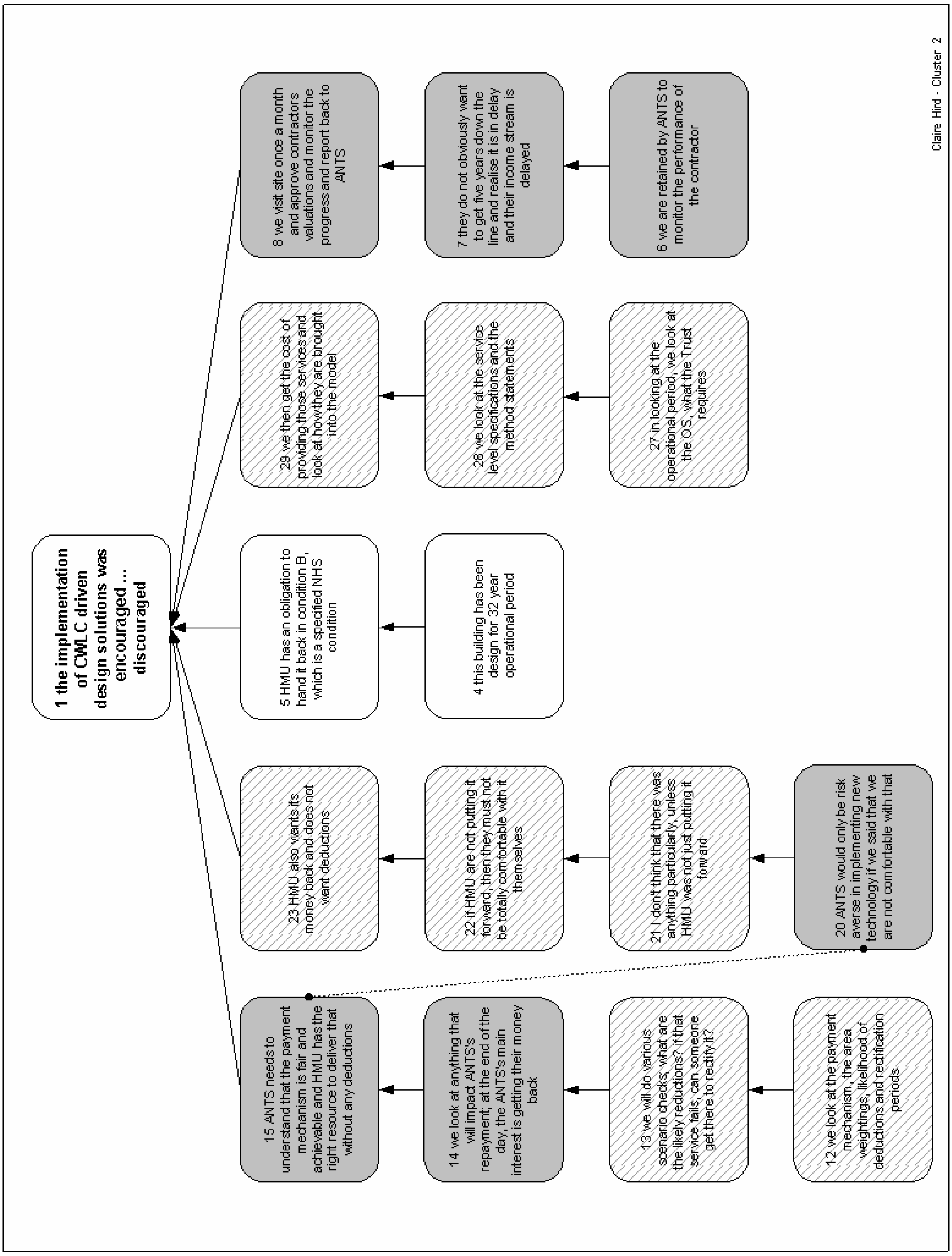

Figure A7.30. Hird storyline map Cluster 2.

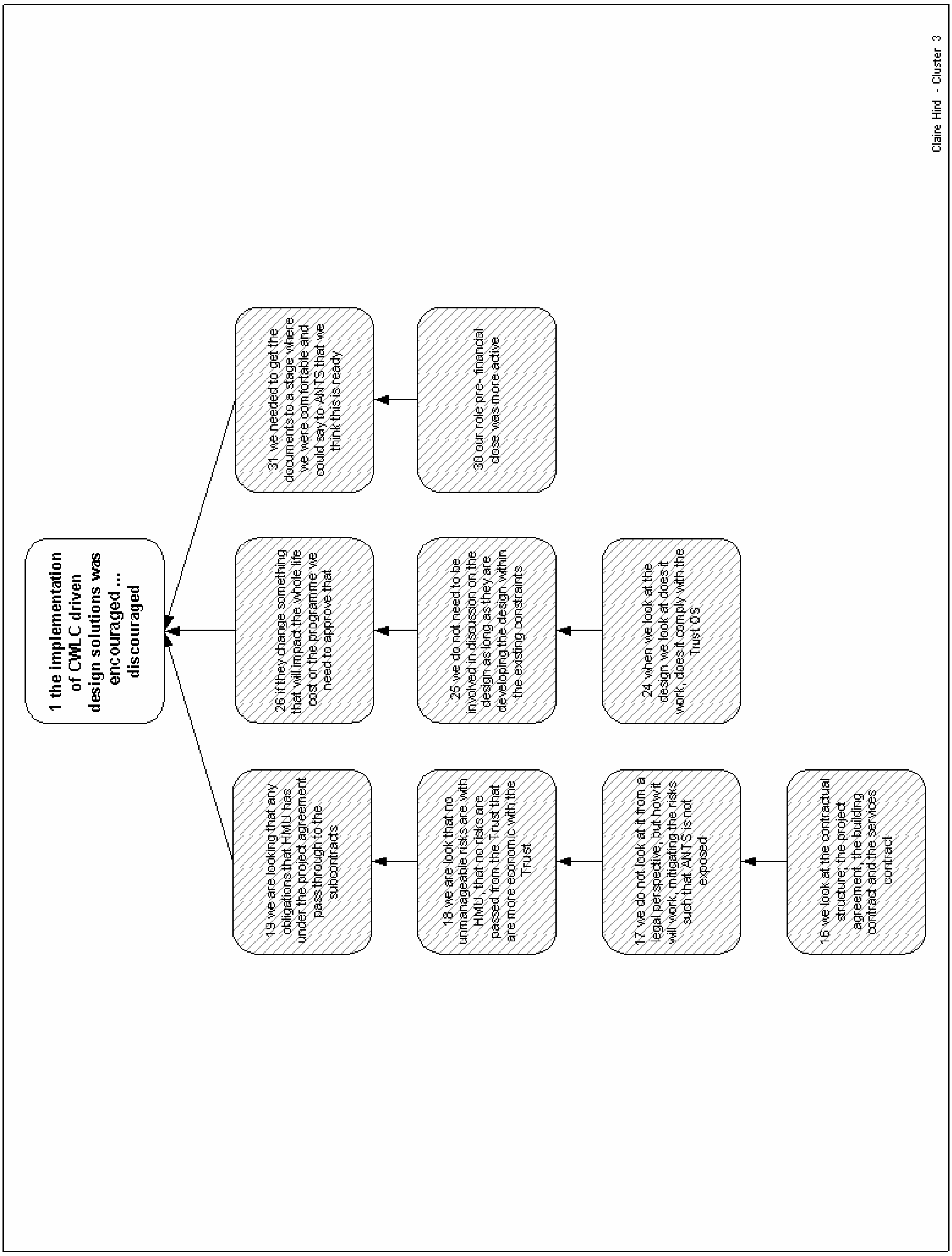

Figure A7.31. Hird storyline map Cluster 3.

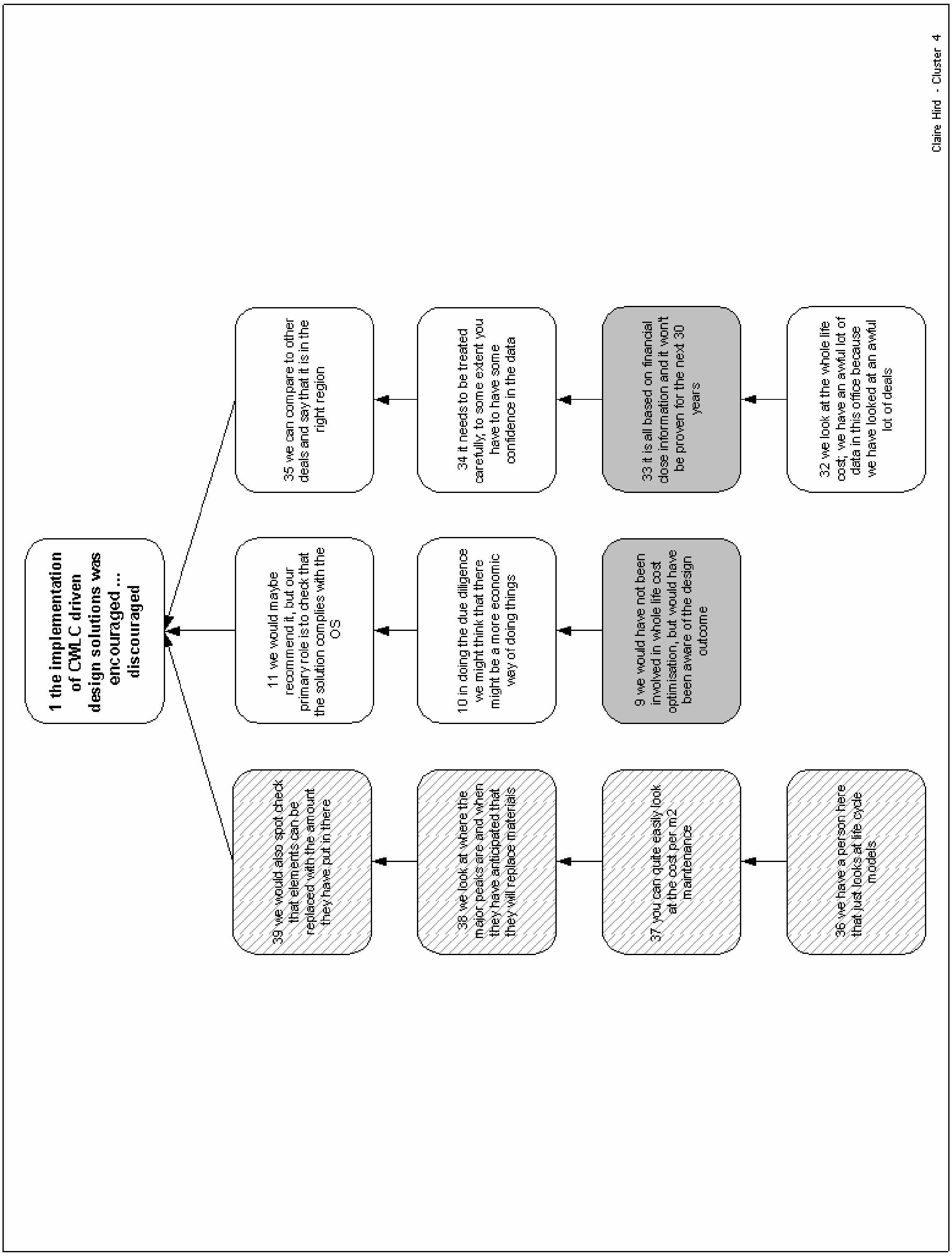

Figure A7.32. Hird storyline map Cluster 4.

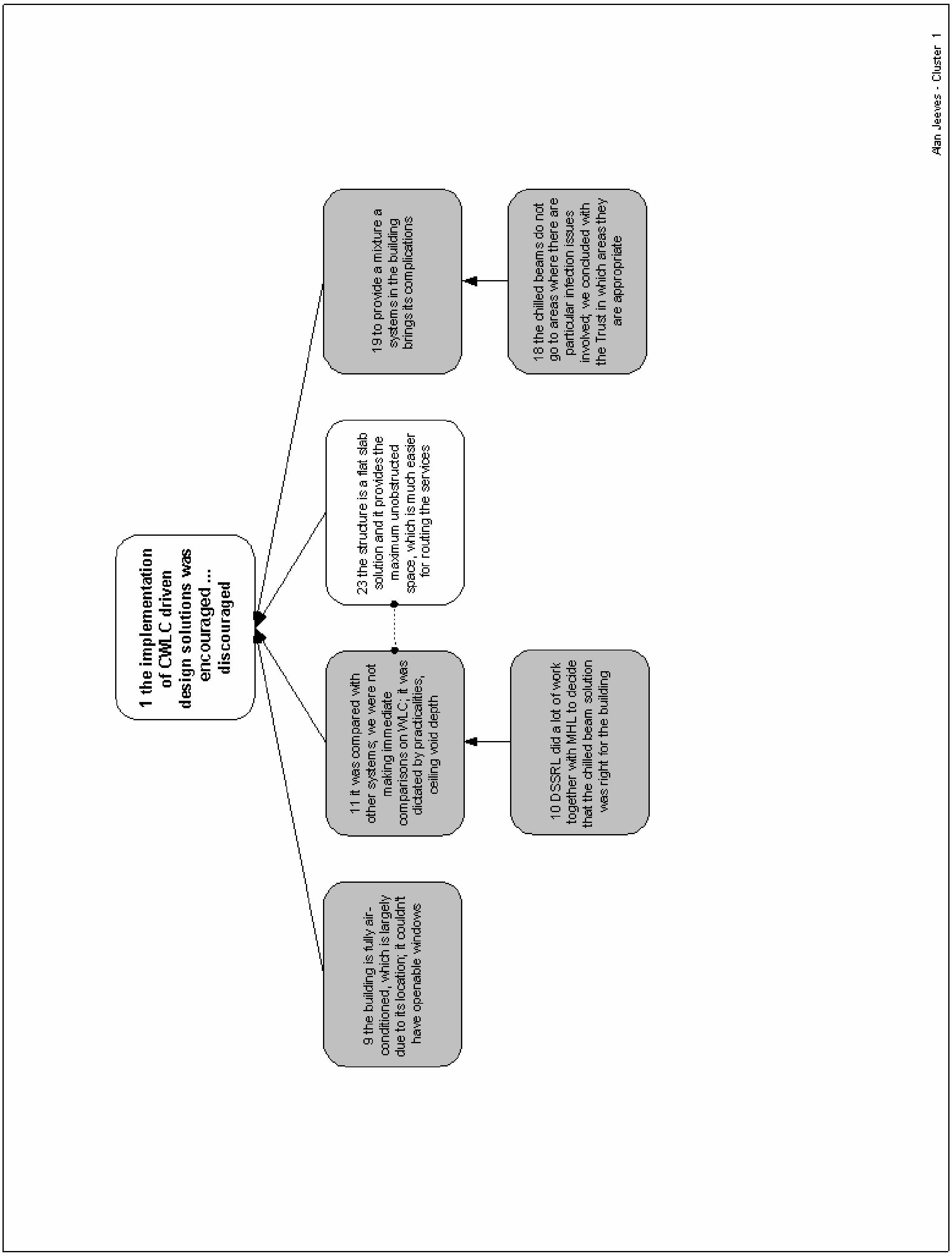

Figure A7.33. Jeeves storyline map Cluster 1.

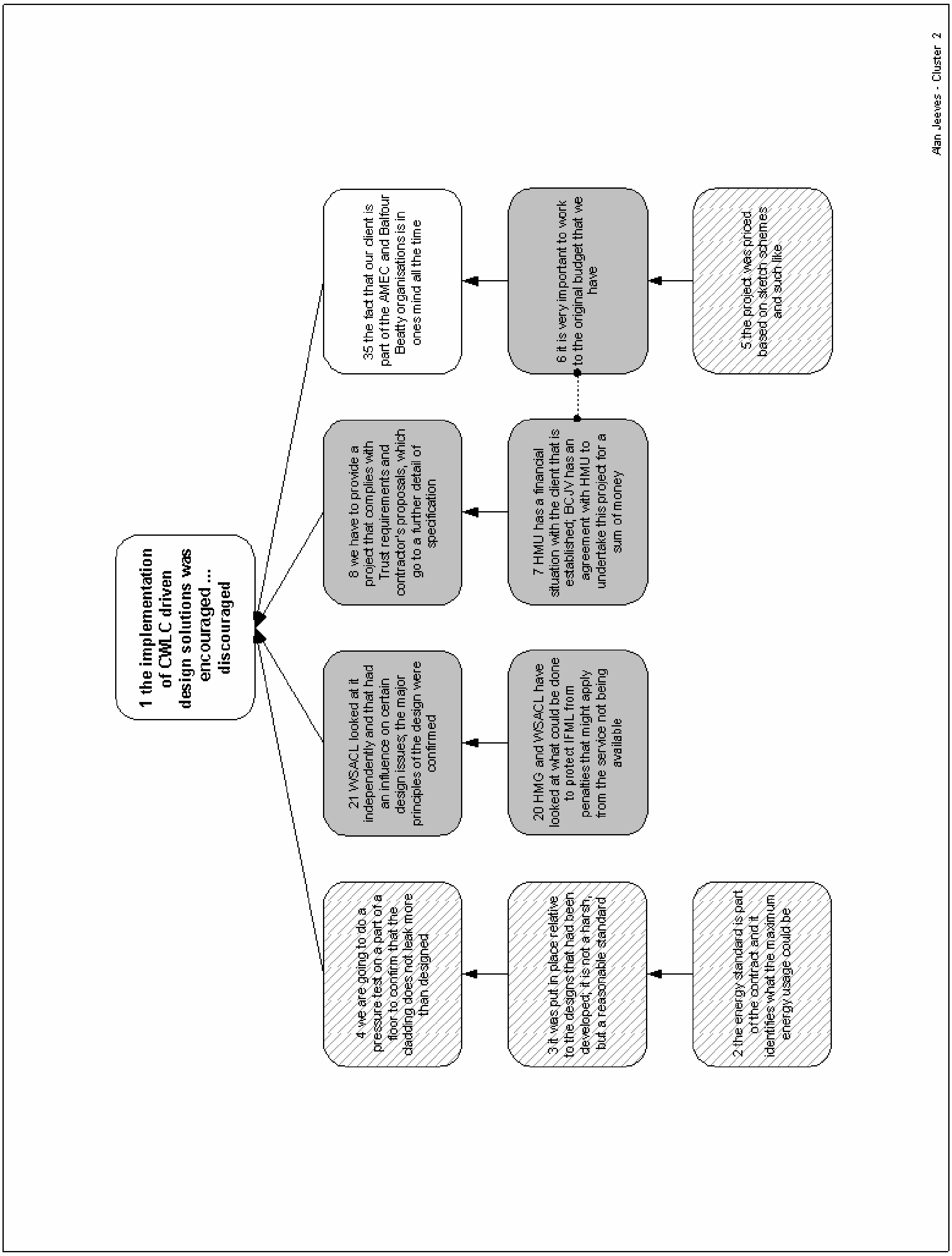

Figure A7.34. Jeeves storyline map Cluster 2.

