RISK MANAGEMENT OF PUBLIC FINANCE INITIATIVE PROJECTS IN HEALTHCARE SECTOR IN THE UK

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ABSTRACT

In the UK, the motive behind the introduction of PFI in health sector is aimed at having private service providers to participate in the provision of ancillary services and to inject private funding, expertise and private sector management into the public sector. Its objective is to achieve optimum risk allocation for project best value over the concession period. In practice, the cost of risk transfer is offset by effective risk management through the payment mechanism in PFI. This has compelled the author to investigate the management of risks of PFI model in health sector.

This research paper reviews major sources of risk in PFI procurement with an emphasized in health sector. It then examines and evaluates current risk management model for managing such risks in two different PFI hospital projects. The main objective of the research is to generate a detailed understanding of how project risks, especially design, commissioning and operating, and technology and obsolescence, are transferred and managed through PFI procurement under the current risk management model. Specifically, it examines the relationship between the risks which the private sectors bear and the returns they actually earn by implementing the payment mechanism used on PFI projects. The study has highlighted how risks are allocated appropriately with the stage of the PFI procurement process.

The data obtained is from semi-structured interviews, questionnaire surveys, public and private sector issued documentation and expert opinions. This study has endeavoured to establish the level of concern for risk management of PFI by the respondent firms.

The findings of the research reveal that the risks in PFI contracts are appropriately transferred and mitigated under the current risk management system in technology and equipment management NHS projects. The transfer of technology and obsolescence risks to the private sector is fundamental to the delivery of VFM in PFI procurement in health sector. PFI procurement in hospital projects results in a more structured approach to operating, maintaining and replacing medical equipments assets.

Keywords: Public Finance Initiative, Risk Management, Risk Transfer, Value for Money, Procurement, Healthcare Sector, Hospitals, Medical Equipment Services

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LIST OF ABBREVIATIONS, ACRONYMS AND INITIALISATIONS

AGH	Airedale General Hospital
ARP	Annual Review Process
AT	Airedale NHS Trust
BCFHT	Barnet and Chase Farm Hospitals NHS Trust
BH	Barnet Hospital
BHPT	Barnet Hospital Project Limited
BUKL	Bouygues UK Limited
CABE	The Commission for Architecture and the Built Environment
CIC	Construction Industry Council
DBFO	Design, build, finance, operate
DELG	The Department of Environment and Local Government
EPR	Electronic Patient Record
ERP	Equipment Replacement Plan
EFL	Ecovert FM Limited
ESL	Ecovert South Limited
FM	Facilities Management
HI	HSBC Infrastructure Company Limited
HM Treasury	Her Majesty's Treasury
MES	Medical Equipment Services
MHL	Metier Healthcare Limited
MRI	Magnetic Resonance Imaging
MSP	Managed Service Provider
MTS	Managed Technology Services
NAO	National Audit Office
NHS	National Health Service
NPV	Net Present Value
OBC	Outline Business Case
OGC	Office of Government Commerce
PFI	Public Finance Initiative
ProjectCo	Project Company
PPM	Planned Preventative Maintenance
PPP	Public Private Partnership
PSC	Public Sector Comparator

PTP	Percy Thomas Partnership
R&D	Research & Development
SHS	Siemens Healthcare Services Limited
SPV	Special Purpose Vehicle
TEMM	Technology and Equipment Management Model
TTF	Treasury Taskforce
UP	Unitary Charge
VFM	Value for Money

CHAPTER 1 INTRODUCTION

1.1. RESEARCH BACKGROUND

Public Finance Initiative (PFI) has become a major source of investment in healthcare facilities and provides an alternative route to procure facilities and services for the health sector without increasing the amount of public sector borrowing. PFI in the National Healthcare Services (NHS) ranges from the simple contracting out of services to the involvement of the private sector in the financing, design, construction, operation, maintenance and, in some cases, ownership of major facilities. The central government carries the risk if the NHS collapses or does not meet the ever-increasing demands of the UK public. This has led to major change in the strategies adopted by the UK Government, which have been focussed on reducing public funding in the NHS. The inefficiency of government and limitation on budget has bought wider private sector involvement (Corry, 1997). The motive behind the introduction of PFI in health sector is thus aimed at having private service providers to participate in the provision of ancillary services and to inject private funding, expertise and private sector management into the NHS. This procurement route is aimed to deliver services in ways to achieve optimum risk transfer and project best value. Nationally, PFI opens up a new market, creates alignment of interests and long term incentivisation (Nielsen, 1997). As of October 2007, there were 93 signed PFI contracts in the Health Services (HM Treasury, 2007). Under current plans, the Department of Health will procure a further 41 schemes, bringing the total capital value of PFI schemes to £15.5 billion (HM Treasury, 2007).

PFI healthcare projects, in practice, pose unique challenges to the NHS on account of the complexity of matching NHS standards with private sector practices. Private sector participants have often found their involvement in PFI hospital schemes to be more challenging than what they experienced in non-NHS projects. PFI in the hospital sector have been criticised for their complex and opaque decision making, the low standard of physical facilities provided once the project was completed, the lack of cost effectiveness and other aspects (Pollock, 1995; Gaffney et al., 1999; Pollock, Shaoul and Vickers, 2002). In this context, it is needed to assess and manage unavoidable risks in the planning and implementation phase which poses major problems to project partners (Akintoye et al, 2000).