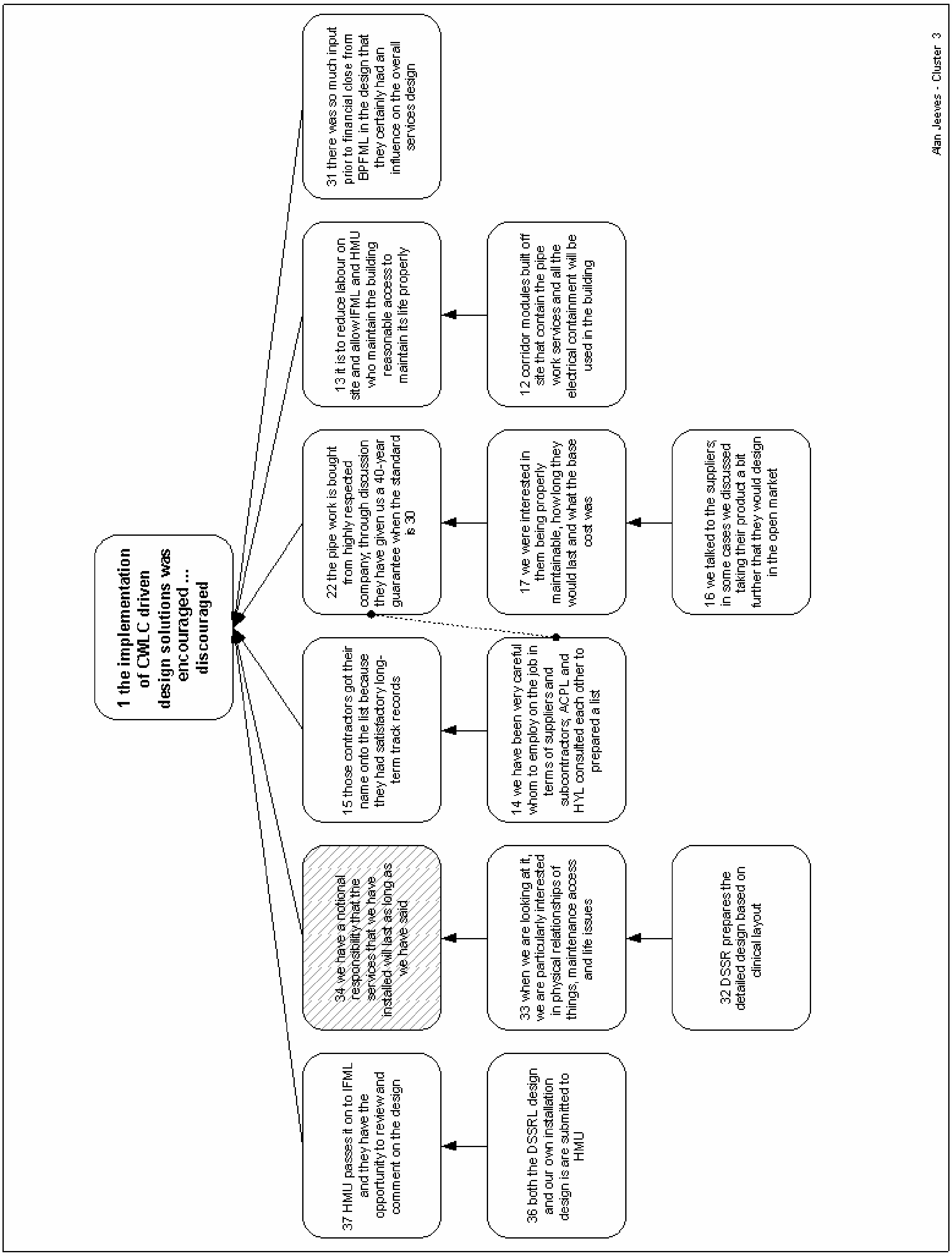

Figure A7.35. Jeeves storyline map Cluster 3.

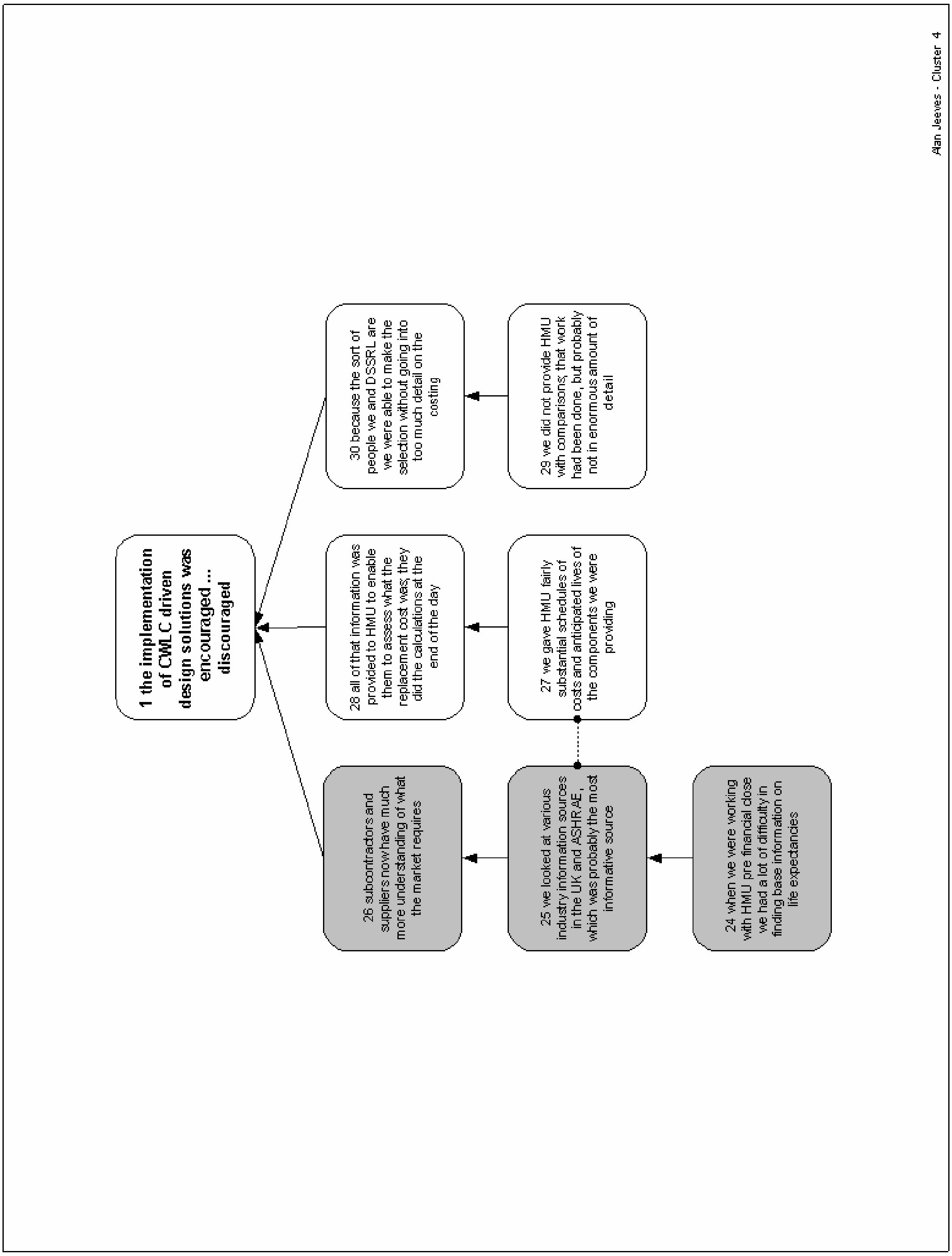

Figure A7.36. Jeeves storyline map Cluster 4.

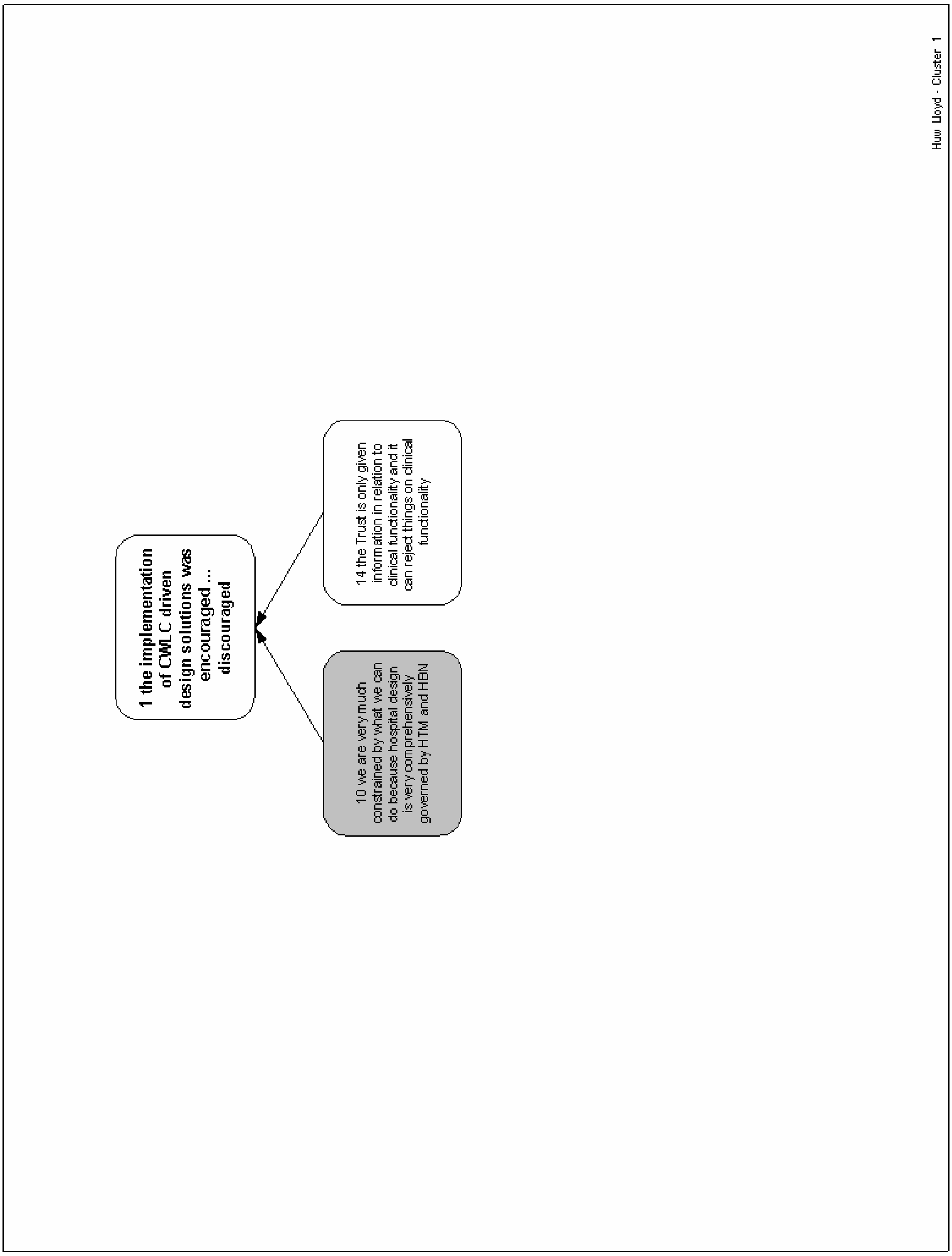

Figure A7.37. Lloyd storyline map Cluster 1.

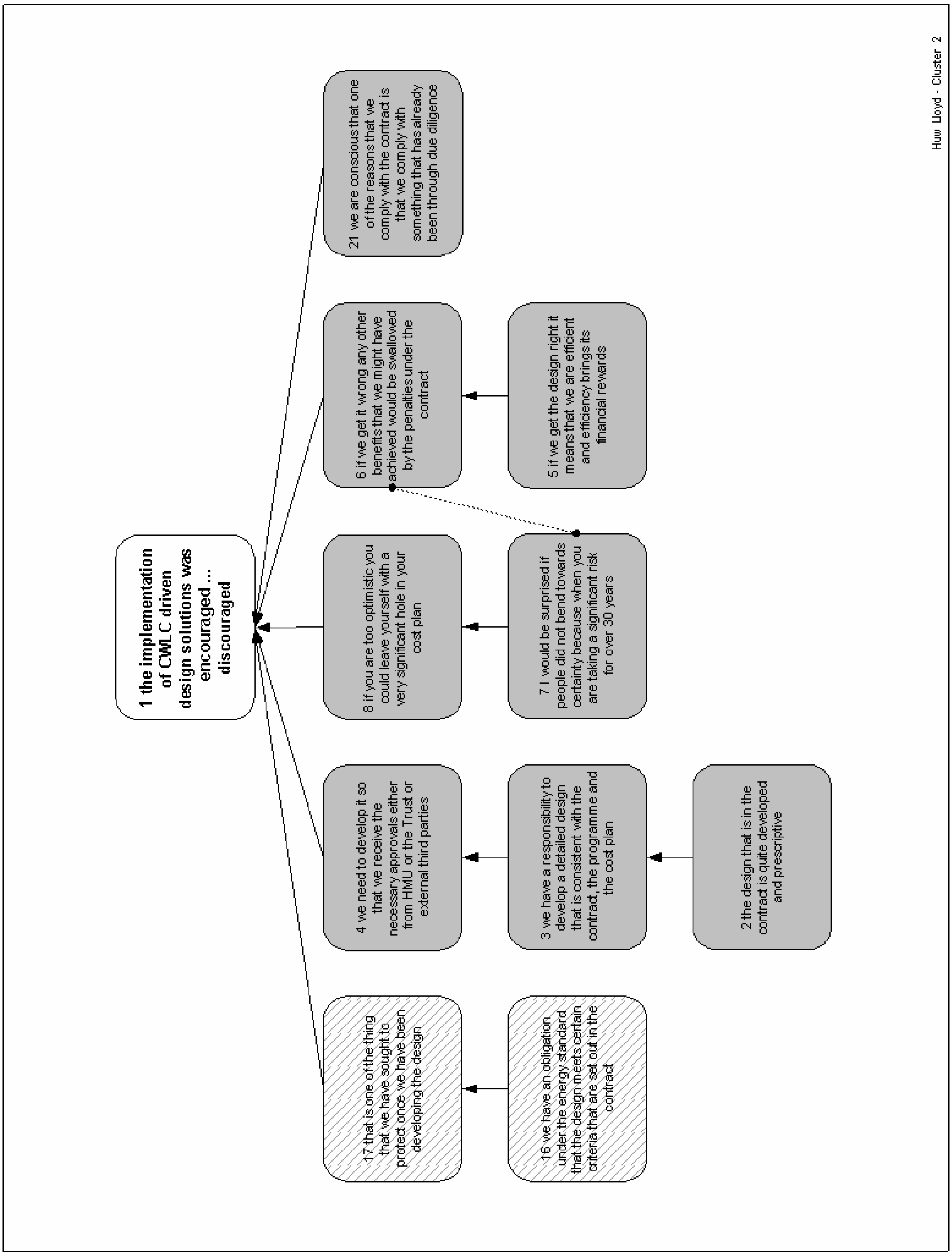

Figure A7.38. Lloyd storyline map Cluster 2.