As the PFI has begun to mature, the emphasis of PFI projects has shifted to effective risk allocation for achieving project best value. Clear and effective procurement processes are therefore central to implementing best value and this strategy sets out the framework for those processes. In NHS projects, the foundation for the strategy will be the development of the NHS Trust's procurement

policy. Throughout the procurement process, it is essential that the private sector evaluates and manages effectively the risks inherent in that process. Where risk is given a market value in PFI projects, risk transfer hence accounts for the different costs of public and private finance (Pollock and Price, 2004). The risk premium paid to the private sector will be offset by effective risk management through the mechanism of risk transfer in PFI. A three step risk management process could be applied. This involves identifying the possible risk drivers, evaluating the risk consequences and reporting the effective mitigation responses. The relationship of procurement, risk and the implications for risk management, which is poorly understood, is in need of further exploration.

1.2. AIM AND OBJECTIVES OF THE STUDY

Conceptually, the most difficult and contentious parts of PFI process is the treatment of risk. The NHS Trust and the Special Purpose Vehicle (SPV) sought a balance between an optimal allocation of risks, choice of facilities and project price via the negotiation for a healthcare PFI project contract. The aim of PFI, according to the NHS Executive (1999), is 'to minimise total project risk by placing particular risks with the party best able to manage them', thus, it is held that the cost of the risk will be less if held by the SPV, than by the Trust. PFI in the NHS allows the private sector to bear more of the risk and thereby reducing public sector expenses, while at the same time exploring the full range of private sector management, commercial and creative skills (NHS Executive, 1999). Thus, the question that needs to be answered is: how can a SPV successfully minimise risks for very complex healthcare PFI projects?

What emerged in the healthcare PFI project is a usage of a plethora of risk management techniques. Although the traditional risk management techniques being used are generic in nature, there is still no evidence to show that they are appropriate for PFI projects. The reason is that all the models were not developed specifically for risk treatment and risk allocation in PFI. The information are insufficient and rather mixed for decision-making for PFI projects. This research paper, therefore, helps to assess the level of current skills in risk management techniques to deal with PFI projects and the extent to which these techniques are appropriate to tackle complex healthcare PFI projects. It fills the gap of the fewness of the empirical research efforts made with regard to the risk factors in various healthcare PFI projects in the UK. Sources of risks, combined with procurement strategy, are used to develop an effective risk management model for the private sector. This model might help project planners or implementers to identify, organise, and manage the risks involved in PFI in order to achieve project best value.

This research paper reviews major sources of risk in PFI procurement with an emphasized in healthcare sector, and then examines and evaluates current risk management model for managing such risks by analysing the management of risks and facilities in two UK PFI hospital projects. The aim of the research can be broken down into three research objectives:

- to generate a detailed understanding of the relationship between the risks which the private sectors bear and the returns they actually earn;
- to highlight how risks are allocated appropriately with the stage of the procurement process; and
- to identify how the current risk management model control and manage PFI project risks.

1.3. STRUCTURE OF THE REPORT

The research paper has six chapters in total. Chapter One presents the introduction of PFI in the NHS and the problem of risk allocation in PFI healthcare projects, as well as the aim and objectives of the study, and the structure of the report.

Chapter Two presents the current PFI models in the UK and the selection of case studies. It discusses the concept of PFI, the types of PFI and its features, and the category of the selected case studies.

Chapter Three presents literature reviews on risk and risk management. This chapter investigates the risk factors associated with the four major types of PFI projects, and then discusses the three important risks associated with PFI healthcare projects. The risk category is proposed and is used as a guideline in the research interviews and questionnaires of case studies. A risk management framework is then adopted for the result interpretation in Chapter Five. Procurement strategies which are critical in management of risk will be examined. A summary table will present the empirical evidence or findings of risk to PFI projects in the UK.

Chapter Four discusses the research procedure and methodology, the case studies, the semi-structured interviews and respondents' information.

Chapter Five critically examines the risks associated with PFI healthcare projects based on the findings of the interviews and questionnaires. Risks arising from hospital design, operating phase and medical technology and equipment will be focused. This chapter describe and analyse the effectiveness of risk transfer which is the central idea of risk management of PFI healthcare projects.

Chapter Six is the concluding chapter. The conclusions and recommendations of the study are presented, together with some suggestions for future research.

CHAPTER 2 OVERVIEW OF PFI MODELS

2.1. TYPES OF PFI PROJECTS

The types of PFI are overwhelming. However, all PFI focuses on services, for the delivery of which present or future investment in assets is required, with the private sector taking the role of owner / operator of the asset in the delivery of those services (Baldwin, 2003). Many authors have consented that there are three broad types of PFI projects (NAO, 1999; Smith, 1999; Allen, 2001). Technology and Equipment Management Model (TEMM) is the newest PFI model which has been developed within the last eight years. Therefore, according to the history and the recent innovation of PFI in the UK, there is existence of four PFI alternatives depending on the characteristics of the projects. The following table will describe briefly the four PFI models and then the next chapter will give a detailed risk identification on each of them.

Category	Model	Model Description
A	**DBFO Model**	Traditional DBFO (design, build, finance, and operate) Model is the ideal form of PFI in which the private contractor builds and operates a facility, and recovers its investment by selling services to the public sector. This DBFO model is designed for large capital projects and primarily driven by building. It can include Managed Equipment Services (MES) contract or Managed Technology Services (MTS) contract.
B	**Technology and Equipment Management Model**	New capital PFI projects are likely to be smaller in size, far more numerous and asset management emphasised (Payne, 2008). Technology and Equipment Management Model (TEMM) is a variation from the DBFO projects and can often be found in healthcare sector where the public sector requires a major shift in the way assets are acquired and managed within the health service. The whole life costing of assets tends to be more complete under this scheme.
C	**Financially Free-standing Model**	The private sector undertakes a project on the basis that costs will be recovered entirely through a charge for the services to the final user. The government may contribute value to the project in terms of initial planning and statutory procedures, awarding works concessions or providing ancillary works. The private sector is wholly responsible for the project and can recoup costs through charges at the point of use. It is not necessary to require a Value for Money (VFM) test.
D	**Joint Venture**	This is a model in which both public and private sectors provide funding to build facilities where operations are managed by the private sector. The public sector involvement is made to secure wider social benefits that cannot be captured in commercial revenue. The government's effective support not only comes from operating subsidies, but rather to contributions for acquiring and using assets for the development.

TABLE 1: TYPES OF PFI PROJECTS

2.2. SELECTION OF CASE STUDIES

The two case to be studied for the purpose of risk analysis and management are Barnet Hospital (BH) Modernisation Project and Airedale NHS Trust's (AT) Medical Equipment Modernisation Project.

BH's Phase 1b PFI scheme is a 34-year DBFO programme with the SPV or the Project Company (ProjectCo), Metier Healthcare Limited, of designing, constructing and maintaining a brand new hospital building and procuring a MES contract at a site. Its design, commissioning and operating, as well as technology and equipment scopes of the projects made it an interesting case study in such a long term contractual agreement.

In order to meet the clinical needs of the community, AT and its Medical Services Provider (MSP), Siemens Healthcare Services (SHS), signed a Managed Equipment Services (MES) contract of supplying, upgrading and maintaining 39 items of equipment and x-ray to help modernise all AT's diagnostic facilities at four sites. This TEMM is a direct contractual agreement of 15 years between the NHS Trust and MSP. During the progress the project encountered fewer obstacles from the DBFO projects. It is mainly because infrastructure development was absent in project under TEMM.

A comparison of these two case studies will mainly help to understand the output specification, performance regime and payment mechanism in relation to technology and obsolescence risk in certain PFI procurement forms, thus allowing a better implementation of risk analysis and management.

CHAPTER 3 LITERATURE REVIEW

This chapter presents a comprehensive overview of risk management techniques in PFI. It starts from the concept of risk, risk premium and risk management. Later sections deal with risk identification in PFI projects and the three most important risks in hospital PFI projects. The last section overviews the role and the importance of procurement, and procurement strategies in risk management.

3.1. FUNDAMENTAL NATURE OF RISK AND RISK MANAGEMENT

3.1.1. RISK AND RISK PREMIUM

Risk involves an activity or decision where either the outcome or consequence is less than certain, and at times, both of these are uncertain (McKim, 1992). According to PMI (2000), the concept of risk in projects is related to all events that involve the possibility of generating losses, damage or presenting threats to the generation of positive returns. Two dimensions of risk, which are probability and impact, are considered for every exposure facing an organisation (Akintoye et al, 2000; PMI, 2000; Pyra and Trask, 2002). Each project risk is matched against the probability and impact, which are the chance and intensity of occurrence, of risk to create a probability and impact matrix. The high risks identify problem areas and need priority responses from an organisation.

Qualitative risk technique is used for risk evaluation when uncertainty is prevalent and information is absent (Akintoye et al, 2000). The negative outcome of an activity is expressed subjectivity, where the likelihood of occurrence and potential impact of risks can be assessed as low, medium or high (Akintoye et al, 2000; OGC, 2008). As suggested by the Office of Government Commerce (OGC) (2008), the risk assessment table with the effects of mitigating action taken into account is shown in Figure 1 below. A table suggested by the Ireland PPP guideline is also shown as a guide in Appendix I. Risks impact in PFI are ultimately translated into financial terms and shown as monetary units for the purposes of assessing affordability (PMI, 2000). Price of each risk can be calculated by multiplying the cost of the impact of the risk by the probability of the risk materialising.

Risk transfer is the key justification for PFI. Risk premium, the cost of transferring risk, is paid by the public sector to private financiers in annual unitary payment (UP). Risk premium is determined on various factors including the risk exposure faced by individual firms from each of the sources,

Probability						
	Very High					*
	High	**		*		
	Medium	*			*Risk Tolerance*	*Line* *
	Low		**	**		
	Very Low			*		
		Very Low	Low	Medium	High	Very High

Impact

Source: OGC, 2008

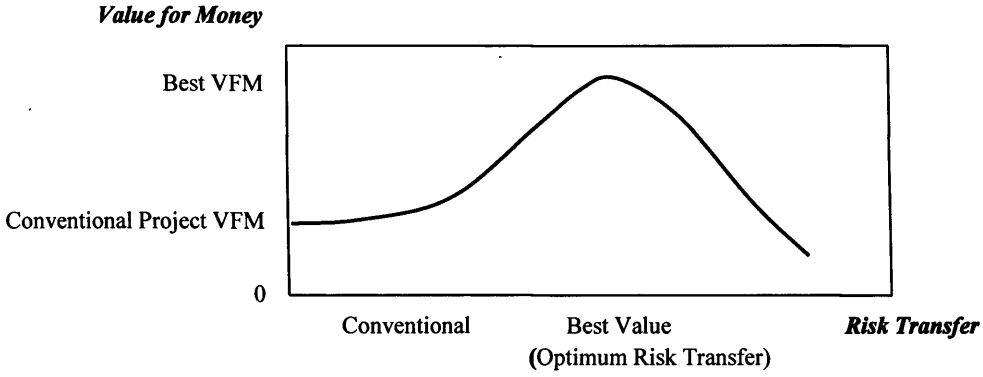
Note: * The position of the risk tolerance line would depend on the organisation and its project objectives.