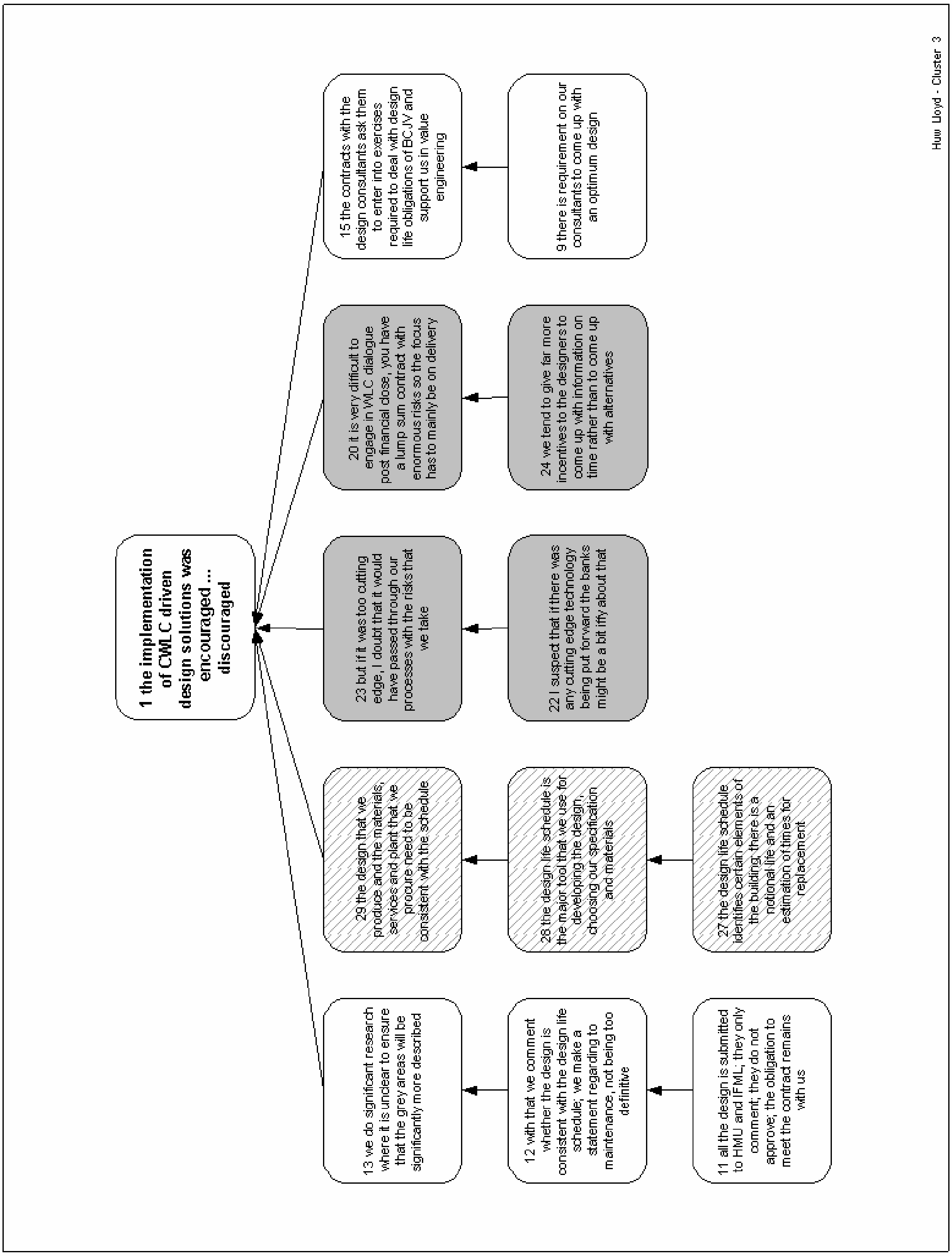

Figure A7.39. Lloyd storyline map Cluster 3.

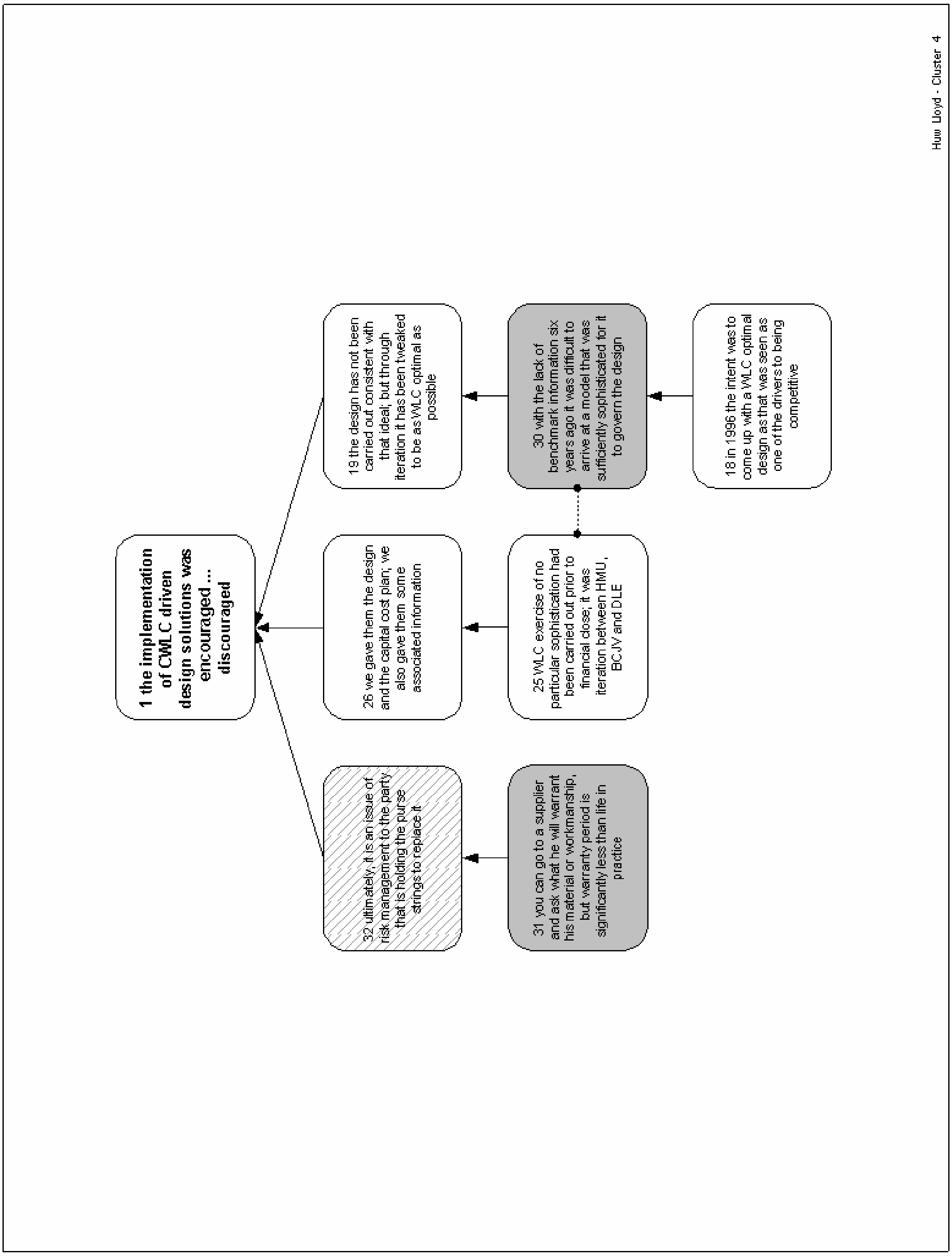

Figure A7.40. Lloyd storyline map Cluster 4.

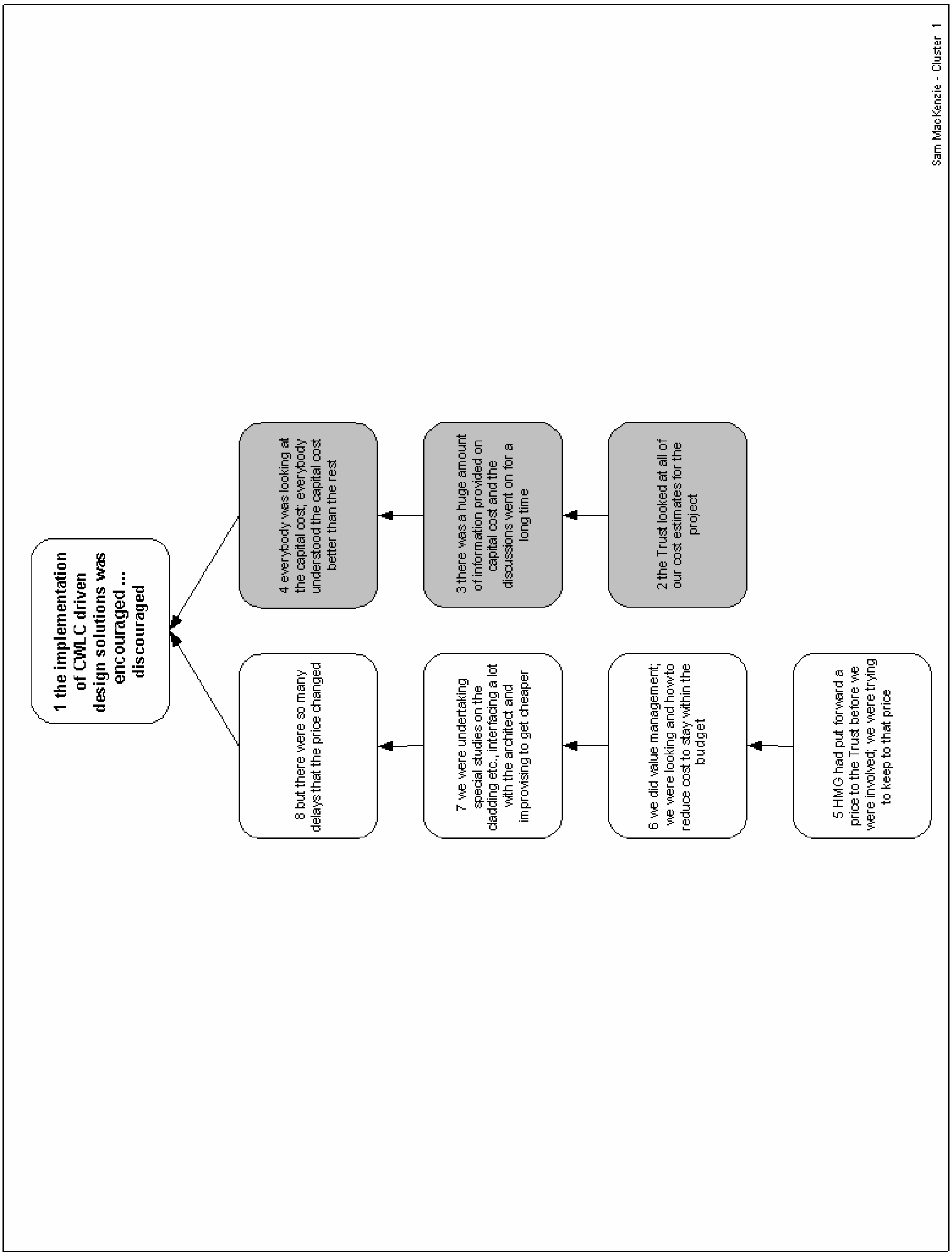

Figure A7.41. MacKenzie storyline map Cluster 1.

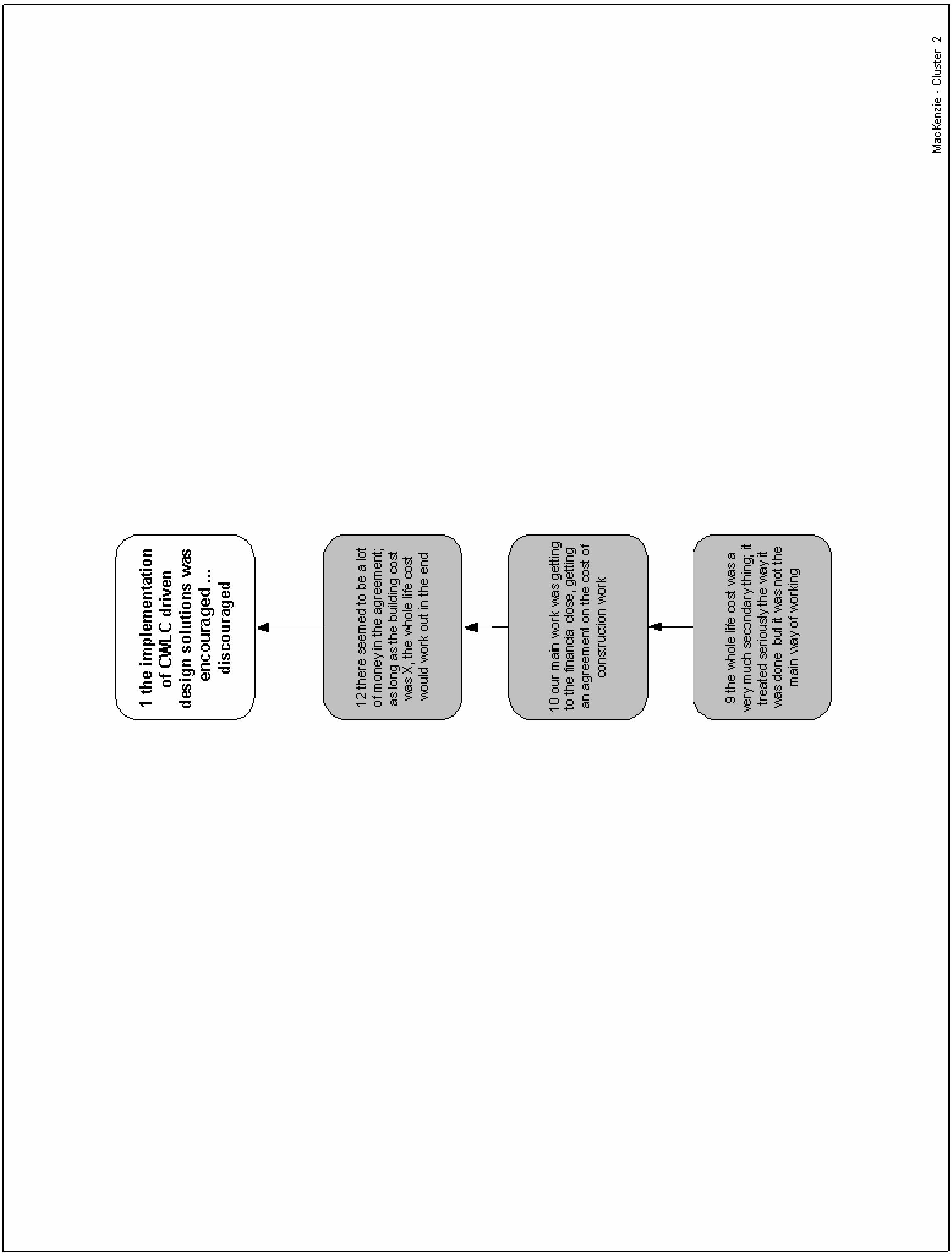

Figure A7.42. MacKenzie storyline map Cluster 2.

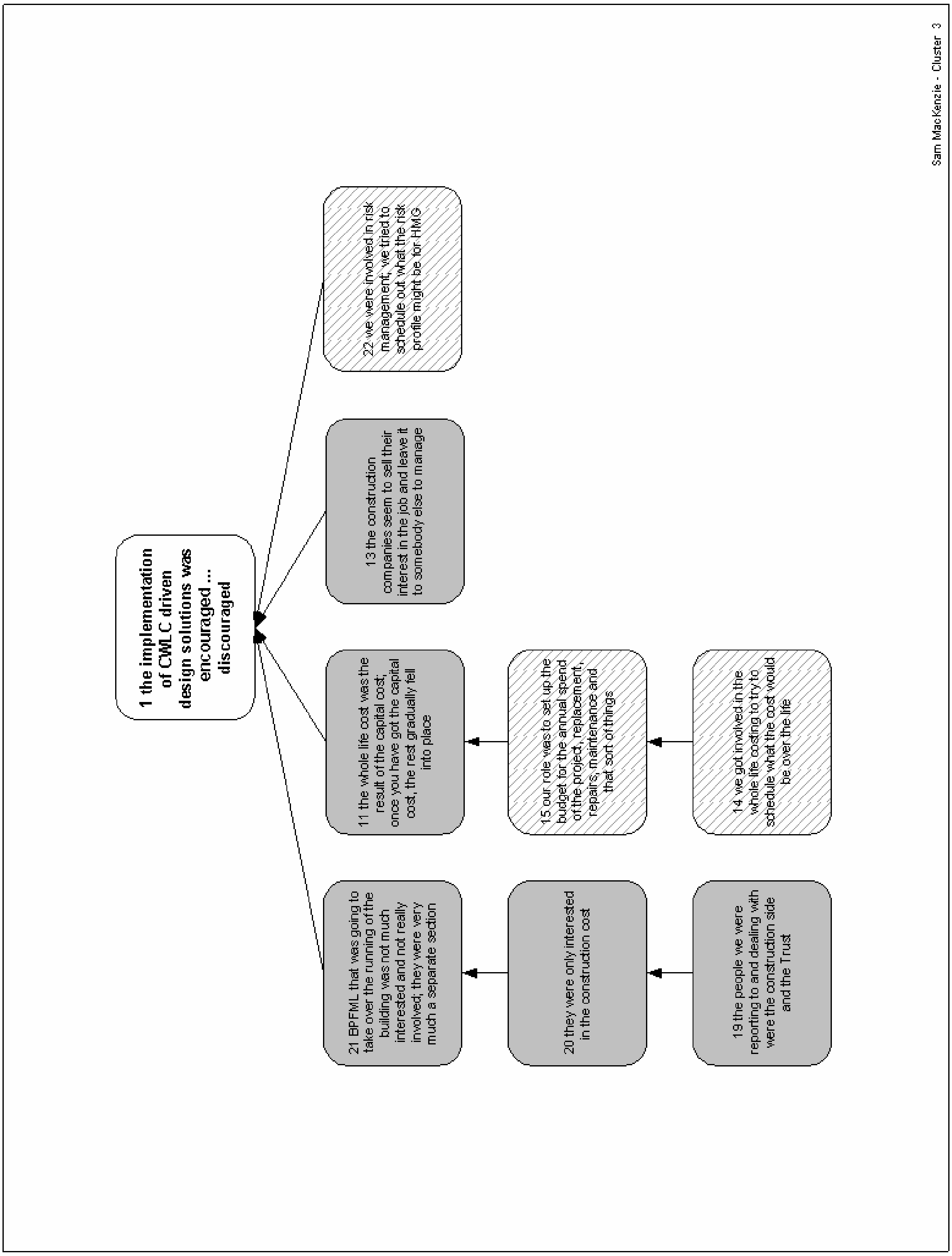

Figure A7.43. MacKenzie storyline map Cluster 3.