FIGURE 1: PROBABILITY AND IMPACT MATRIX OF RISK

the likelihood of occurrence, the experience of the firm in dealing with the particular type of risk, the attitude of the firm to risk, the extent of impact exposed by the sources, and etc (HM Treasury, 2000). Some of the risk sources are more important to a type of PFI and this is recognised by the different risk premium associated with PFI (Akintoye and MacLeod, 1997). The higher the impact from risk sources, the higher the risk premium as profit margins for the private sectors to finish the project. In relation to hospital building programmes, the NHS Trusts appear to be paying a risk premium of about 30% of the total construction costs to get the hospitals built on time and to budget (HM Treasury, 2000). Given a profit incentive, the private sector is better able to manage many types of risk in PFI.

VFM approach, the central idea of PFI, is worked out using public sector comparator (PSC). PSC is designed to compare the cost of a PFI project with the estimated cost of the same project run by the public sector. However, only those risks that will be transferred to the private sector are included in the PSC. Theoretically, PSC involves a number of risks which would not figure in the PFI option and certain risks which differ under a PFI approach. In each PFI, net present value (NPV) is calculated for the purpose of VFM. NPV is the cost of the project for each year of the contract, discounted to what the project would be worth at today's prices. The methodology takes account of build costs, facilities management costs, lifecycle costs and risk transfer. Discounting allows for the depreciation in the VFM over time. Therefore, by taking these two elements into account, if the current total value of the PFI unitary charges is lower than the total discounted costs of PSC ($NPV_{PFI} < NPV_{PSC}$), the PFI alternative project will meet the VFM criterion. It is concluded that VFM can be maximized by transferring the appropriate amount of risk (Akintoye and MacLeod, 1997). Best VFM is the optimum combination of whole life costs and benefits (NHS Executive, 1999). Economic appraisal to this Outline Business Case (OBC) stage assesses is a

mandatory Treasury requirement in PFI procurement. Clearly, risk transfer is the central element in justifying VFM. Their relationship is illustrated in Figure 2 below.



Source: TTF, 1999b

FIGURE 2: RISK TRANSFER AND VFM OPTIMISATION

However, the National Audit Office (NAO) published a report on 2003 'PFI: Construction Performance' which detailed that there is a lack of transparency as to whether the total returns which construction companies derive from PFI projects are reasonable in relation to the risks they are actually bearing. VFM method has also been criticised as biased and too objective (Gaffney and Pollock 1999; Price et al. 1999; Pollock et al. 2000; Rutherford, 2008). The calculation of discounted risk adjusted costs has problem because it gives long term PFI projects a lower NPV and an advantage over conventional projects. Another problem is that there is no existing PSC for bids for large scale or bundled projects for comparison. PSC also contains material errors and omissions, and is failed to take account of uncertainties (House of Commons, 2003). Moreover, local authorities and government officials have an interest in ensuring that the PSC is calculated to produce an outline business plan that is higher than the private sector bid. The attractiveness of PFI procurement route can be, therefore, quite distinct.

Until lately, the Treasury has suggested 'the economic case for VFM should not be the single reason for deciding to take the PFI route.' (PPP Forum, 2008) VFM should include wider social benefits to ensure 'the VFM does not come at the expense of employees' terms and conditions.' (PPP Forum, 2008) A recent report 'PFI: Meeting the Investment Challenge' (2003) contains proposals to increase PFI contractors' funding options in an attempt to reduce their cost of finance without increasing the public sector's exposure to risk. This new funding regime in particular provides a faster and cheaper funding solution to smaller schemes. It is essential that future research should be focused on improvement of the clarity of the treatment of risks and benefits in the structure of PSC and the assessment of VFM.

3.1.2. RISK ANALYSIS AND MANAGEMENT

Risks associated with a complex system involve long chains of events. A risk management strategy is designed for each of the project risks facing an organisation. The purpose of risk management strategy, according to OGC, is used to define how risks will be managed during the lifecycle of the programme and to plan the way risks are handled within the programme. Essentially, the utilisation of the private sector places the formal responsibility for the management of risk on them (Akintoye and Taylor, 1997).

There are two parts to the risk management strategy (OGC, 2008). The first part is risk analysis, which involves the definition and identification of risks, plus the evaluation of impact and consequent action. The second part is risk management, which covers the activities involved in the planning, monitoring and controlling of actions that will address the threats and problems identified, so as to improve the likelihood of the project achieving its stated objectives. Risk analysis and risk management phases are interrelated and undertaken iteratively (OGC, 2008).

The application of risk management procedures gives early visibility to potential problems and opportunities. The objective of risk management in large and complex projects is therefore a proactive management of projects, where problems are reduced and often in a less expensive way as they are identified, thus reducing the negative impact and uncertainty to the projects and avoiding possible losses or damages from partners. The early detection of risks allows that limited resources will be concentrated on the major risks to achieve maximum effect. As a result, there is no need for contingency plans to cover almost every eventuality (Dawood, 1998). An effective risk management system should have four basic constructs (Jüttner, Peck and Christopher, 2003), which are:

- risk sources;
- risk consequences;
- risk drivers; and
- risk mitigating strategies.

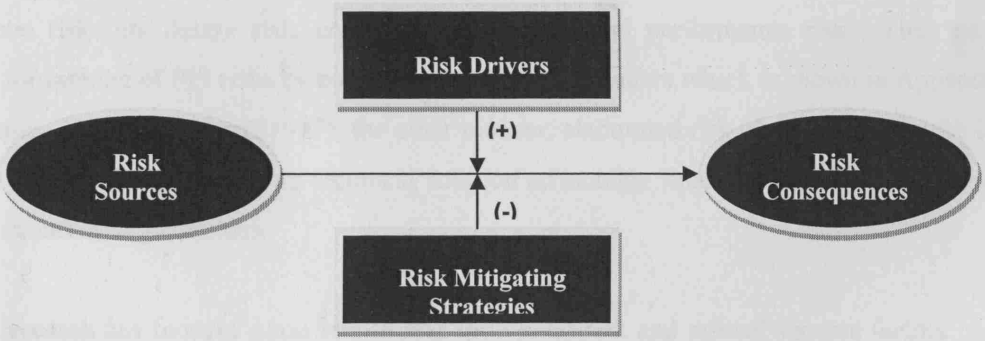
Risk Sources and Risk Consequences

Risk Sources are the environmental, organisational or project-related variables that cannot be predicted with certainty and that impact on the project outcome variables. Risk Consequences are the focused project outcome variables like costs or quality.

Risk Drivers and Risk Mitigating Strategies

Risk Drivers involves the impact of any project disruption. Svensson (2002) indicated that competitive pressures are often the drivers of risk. It is the risks that an organisation takes in order to improve competitiveness, reduce costs and increase or maintain profitability. Transaction costs are also a significant risk driver. A large proportion of high transaction cost is often fixed, and will impose a significant burden on smaller projects in the return on equity. Other risk drivers can be information deficiency or asymmetry among participants, opportunistic behaviour and project complexity. There are closely correlations between the risk drivers and selected risk sources. Risk-mitigating strategies, on the other hand, are those strategic moves organisations deliberately undertake to mitigate the uncertainties identified from the various risk sources (Miller, 1992).

The structure of these four basic constructs, which are summarised in Figure 3, derives the terms vulnerability and risk management (Jüttner, Peck and Christopher, 2003). Vulnerability is 'the propensity of risk sources and risk drivers to outweigh risk mitigating strategies, thus causing adverse risk consequences'. The adverse consequences affect an organisation's goal accomplishment (Svensson, 2002) and can jeopardise the procurement's ability to serve effectively the end customer market. In this sense, risk management aims to identify the potential sources of risk and implement appropriate actions to avoid or contain vulnerability (Jüttner, Peck and Christopher, 2003). Consequently, it can be defined as 'the identification and management of risks for the service delivery, through a co-ordinated approach amongst suppliers and contractors, to reduce vulnerability occurring from procurement as a whole'.



Source: Jüttner, Peck and Christopher, 2003

FIGURE 3: RISK MANAGEMENT MODEL – THE INTERRELATED CONSTRUCTS

These four interrelated constructs of risk management provide a framework for systematically exploring the concept of risk management in PFI procurements. The entire risk management process is qualitative and to examine the traditional measures focusing on the loss prevention.

3.2. RISK IN PFI PROJECTS IN THE UK

3.2.1. VARIATION OF RISKS ACROSS TYPE OF PROJECTS

In the literature of categorising sources of risk, the classification clarifies the relevant dimensions of potential disruptions faced by organisations in construction industry and provides the basis for risk assessment. Within the consortium in PFI, there are many risks that need to be addressed in order to ensure that investment into the project is viable (Salzmann and Mohamed, 1999). Some risks are more likely to influence the other risks. Walker and Smith (1995) identified pre-completion or construction phase and post-completion or operation phase of risk as when financing risks occur. Risks can also be classified as internal, when the project team can influence or control them, and external when the project team are unable to control and influence them (PMI, 2000). As Walker and Smith (1995) stated, infrastructure projects are particularly vulnerable to external risk such as demand risks. Future demand for volume and usage is unpredictable. This kind of risk is particular to the private sectors.

David and Fernando (1995) divided risks into investor perceptions of risk and host perceptions of risk based on who perceives the risk as most relevant. Some other researchers such as Woodward (1995), Hickman (2000), Hardcastle and Boothroyd (2003), and Bing et al (2005) have further classified risks associated with the contractors of the consortium in a PFI scheme by using risk surveys method. Akintoye et al (1998) investigated risk analysis and management in construction via a questionnaire survey of 100 top firms in the UK. In their findings, the three most signification risks are design risk, construction cost risk and performance risk. They gave a summary for ranking of PFI risks by contractors, clients and lenders which is shown in Appendix II for reference. Tiong and Alum (1997), the other pioneer, elaborated risk identification on the basis of critical success factors including technical solution advantage, financial package differentiation and differentiation in guarantees.

Previous research has focused upon identifying individual risk and critical success factors in PFI projects that lead to project success or failure (Salzmann and Mohamed, 1999). However, little attention has been paid to comprehensively detailing every aspect of a DBFO PFI project where problems may arise to make good decisions regarding risk allocation. The most relevant classification of risk sources in PFI is suggested by the NAO. It has defined nine generic risks for PFI projects as design and construction, commissioning and operating, demand for volume / usage, residual value, technology / obsolescence, regulation, project finance, contractor default and political / business when this newer form of contract was used (NAO, 1999). Based on the literature review and fieldwork findings, it is suggested that the identified risks sources in this

research paper, which are based upon and also a minor modification of the NAO, fall into seven categories. They are design, construction and development, commissioning and operating, technology and obsolescence, contract agreement and regulation, investment and variation in revenue, and residual value. The minor changes to generic categories listed above reflect special risk especially occurring on design phase in certain procurement forms.