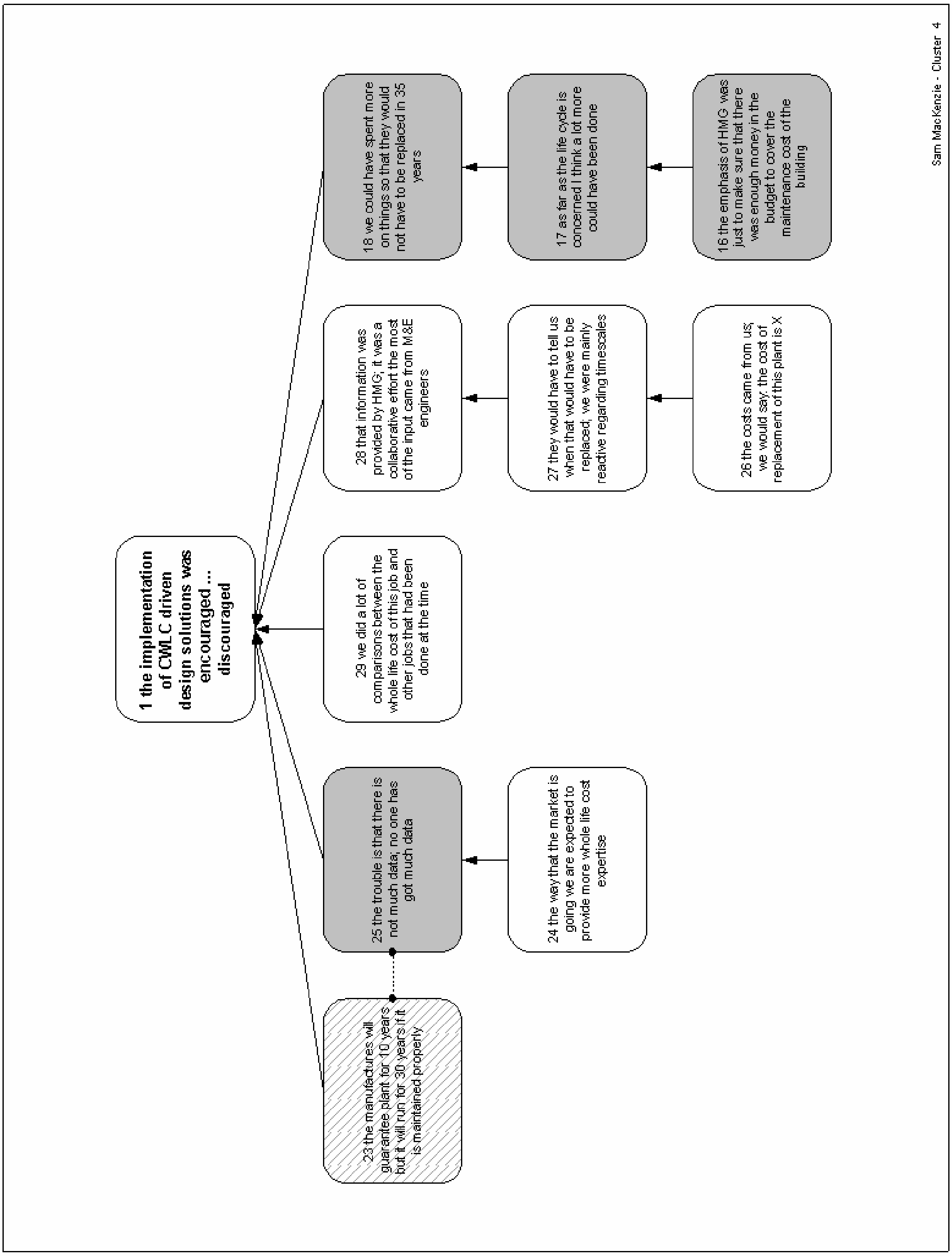

Figure A7.44. MacKenzie storyline map Cluster 4.

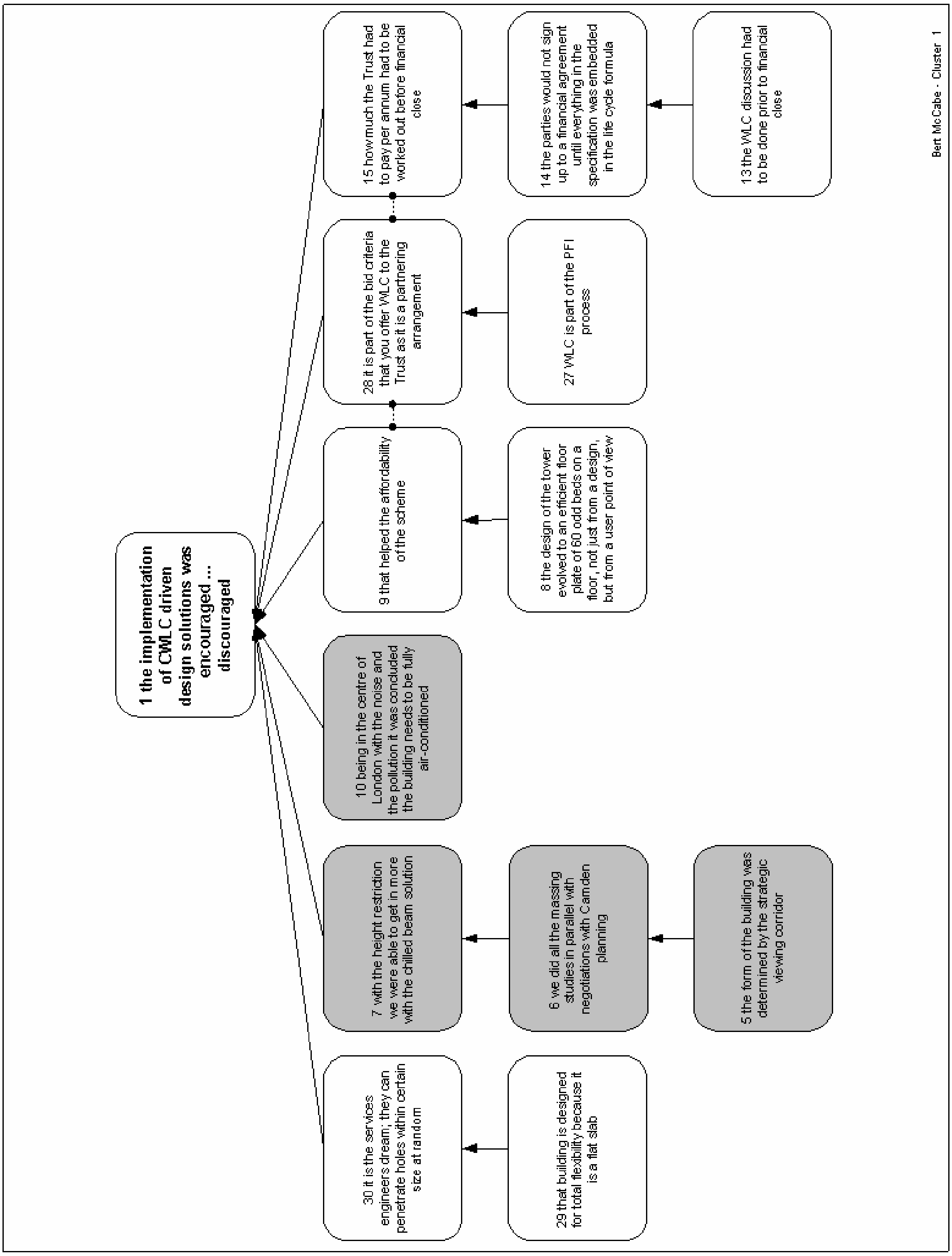

Figure A7.45. McCabe storyline map Cluster 1.

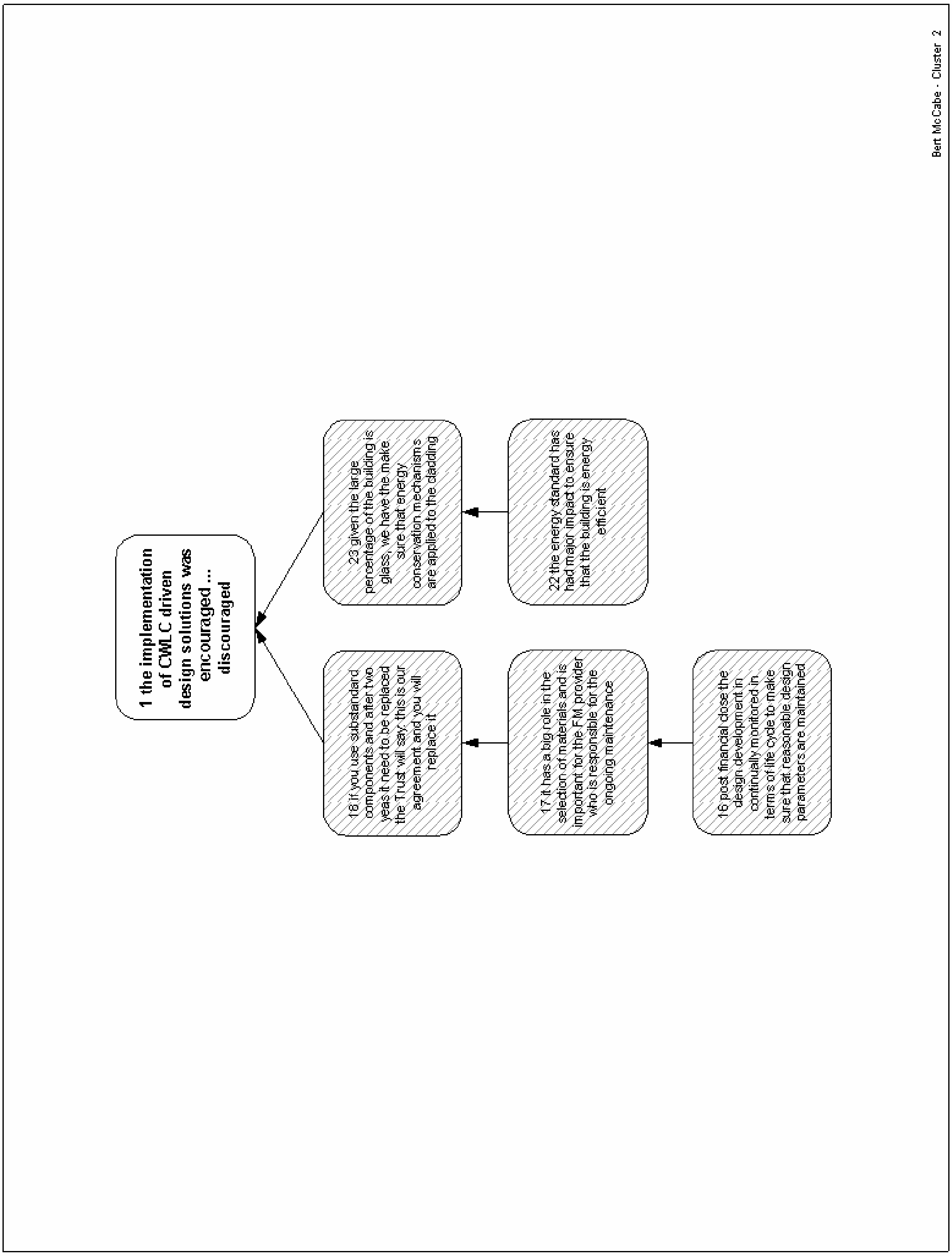

Figure A7.46. McCabe storyline map Cluster 2.

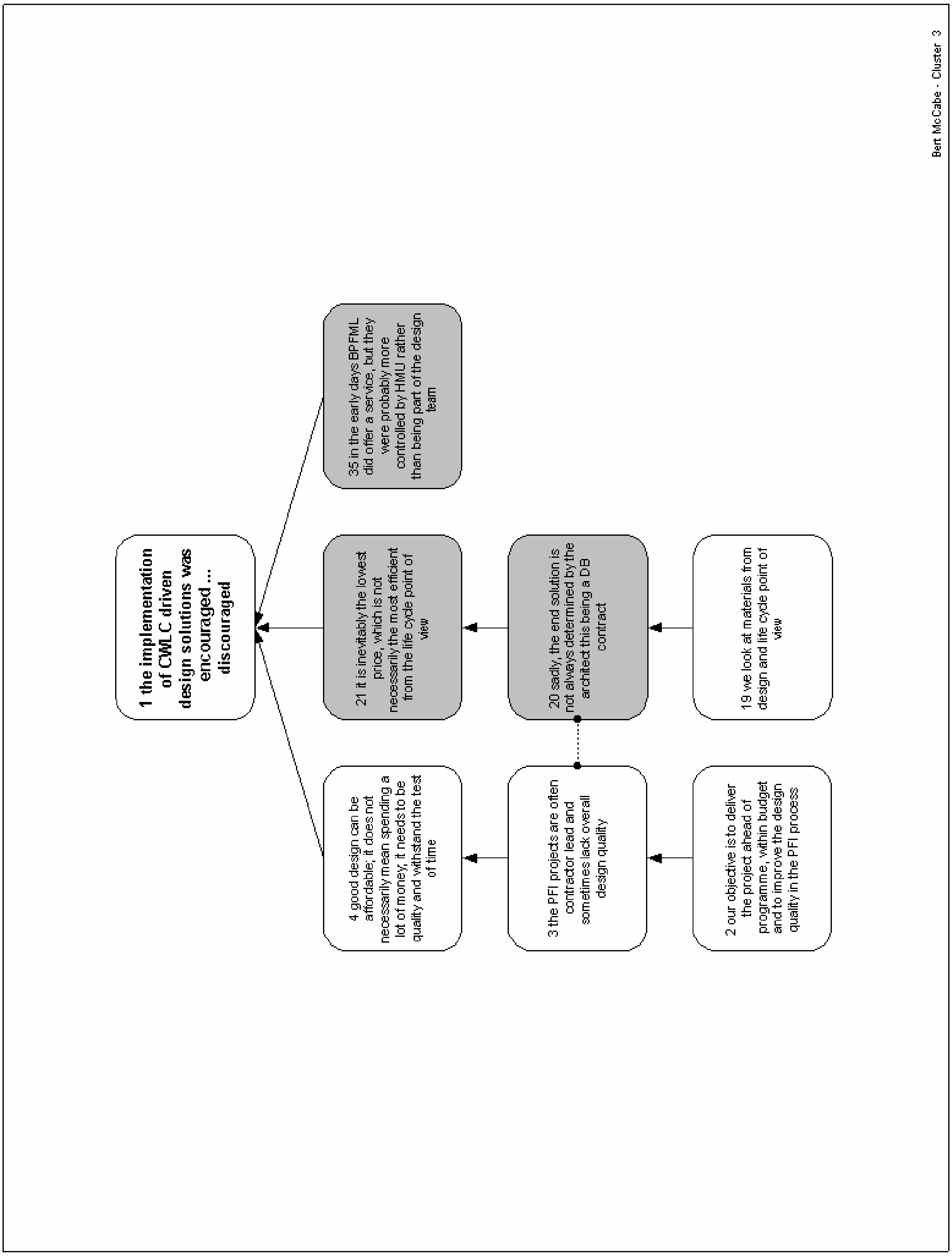

Figure A7.47. McCabe storyline map Cluster 3.

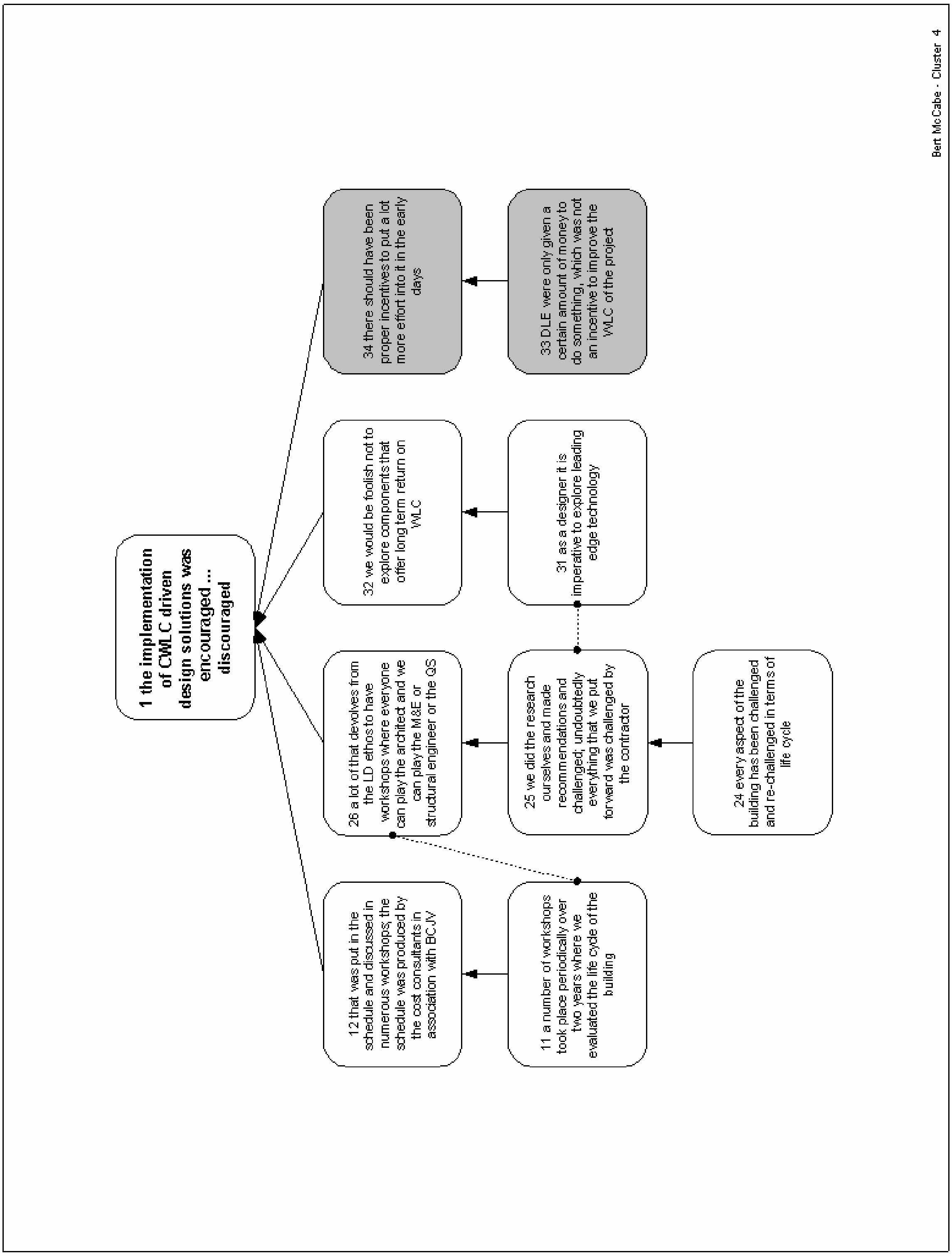

Figure A7.48. McCabe storyline map Cluster 4.

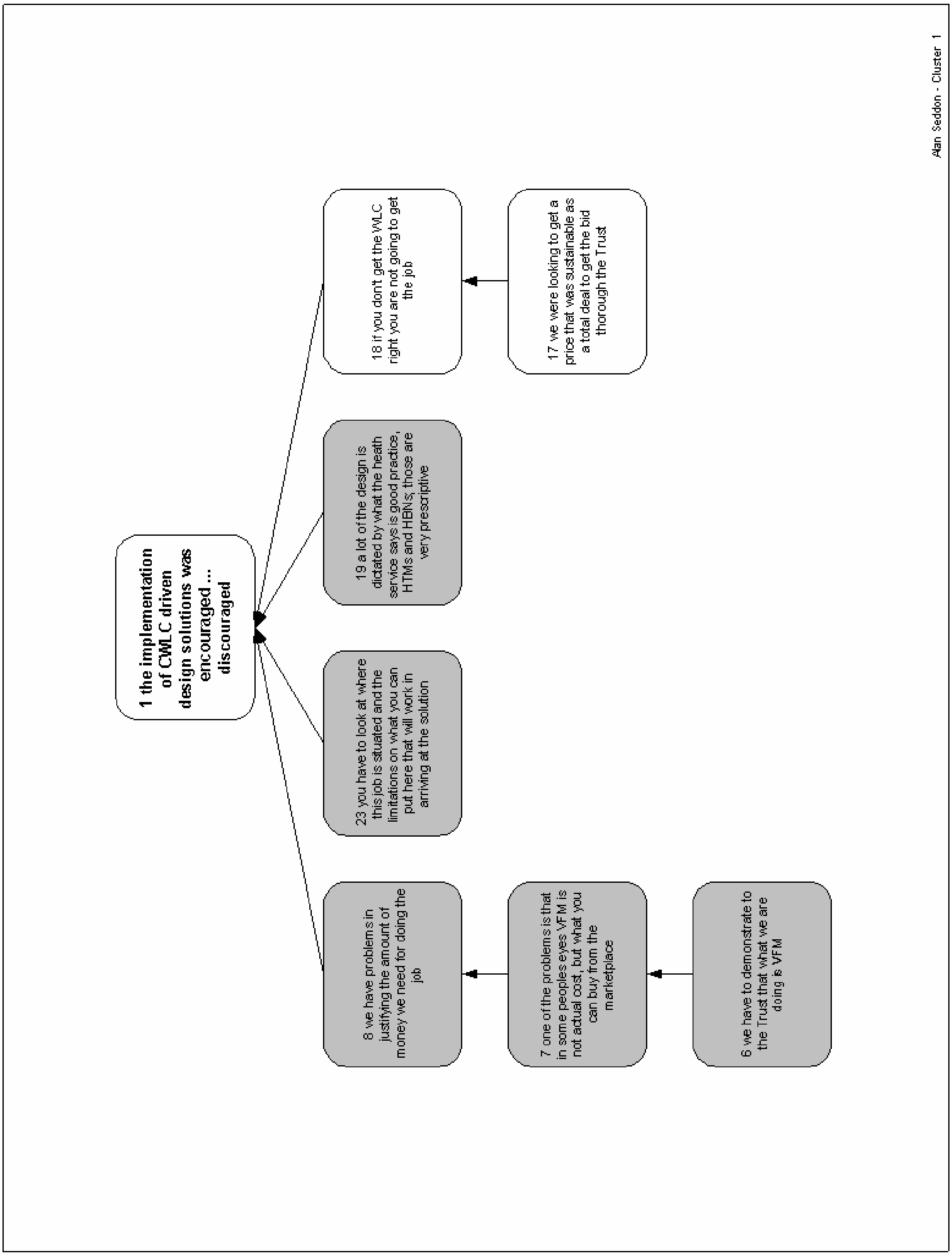

Figure A7.49. Seddon storyline map Cluster 1.

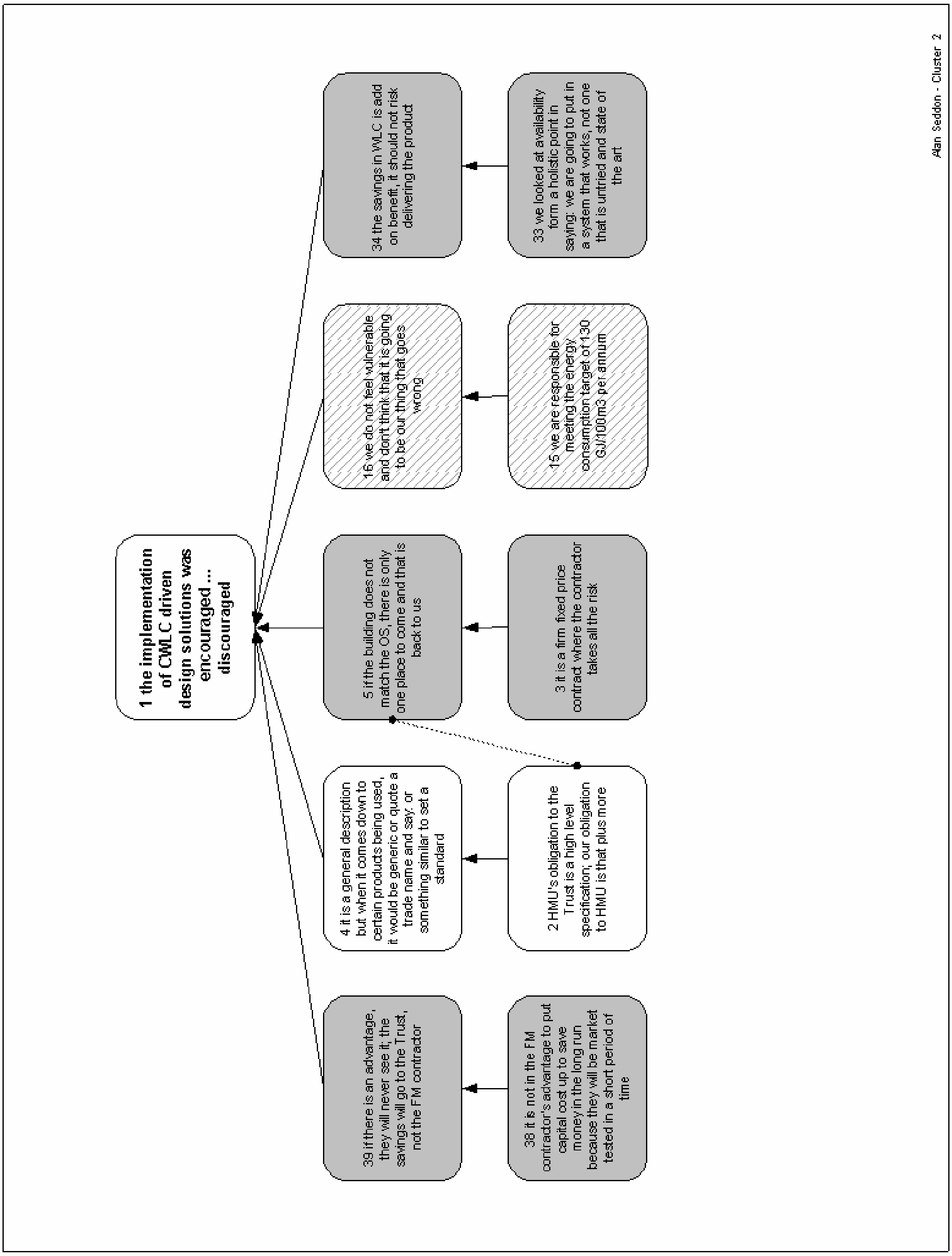

Figure A7.50. Seddon storyline map Cluster 2.

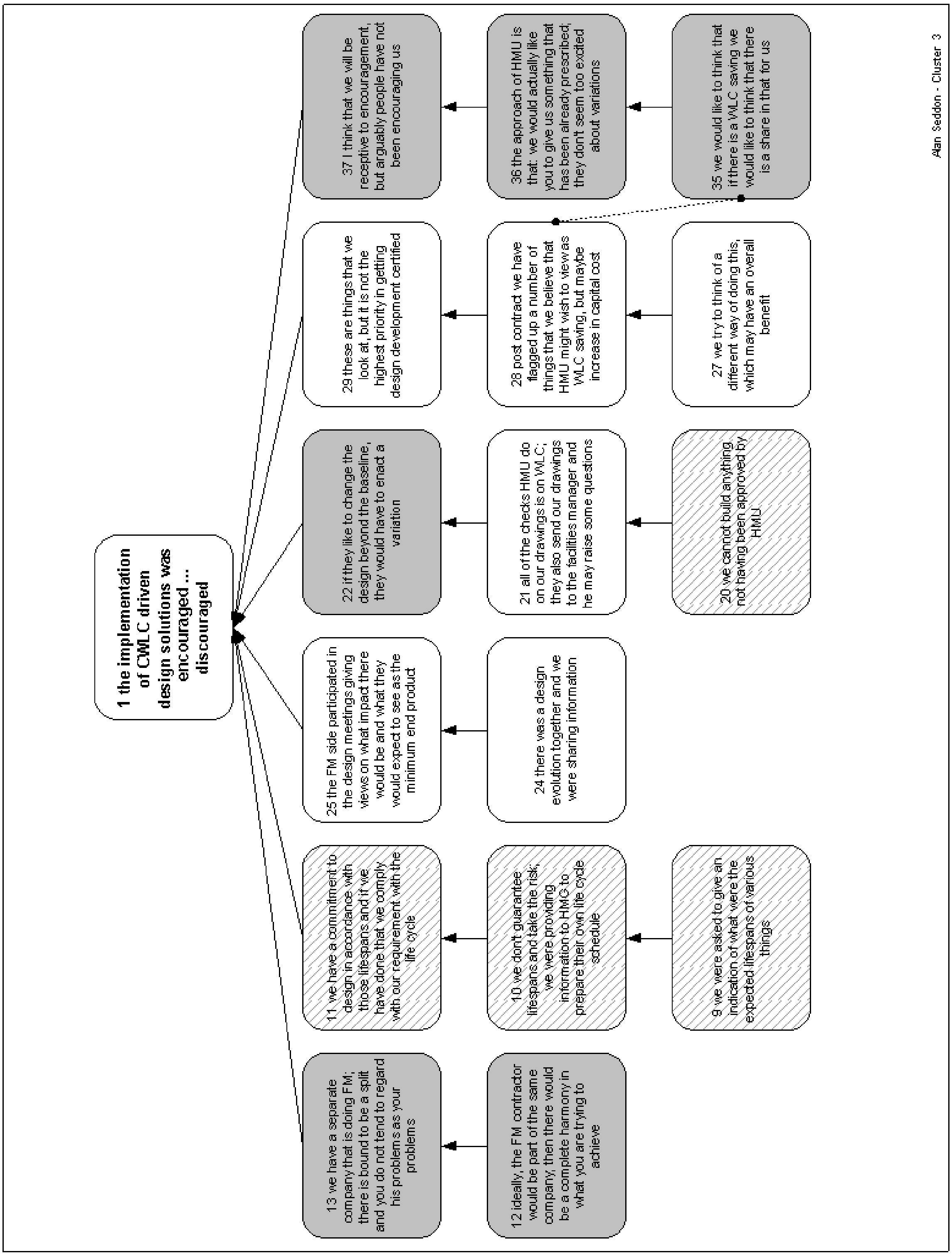

Figure A7.51. Seddon storyline map Cluster 3.

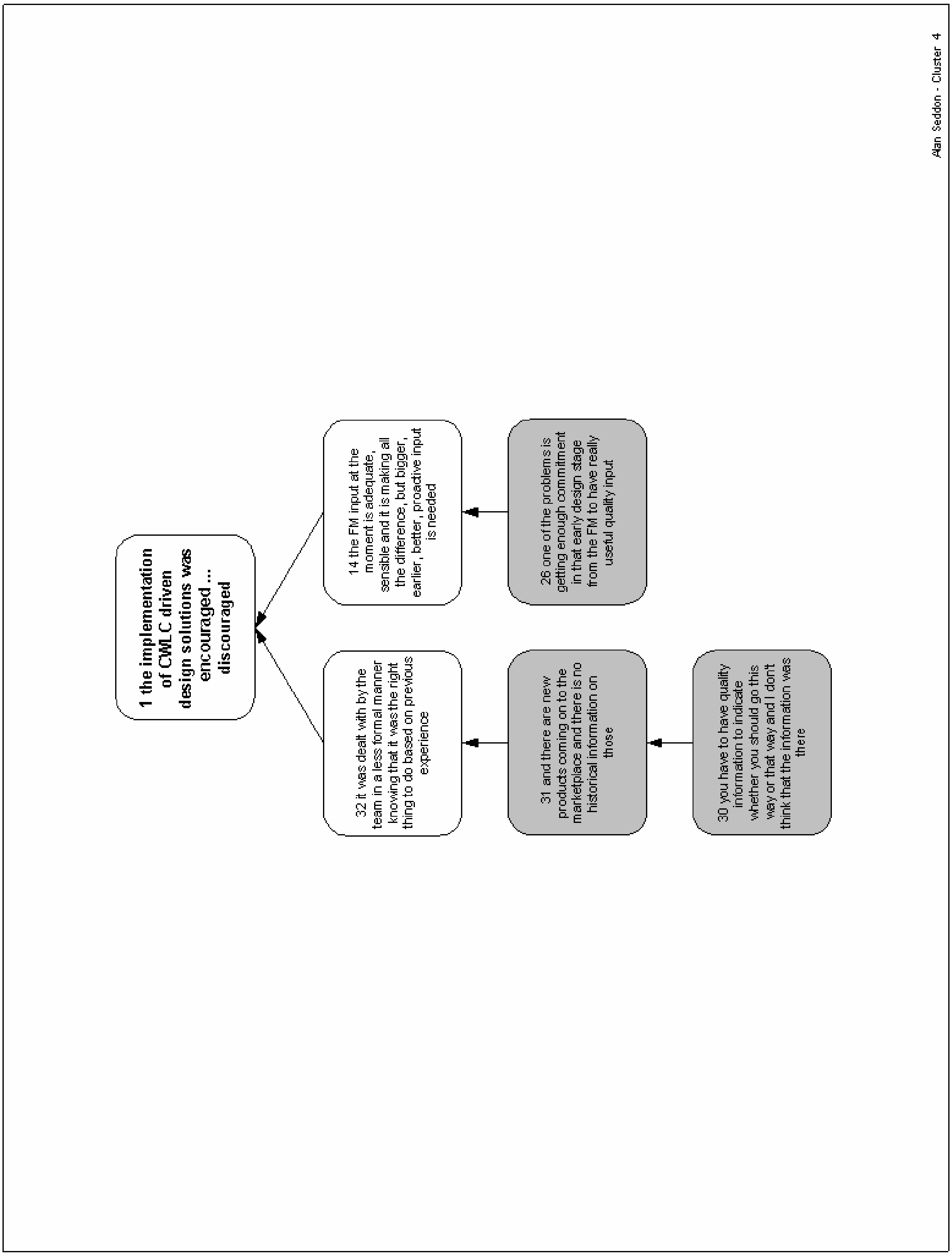

Figure A7.52. Seddon storyline map Cluster 4.