This paper uses a checklist method for risk identification and classification. Several related risk factors at project level are consisted into a source. A summary of associated risks and impacts for each type of PFI projects is shown in Table 2 in the following pages.

3.2.2. RISK IN PFI HEALTHCARE PROJECTS

Of the seven categories of risk identified, three are judged in this research paper to be significantly important to the success of PFI healthcare projects and have to be transferred to the private sector. They are design, commissioning and operating, as well as technology and obsolescence risks. This consideration is based on the report findings of Akintoye et al in 1998 and the remarkable similarity in the nature of hospital projects.

Design Risk

Design will be a key factor in determining which bids win PFI contracts (NHS Executive, 1999). Good design enables the NHS Trust to obtain VFM and achieve WLC (NHS Executive, 1999). According to NHS, a good design is the best designed methods of meeting the output specification, which is focused on total design quality of the healthcare environment as good designed facilities can lead to better health outcomes.

In PFI, the key design risks are related to design deficiency and design alteration. Design deficiency indicates that the design fails to meet the specified requirement. Hospital projects are complex in terms of unusual architectural design and very sophisticated hospital engineering services (Lam, 2005). Lam (2005) indicated that the design of hospital building requires the extraordinary considerations of medical techniques to be taken into account. To deliver healthcare services sufficiently, healthcare premises must have the right amount of space and the correct tools, that is hospital equipment, supporting mechanical and electrical engineering services (Lam, 2005). Design deficiency here is therefore defined that the design of the facility is not fully or partially suitable for its intended purpose, and is not capable of supporting the required service delivery output (Akintoye and Black, 1999).

TABLE 2 INDICATIVE TABLE FOR SIGNIFICANT RISKS AND THEIR ASSOCIATED RISK LEVELS FOR 'FI PROCUREMENT

DESIGN	CONSTRUCTION AND DEVELOPMENT	COMMISSIONING AND OPERATING	TECHNOLOGY AND OBSOLESCENCE	CNTRACT AGREEMENT AND REGULATION	INVESTMENT AND VARIANCE IN REVENUE	RESIDUAL VALUE	COMMENTS
Category A **DBFO MODEL (WITH OR WITHOUT MES / MTS)**							
High • Significant design change or variations from the public sector • Over emphasised on cost saving • Design of the building override equipment solution • Failure to translate the output requirements into the design • Time overrun • Late incorporation of MES	High • Ineffective design of infrastructure • Unforeseen site unavailability • Incorrect estimate of cost and time overrun • Increases in construction work • Delay in site access • Poor quality of work	High • Ineffective design and construction of infrastructure • Unexpected changes in the cost of equipment, labour, utilities, and other supplies • Increases in maintenance cost • Increases in production costs and input cost • Decreases in input quality • Inherent defects in building and equipment • Uncertainties in labour supply • Poor facilities management • Poor performance of services	High • Longevity of building elements and components • Large equipment downtime • Increases in costs of replacing equipment • Increases in maintenance costs • Increases in costs of spare parts • Inequivalency of new equipment in terms of functionality • Rapid changes of technology • Increases in costs of upgrading equipments including vendor independence to meet future technology • Reduced equipment reliability	Medin • Coract disputes on interpretation of theontract • Mar procurement entity defaults • Prcacted or complex negotiations incase legal costs • Leglative or regulatory changes	High • Increases in interest rates • Increases in inflation above FPI • Existence of substituted service • Unexpected changes in required technology or epidemiology of the people in the catchment area • Changes in resources allocated to the area leads to re-scaling of the provision of services	Low • Lower residual value • Increases in decommissioning cost caused by asset vacating at the end of contract	• Low demand risk, rapid rate of technological change • Example: Hospitals • Difficulty in transfer of demand risk to the private sector as operator's profit is not depended on the use of technology and equipment
Category B **TECHNOLOGY AND EQUIPMENT MANAGEMENT MODEL**							
N/A	N/A	N/A	High • Large downtime with MES • Increases in costs of replacing equipment • Increases in maintenance costs • Increases in costs of spare parts • Inequivalence of new equipment in terms of functionality • Rapid changes of technology • Increases in costs of upgrading equipments including vendor independence • Reduced equipment reliability	Medin • Coract disputes on interpretation of theontract • Laof standard contract form for MES • Leglative or regulatory changes	Medium • Increases in interest rates • Increases in inflation above RPI • Unexpected changes in required technology • Funding pressure	Low • Lower residual value • Increases in decommissioning cost caused by asset vacating at the end of contract	• High demand risk, rapid rate of technological change • Example: IT projects • Use of effective payment mechanism plus additional incentives • High refresh risk and technology risk is countered through track record which makes PFI unsuitable
Category C **FINANCIALLY FREE-STANDING MODEL**							
Medium • Significant design change or variations • Increases in design cost • Time overrun	High • Ineffective design of infrastructure • Unforeseen site unavailability • Incorrect estimate of cost and time overrun • Delay in site access • Poor quality of work	High • Unexpected changes in the cost of equipment, labour, utilities, and other supplies • Increases in maintenance cost due to ineffective design and construction of infrastructure • Inherent defects in building	High • Increases in maintenance costs • Decreases in quality of technology • Reduced equipment reliability	Medin • Coract disputes on interpretation of theontract • Prracted or complex negotiations incase legal costs • Leglative or regulatory changes	High • Increases in interest rates • Increases in inflation above RPI • Increases in capital cost • Low demand for volume and usage • Existence of substituted service • Unexpected low revenues received for the provision of outputs	Low • Low residual value • Increases in decommissioning cost caused by asset vacating at the end of contract	• High demand risk, slow rate of technological change • Example: Bridge construction • Slower rate of technical progress indicating limited obsolescence or residual value risk • Significant impact of demand risk
Category D **JOINT VENTURE**							
High • Significant design change or variations from the public sector • Failure to translate the output requirements into the design • Time overrun	High • Protester opposing action • Ineffective design of infrastructure • Unforeseen site unavailability • Incorrect estimate of cost and time overrun • Delay in site access • Poor quality of work	Medium • Unexpected changes in the cost of equipment, labour, utilities, and other supplies • Increases in maintenance cost due to ineffective design and construction of infrastructure • Increases in production costs and input cost • Decreases in input quality • Inherent defects in building	Medium • Increases in maintenance costs • Decreases in quality of technology • Reduced equipment reliability	High • Coract disputes on interpretation of thcontract • Mar procurement entity defaults • Inpropriate contractual protection in foa of collateral warranties • Lai acquisition problem e.g. refusing to ll of landowners	High • Increases in Interest rates • Increases in inflation above RPI • Increases in capital cost • Existence of substituted service • Unexpected changes in required technology or epidemiology of the people in the catchment area • Changes in resources allocated to the area leads to re-scaling of the provision of services	Low • Low residual value • Increases in decommissioning cost caused by asset vacating at the end of contract	• Low demand risk, slow rate of technological change • Example: Urban regeneration projects • Little added value • Achievement of best value via direct public sector procurement