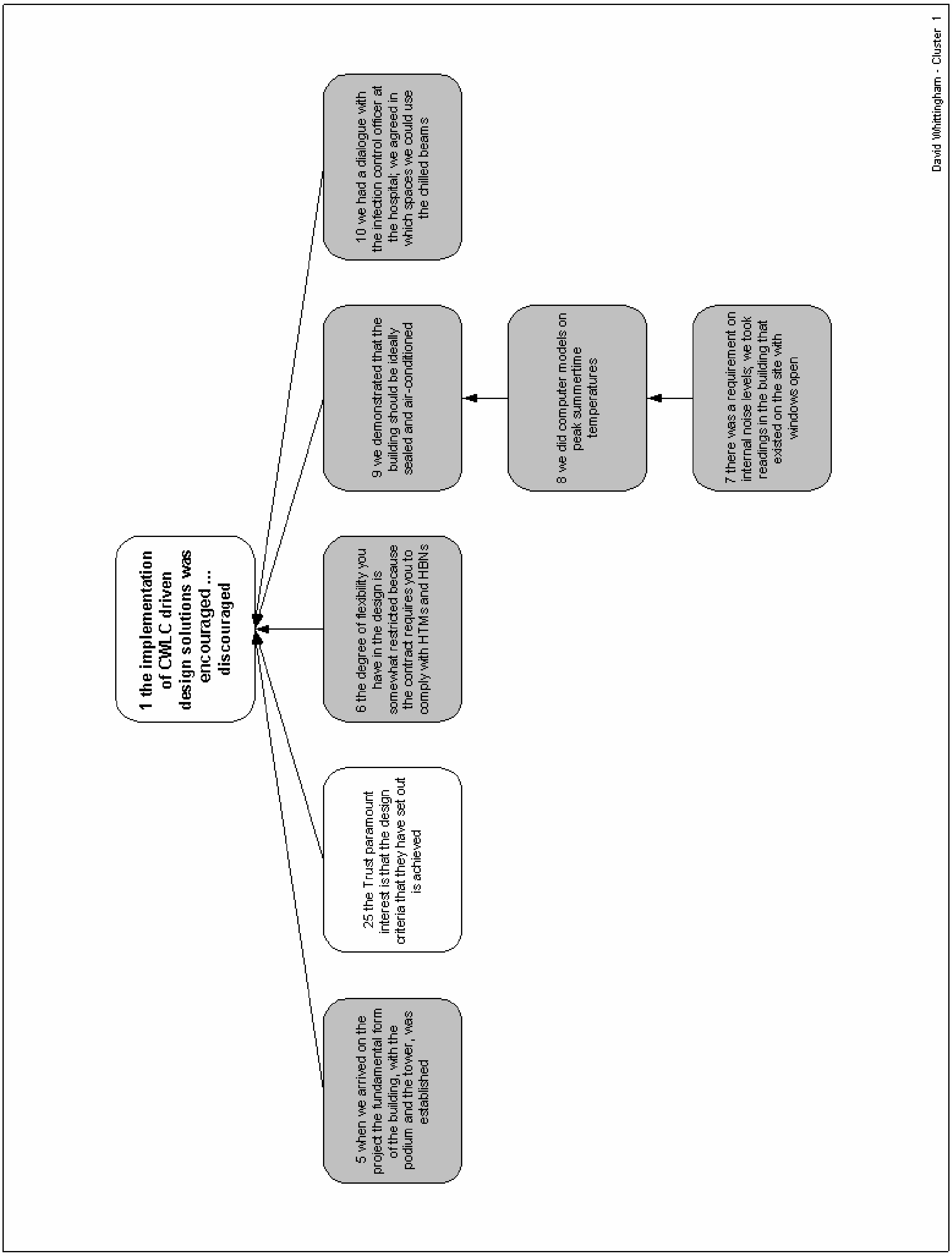

Figure A7.53. Whittingham storyline map Cluster 1.

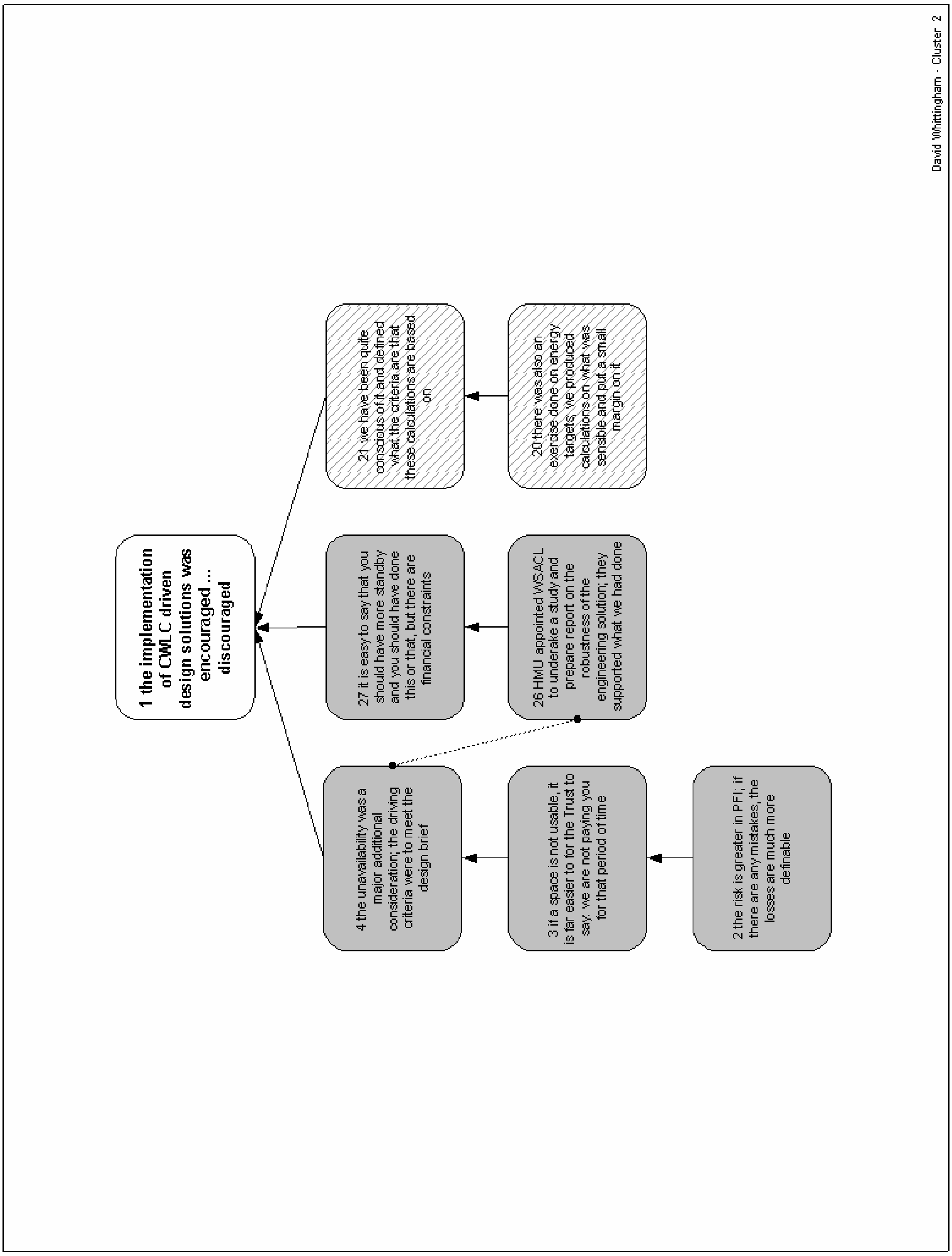

Figure A7.54. Whittingham storyline map Cluster 2.

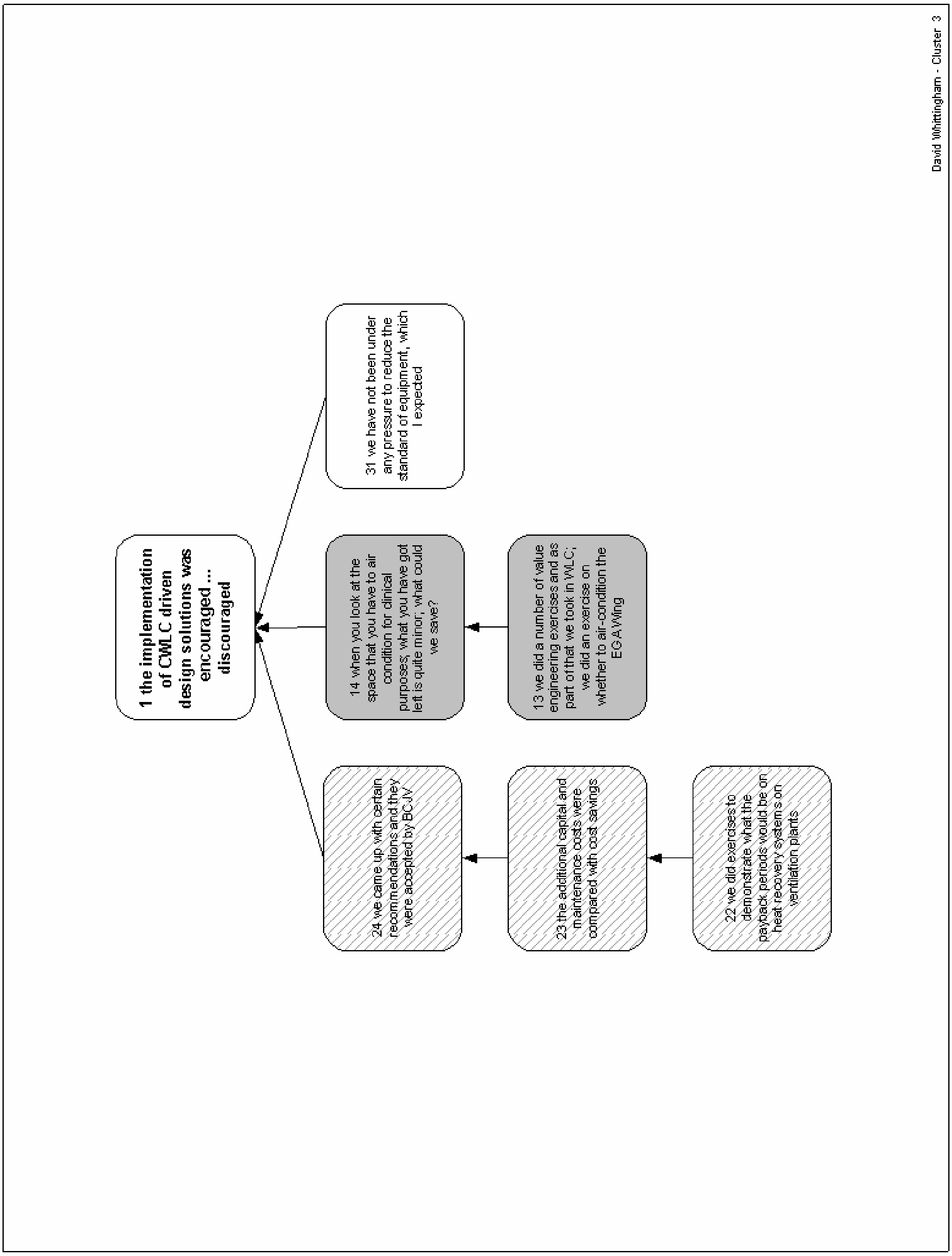

Figure A7.55. Whittingham storyline map Cluster 3.

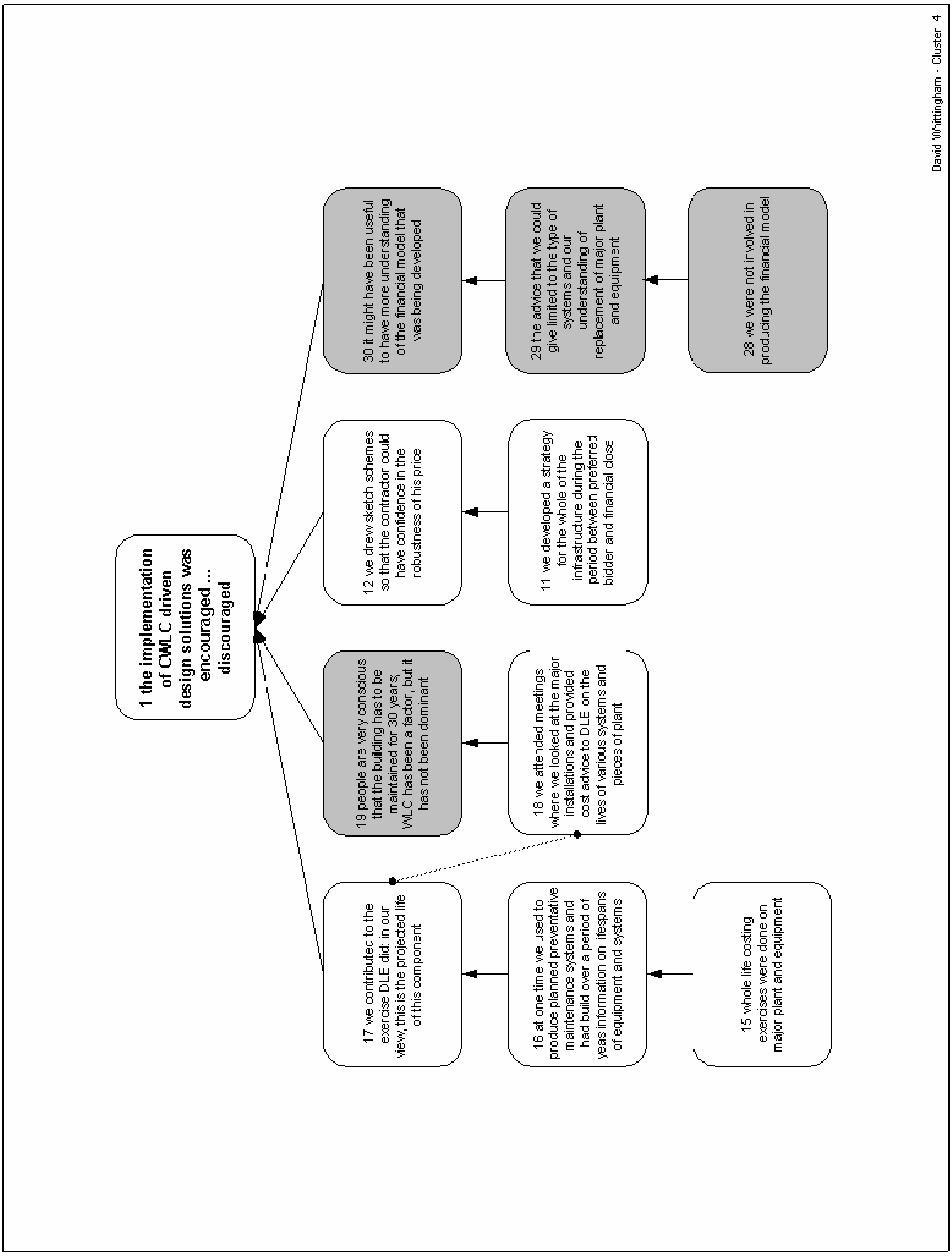

Figure A7.56. Whittingham storyline map Cluster 4.

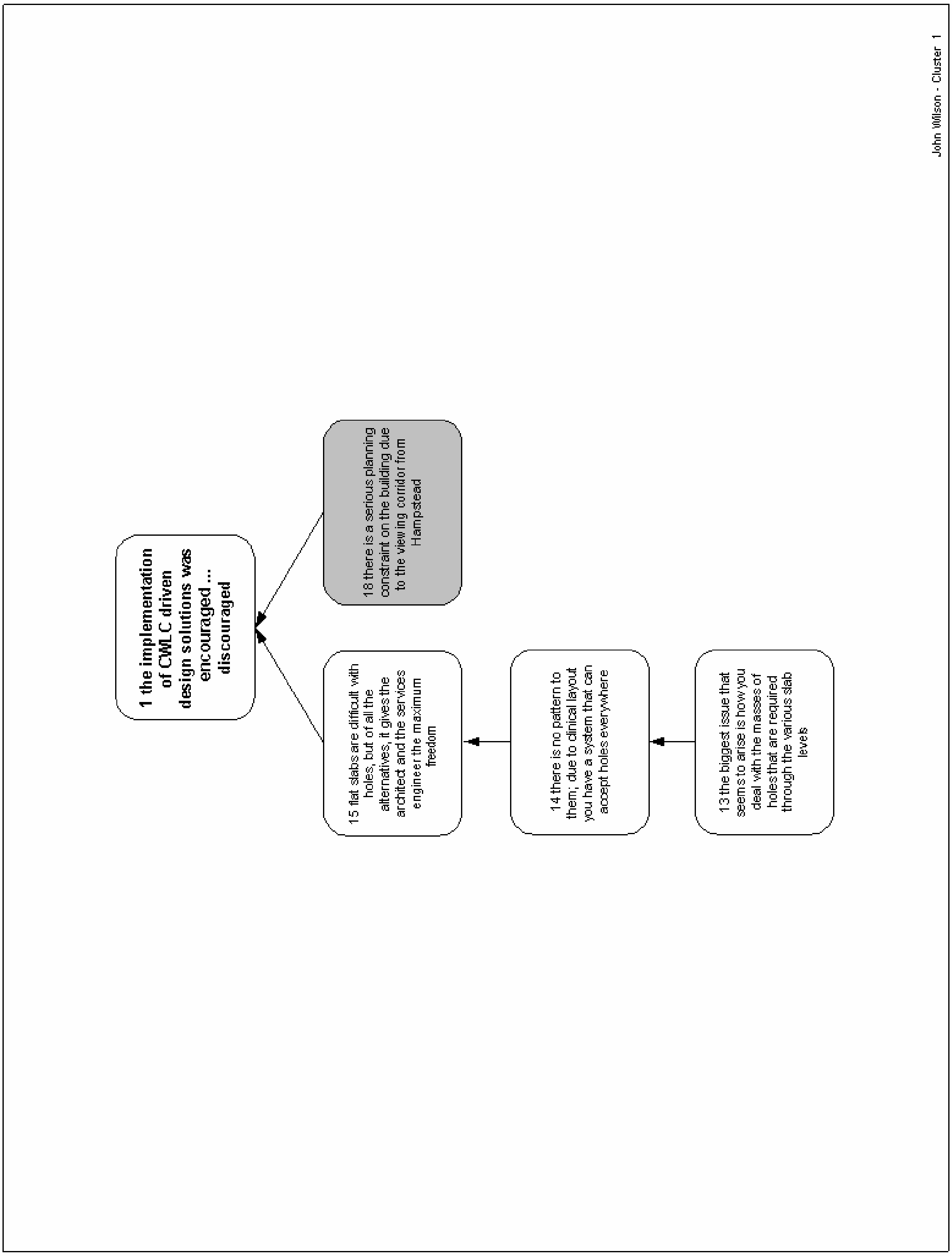

Figure A7.57. Wilson storyline map Cluster 1.

Figure A7.58. Wilson storyline map Cluster 2.

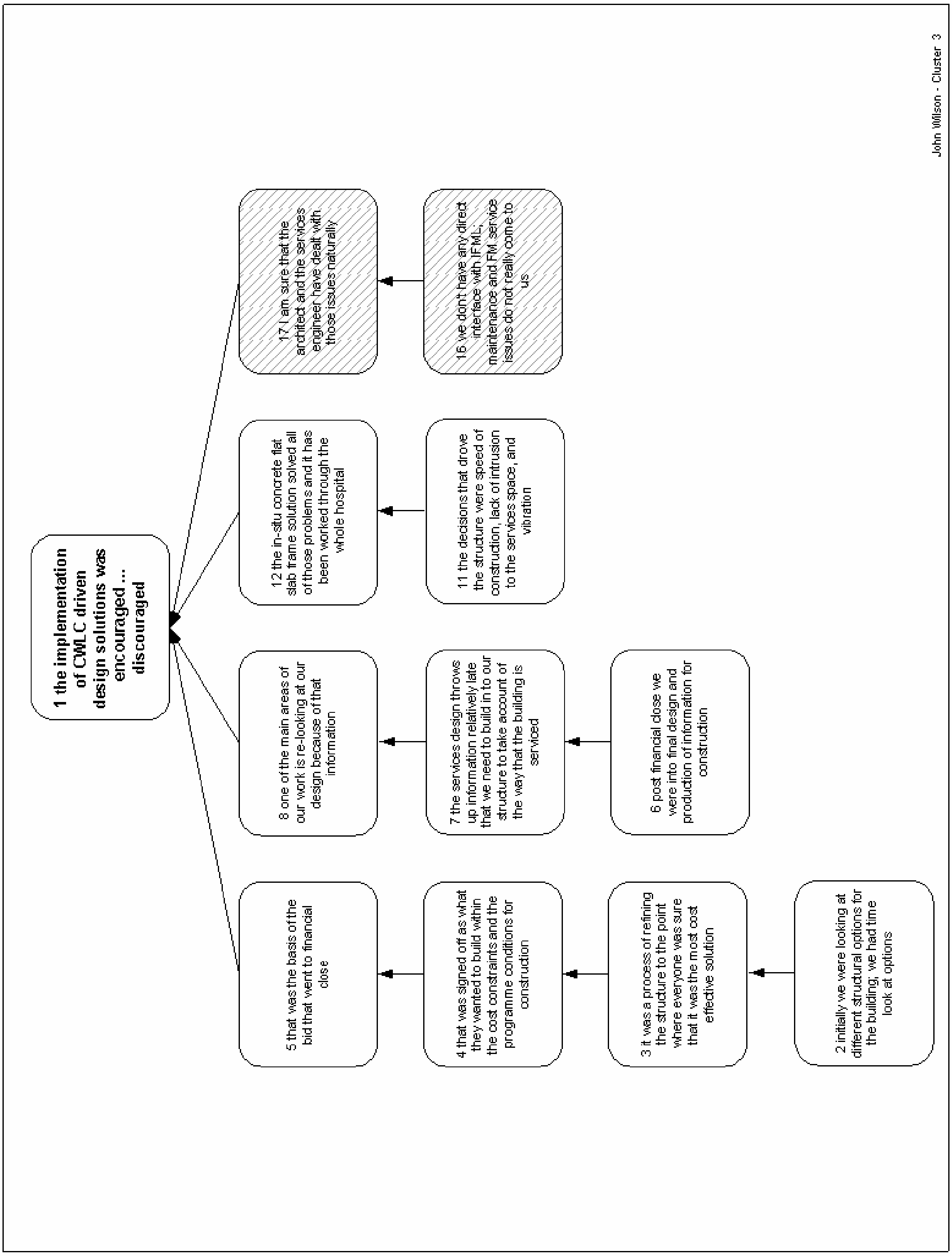

Figure A7.59. Wilson storyline map Cluster 3.

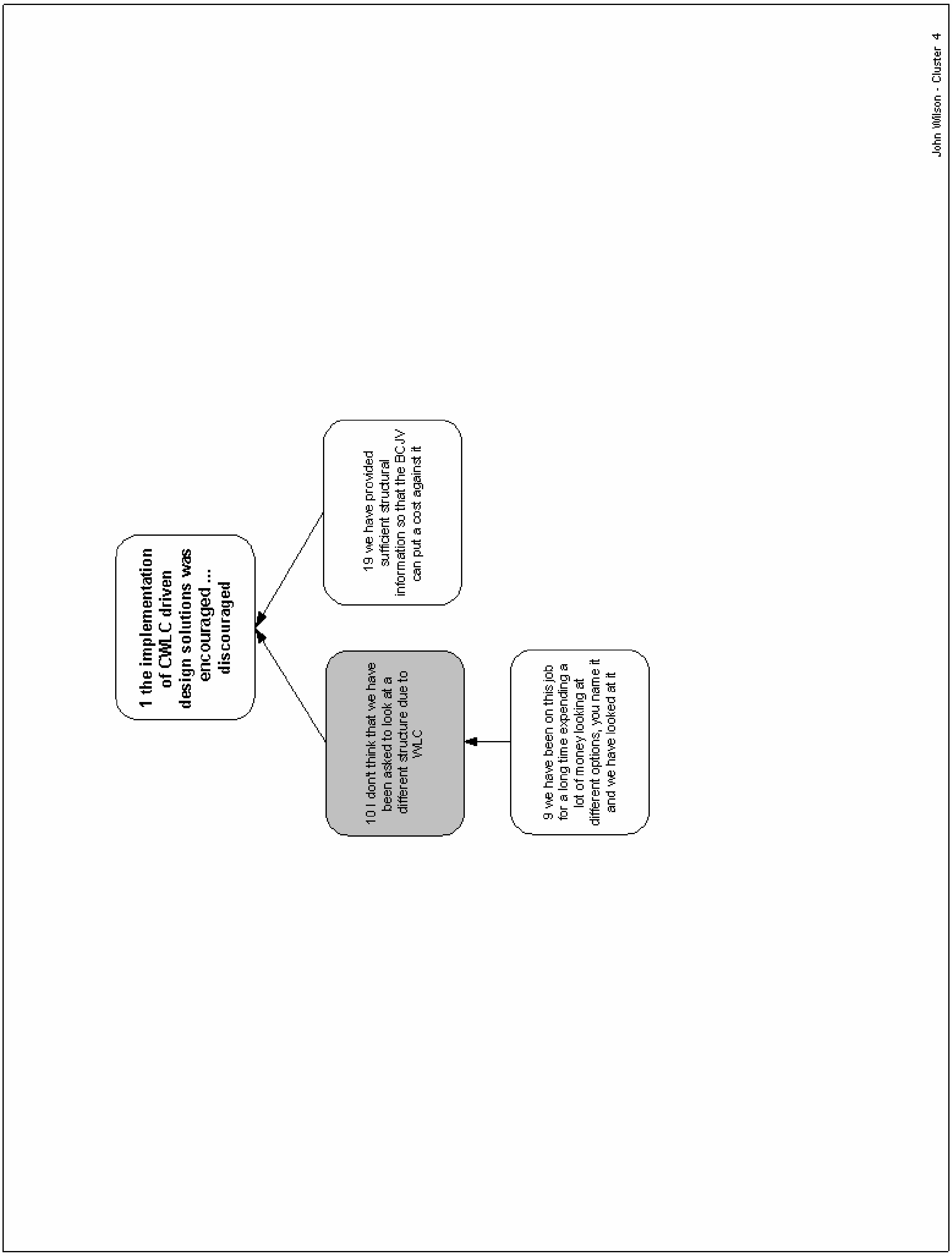

Figure A7.60. Wilson storyline map Cluster 4.

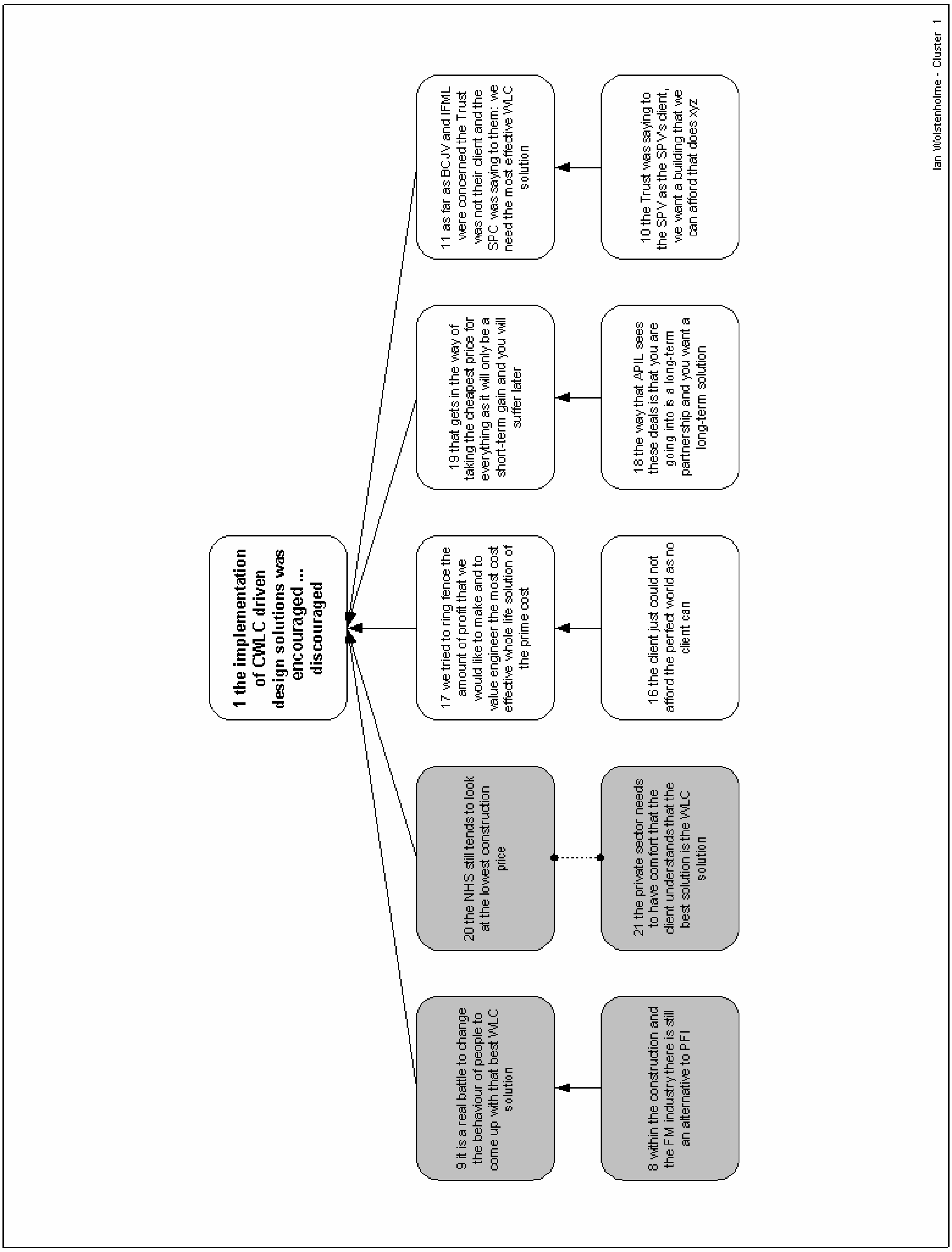

Figure A7.61. Wolstenholme storyline map Cluster 1.

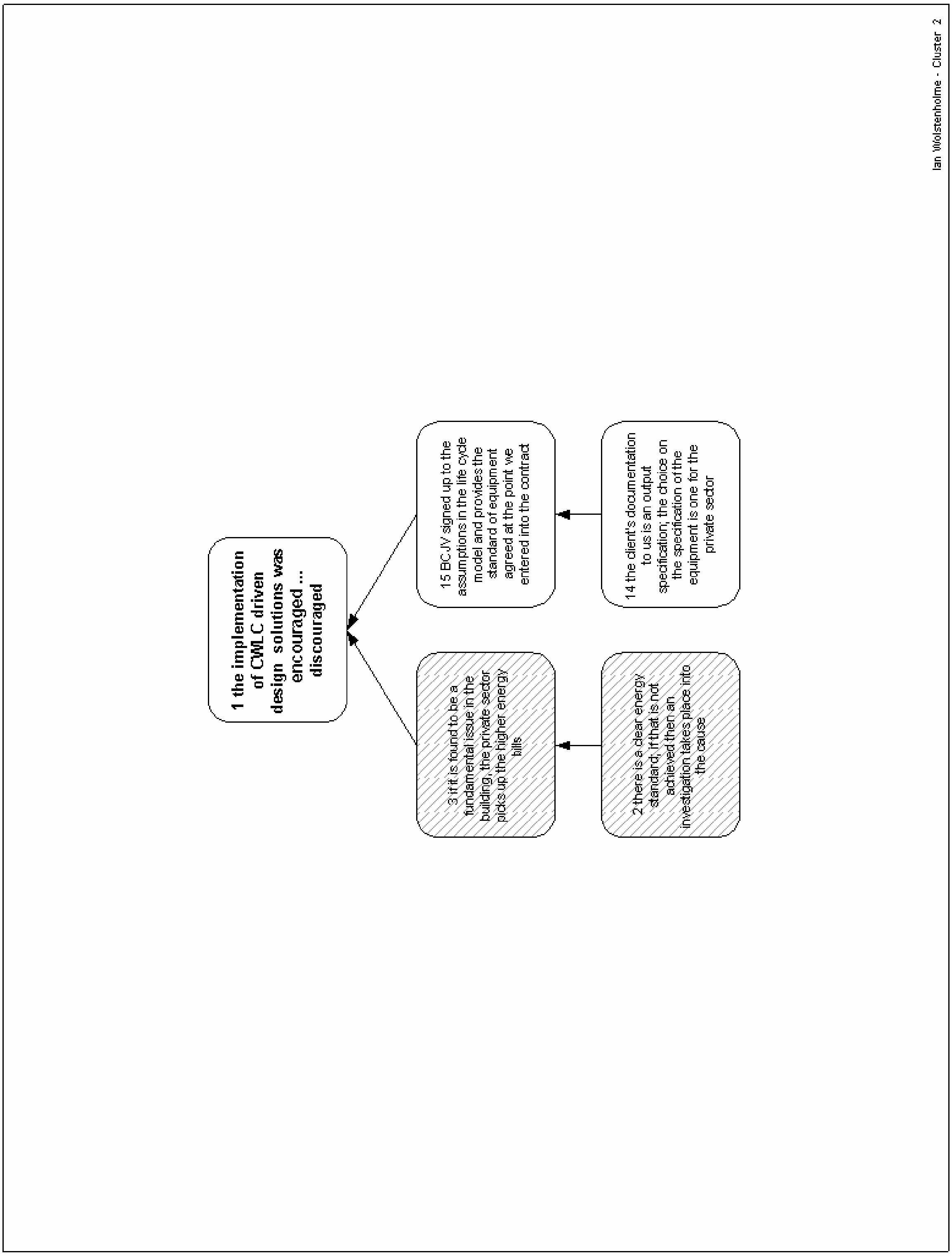

Figure A7.62. Wolstenholme storyline map Cluster 2.