Design deficiency can be caused by errors of design documents, confusion or misunderstanding which in turn lead to mis-pricing and errors in the final design. Design deficiency may also be due to impracticable and inferior technical feasibility if design consultants are lack of detailed technical understanding of the issues and experience of public capital procurement, and inability to be open minded and to explore what the options for delivering healthcare mean. To achieve good design quality for a large and complex PFI healthcare scheme, it is important to ensure that the right skills and resources are available at each step.

On the other hand, design alteration is a risk when the public sector requires changes to the design of a facility, or to the output of a facility before the financial close (Dawood, 1998). Design change or design variations may increase project direct cost, and also disrupt the progress of the construction works that leading to additional time and cost overrun. Thus, the degree of flexibility and adaptability of buildings to allow for changes in the operations of the NHS Trust throughout the contract period are important (NHS Executive, 1999).

Commissioning and Operating Risk

Healthcare is a risky activity whose operations are diverse and complex to manage. Commissioning and operating risks are those risks which occur after the project is commissioned and before the project concession expires. It is the longest phase in the PFI project and involves a large number of companies in a wide range of occupations. The acute care sector has been subject to enormous technological and social change, and operates under intense public and political scrutiny. Akintoye and Black (1999) have said that operational risks are very fundamental to the use of partnering for construction because of conflicts of interest and communication difficulties.

Operating risks typically relate to production and operation, availability, quality and efficiency of management and operation, as well as maintenance and upgrade requirements. Operating cost overrun of hospital development is caused by the actual cost of providing designated services which are different to the expected cost because of unexpected changes in the cost of equipment, labour, utilities, and other supplies (NHS Executive, 1999). Non-clinical support services include hard and soft FM. Hard FM contract only covers plant and equipment that would normally be expected to be provided as part of the building infrastructure (Group 1 equipment). Their services are particularly very dependent on labour for operation and are subject to uncertainties in the supply of labour (Kopp, 1997).

A well designed building should do exactly what it needs and will do it in an efficient manner. Within the basic cost of fulfilling the need, it will provide as much extra added value to the lives of those who use it (NHS Executive, 1999). Spacial and operational relationships should be covered by specialist professional and technical advisers with reference to statutory requirements in order to

mitigate the risks regarding mismatched building spaces to new equipments. Other environmental issues related to operational phase should be covered and include (NHS Executive, 1999):

- obsolescence of both space and infrastructure;
- use of labour-saving technology and designs;
- rationalisation of resources by use of flexible facilities such as multi-purpose rooms;
- site master-planning to allow for possible down-sizing and / or expansion of clinical departments;
- environmental standards of energy efficiency and for reducing waste; and
- utility connections in place such as the use of natural light, external views, and de-institutionalised atmosphere.

Other possible factors of operating risk may due to higher production costs, higher input costs, reduced input quality, unsuitable design, reduced equipment reliability, inherent defects or force majeure event.

Technology and Obsolescence Risk

Projects could face technical risks that reflect their engineering difficulties and novelty. Technology risks are inherent in the designs or technologies employed. The health sector is especially subject to this risk as many new technologies such as Picture Archiving and Communications System are currently being deployed. In hospitals, the speed of technological progress makes contracting future quality standards very difficult, and the private sector management of system upgrades may have a significant bearing on contract renewal and hence residual value. This situation emerges the existence of the recent TEMM which is a flexible contract to manage the equipment and technology that the exact term is determined by issues which have impact upon affordability and VFM.