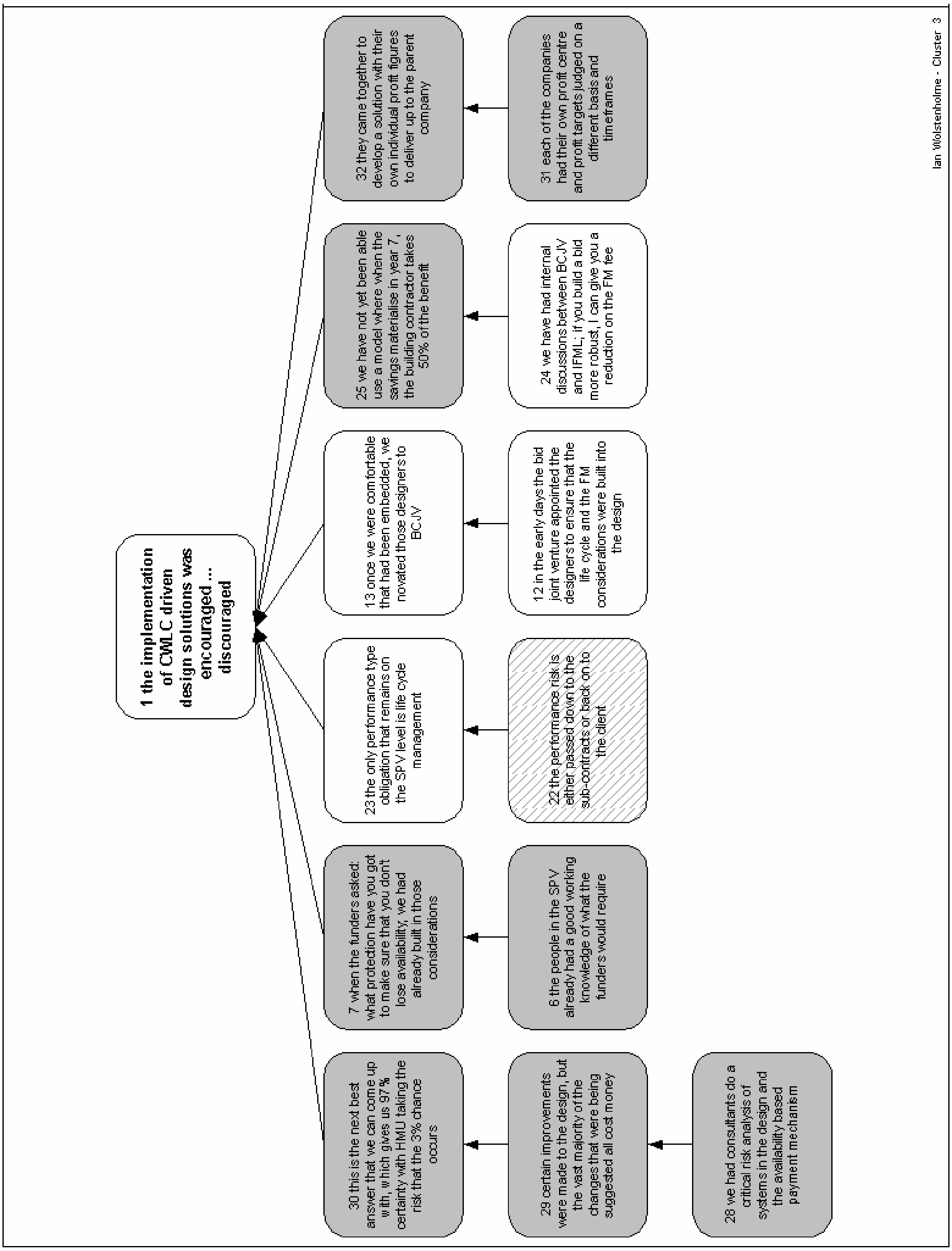

Figure A7.63. Wolstenholme storyline map Cluster 3.

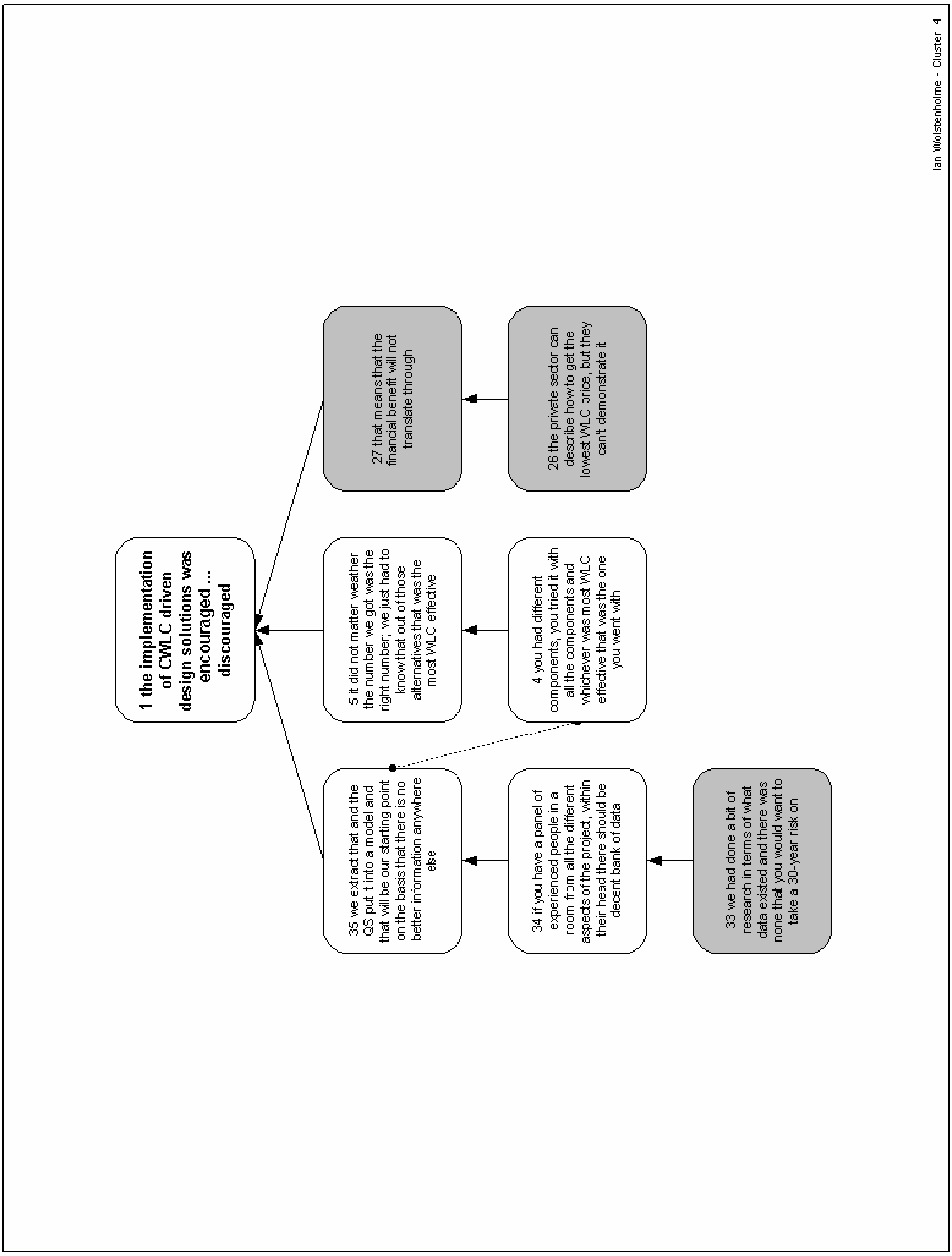

Figure A7.64. Wolstenholme storyline map Cluster 4.

APPENDIX VIII

Actor	Cluster	7(PA)/1	7(PA)/2	7(PA)/3	7(PA)/4	7(PA)/5	7(PA)/6	7(PA)/7	7(PA)/8	7(PA)/9	7(PA)/10
Blunt	1		22,23		3,36	2,11,12					
	2										13,14
	3										
	4				24						
Brierley	1					20					
	2										17,18,19
	3			2,4	15,16						
	4						21				
Coleman	1		2,3,4								
	2										5,6
	3										
	4										
Dolan	1		24,25								
	2										2,3,4,5
	3								15,16,28		
	4						22,23,31	29,30,31			
Doughty	1		17			24,25					
	2				19,28,29,30						
	3			9,10,11					12,13,14		
	4										
Field	1					10,11,12		21,34			
	2										
	3			16,17,18	24,25						
	4						7,8,9	5,6			

Figure A8.1. Links between storyline maps and perception analysis boxes – part I.

Actor	Cluster	7(PA)/11	7(PA)/12	7(PA)/13	7(PA)/14	7(PA)/15	7(PA)/16	7(PA)/17	7(PA)/18	7(PA)/19	7(PA)/20
Blunt	1										
	2		15,16								
	3			5,6,7							
	4										
Brierley	1		20								
	2										
	3										
	4										
Coleman	1										
	2		7,8,9								
	3			10,11,12,13							
	4			22							
Dolan	1						8,9,10	19,20,21			
	2		11							11,12,13,14	
	3			32,33				34,35			
	4										
Doughty	1							2,3,4,5,6			
	2										7,8,18,19,20
	3					35,36					
	4										
Field	1							26,27	21,34		
	2										
	3										3,4
	4										

Figure A8.2. Links between storyline maps and perception analysis boxes – part II.

Actor	Cluster	7(PA)/21	7(PA)/22	7(PA)/23	7(PA)/24	7(PA)/25	7(PA)/26	7(PA)/27	7(PA)/28	7(PA)/29
Blunt	1		10,11,12							
	2									30,31
	3					34,35	4,8,9,19,20,21			17,18,26,27,28,29
	4									24,25,32,33
Brierley	1		10, 11							
	2									
	3		6,22,23				3,5,14		7,12,13,26,27	14
	4									8,9,21,24,25
Coleman	1									
	2									
	3		14				15,16,17,18,19,20			
	4									21,22
Dolan	1	6,7								
	2									
	3							26,27	17,18	
	4									
Doughty	1			31						
	2								15,16,37	
	3						21,22,23	26,27,32,33,34		
	4									
Field	1	13,14,15		19,20	28			28,29		
	2		30,31						30,31,32	
	3							2,33		22,23
	4									

Figure A8.3. Links between storyline maps and perception analysis boxes – part III.

Actor	Cluster	7(PA)/1	7(PA)/2	7(PA)/3	7(PA)/4	7(PA)/5	7(PA)/6	7(PA)/7	7(PA)/8	7(PA)/9	7(PA)/10
Fraser	1		25			4,5,26,28,30					
	2										8,9
	3										
	4						17	31,32,33			
Hird	1										
	2				14,15,20	27,28,29					
	3				16,17,18,19, 30,31						
	4					11	9,10,11,32,2 3,34,36	36,37,38,39			
Jeeves	1	23	9,10,11			18,19					
	2										2,3,4
	3			31	12,13						
	4						24,25,26,27	28,29,30			
Lloyd	1					10					
	2										16,17
	3				22,23						
	4						26	18,19,25,30			
MacKenzie	1										
	2										
	3			21							
	4						24,25,26,27, 28	29			
McCabe	1	30,29	5,6,7,10								
	2										22,23
	3			35							
	4				31,32			11,12,24,25, 26,34,35			

Figure A8.4. Links between storyline maps and perception analysis boxes – part IV.

Actor	Cluster	7(PA)/11	7(PA)/12	7(PA)/13	7(PA)/14	7(PA)/15	7(PA)/16	7(PA)/17	7(PA)/18	7(PA)/19	7(PA)/20
Fraser	1										
	2				2,3,18,19						
	3				15	15					10,11
	4										
Hird	1							2,3			
	2		12,13,14,15		6,7,8	4,5					21,22,23
	3										
	4										
Jeeves	1										
	2									20,21	
	3			34	13	13					
	4										
Lloyd	1										
	2										5,6,7,8
	3			12,27,28,29							
	4										
MacKenzie	1						2,3,4	5,6,7,8			
	2							9,10,12			
	3			14,15		13	19				22
	4			16,17,18							
McCabe	1							8,9,13,14,15			
	2			16,17,18							
	3										
	4										

Figure A8.5. Links between storyline maps and perception analysis boxes – part V.

Actor	Cluster	7(PA)/21	7(PA)/22	7(PA)/23	7(PA)/24	7(PA)/25	7(PA)/26	7(PA)/27	7(PA)/28	7(PA)/29
Fraser	1		5,6,7,26,27						28,30	
	2		12,13							
	3								20,21,22	14,15,16
	4									
Hird	1									
	2									
	3		24,25,26							
	4									
Jeeves	1									
	2		8				5,6,7,8	35		
	3					37	32,33,36,37			14,15,16,17
	4									
Lloyd	1		14							
	2		2,4,21				3			
	3						9,15,20,24			13
	4									31,32
MacKenzie	1									
	2									
	3						19,20			
	4									23
McCabe	1				27,28					
	2									
	3						2,3,4,19,20,21			
	4									

Figure A8.6. Links between storyline maps and perception analysis boxes – part VI.

Actor	Cluster	7(PA)/1	7(PA)/2	7(PA)/3	7(PA)/4	7(PA)/5	7(PA)/6	7(PA)/7	7(PA)/8	7(PA)/9	7(PA)/10
Seddon	1		23			19					
	2										15,16
	3			24,25			9,10				
	4			26			14,26,30,31, 32				
Whittingham	1		5,7,8,9			6,10,25					
	2					4					20,21
	3										22,23,24
	4						15,16,17,18, 19,29	11,12,28,29, 30			
Wilson	1	13,14,15	18								
	2										
	3	11	2,3,4,5,11,12								
	4										
Wolstenholme	1							8,9			
	2										2,3
	3				6,7				22,23	12,13	
	4						33,34,35	4,5,26,27,35			

Figure A8.7. Links between storyline maps and perception analysis boxes – part VII.

Actor	Cluster	7(PA)/11	7(PA)/12	7(PA)/13	7(PA)/14	7(PA)/15	7(PA)/16	7(PA)/17	7(PA)/18	7(PA)/19	7(PA)/20
Seddon	1						6,7,8	17,18			
	2	38,39	33,34								
	3			9,10,11							
	4										
Whittingham	1										
	2		2,3,4							26,27	
	3		13,14								
	4					19					
Wilson	1										
	2										
	3	11									
	4										
Wolstenholme	1						20,21	16,17			
	2			15							
	3									28,29,30	
	4										

Figure A8.8. Links between Storyline Maps and Perception Analysis boxes – part VIII.

Actor	Cluster	7(PA)/21	7(PA)/22	7(PA)/23	7(PA)/24	7(PA)/25	7(PA)/26	7(PA)/27	7(PA)/28	7(PA)/29
Seddon	1									
	2		2,4				3,5			
	3		20,21,22					12,13	27,28,29,35, 36,37	
	4						14			
Whittingham	1									
	2									
	3						31			
	4									
Wilson	1									
	2									
	3						6,7,8,16,17			
	4						9,10,19			
Wolstenholme	1				18			10,11,18,19		
	2		14,15							
	3							31,32	24,25	
	4									

Figure A8.9. Links between storyline maps and perception analysis boxes – part IX.

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The economic efficiency of accommodation service PFI projects

Abstract

In 1992, the UK Government introduced the Private Finance Initiative (PFI) as a policy to allow and regulate privately financed public projects. However, PFI is better understood as an innovative procurement method. PFI involves a private sector entity taking the responsibility to design, build, finance and operate (DBFO) an asset used in the provision of a public service for a contract period of up to four decades. It is widely propositioned that PFI procurement leads to improved value for money (VFM) and profit for the public sector clients and private sector actors respectively as a result of improvements in economic efficiency. The aim of this research is to *generate a detailed understanding of how the economic efficiency of an accommodation service PFI project is determined in its development through contract whole life cost ($CWLC_P$) minimisation.*

This research consists of two case studies on large and complex accommodation service PFI projects. It focuses, in particular, on the effects of PFI procurement on the heating and ventilation design solutions of the project-facilities. The data obtained is self-report interviews, public and private sector issued project documentation and expert opinions. The data is subjected to solution, incentive, opportunity and perception analyses.

The research unexpectedly identifies only a small number of design solutions that are incorporated in the project-facilities with the aim of achieving $CWLC_P$ reductions. In other words, the research finds that the economic efficiency improvement in the procurement of public accommodation services due to the adoption of PFI is considerably smaller than proposed by economic theory. This, however, does not suggest that the economic efficiency of PFI accommodation services is found to be worse than those procured traditionally. The research establishes that the limited improvement is because of: the guidance documentation used to govern the design of PFI project-facilities; the market testing mechanism used to adjust the payment for the service provision in the operational phase; the organisation of the private sector actors in the project development; and the lack of good quality data to estimate expected $CWLC_P$ reductions. The research develops possible strategies to rectify the identified problems. The adoption of these strategies should enable the economic efficiency of future accommodation service PFI projects to be improved through $CWLC_P$ minimisation.

Keywords
Private Finance Initiative (PFI), Design Build Finance and Operate (DBFO), Public Private Partnership (PPP), accommodation service, economic efficiency

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