Obsolescence risk is the risk that the asset ceases to be the technically best way of delivering the service during the lifetime of the contract. Obsolescence risk is closely related to design risk. In most DBFO hospital development, healthcare MES is provided under a PFI contract of between 25 and 35 years, although the design life of a hospital is generally 60 years (Julie and Jean, 2001). The useful economic life of information management and technology as well as medical equipment is much shorter than for buildings, thus making contract matching and management more complex. There is essentially 'a strong desire to incorporate tomorrow's medical equipment technology design into the hospital building today. Infrastructure projects that rely on the commercial application of new technology involve risks associated with pioneering implementation issues.' (Lam, 2005) Standalone MES contract or TEMM, on the other hand, eradicates the risk associated

with traditional forms of IT procurement in hospitals. The smaller scheme encourages better innovation in design and development of equipment and the making of technological efficiencies.

MES contract covers equipment, including major medical and scientific equipment, which has implications in respect of space, construction or engineering services (Group 2 and some Group 3 equipment). Numerous risks are transferred away from the NHS Trust to MSP under both forms of MES PFI contract. Examples of risk transfer are (Asteral, 2008):

- cost of medical equipment;
- cost of maintaining medical equipment;
- reliability of medical equipment;
- speed of rectifying faults;
- cost of installing and commissioning;
- time taken to install and commission equipment;
- overall availability of equipment;
- long-term cost of financing capital investments e.g. interest rates;
- risk of technology obsolescence;
- room design risk; and
- FM interface risks.

Overview of Risk Identification in PFI Healthcare Projects

Williams (1995) found that the identification of each risk is an essential first step in risk management and is possibly the most difficult. The identification of each source of risk and the components allows the risk item to be separated from others. Consideration of each influencing factor will simplify the analysis and management of the risk (Bajaj, 1997). These design, commissioning and operating, as well as technology and obsolescence risks discussed in this section are important. In the next section, the relationship between them and a risk management strategy will be observed.

3.3. RISK MANAGEMENT STRATEGY

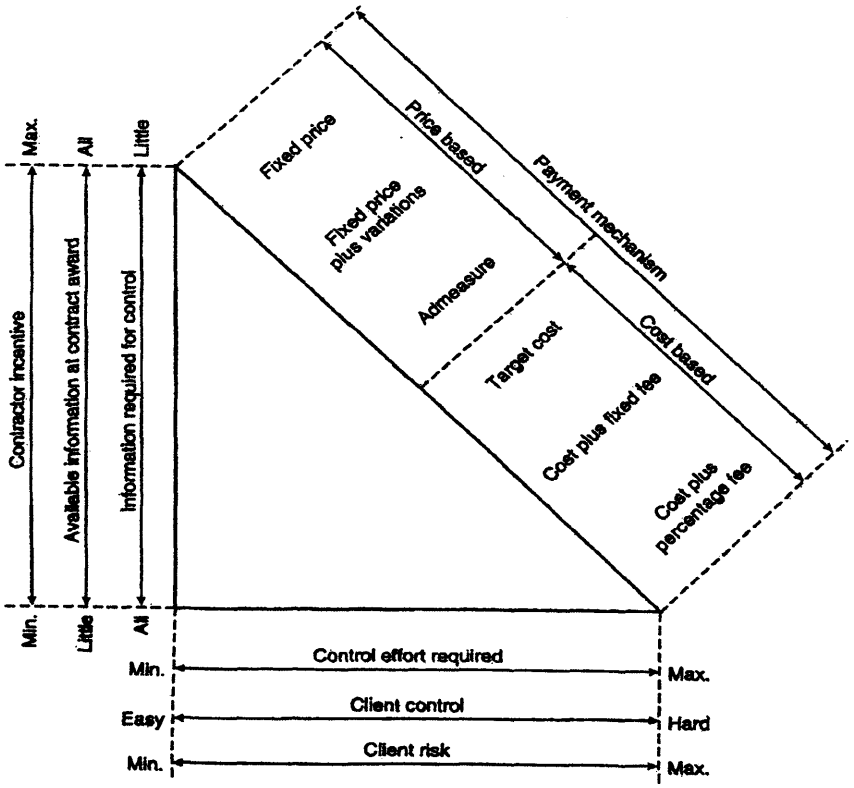
3.3.1. IMPORTANCE OF PROCUREMENT IN RISK MANAGEMENT

Among practitioners, risk taking is generally perceived as an integrated and inevitable part of management (March and Shapira, 1987). In their view, risk taking equals decision-making under uncertainty and hence any strategic choice has certain risk implications. Procurement represents a significant risk faced by most organisations (Akintoye and Black, 1999). Any decision-making made under procurement processes is therefore a strategy and will require appropriate risk management initiative to evaluate and manage effectively the risks inherent in that process.

According to McDermott (1999), procurement is the framework within which construction is brought about, acquired or obtained. This means that procurement works contain a series of activities and involves different parties who face different kinds of risks. How to manage these activities to achieve project objective depends on the effectiveness of the risk management. The procurement process is therefore the fundamental of the project success. It determines the role of each party in the project, the occurred risks in the project, and the attitude of each party towards risks.

Roles and responsibilities of each party involving in the procurement stage and the timescales within which each party is expected to perform are then needed to develop into a contractual relationship. Contract documentation is used to assist in understanding and implementing the procurement process. It is actually a tool for managing risk. It is concerned with the allocation of risk between different parties, while seeking for flexibility, clarity, simplicity and the promotion of good management practice (Smith, 1999). Clear and comprehensive allocation of risk is therefore an important element in contract.

A good contract lays out all of the core terms that are necessary to a good project and should be flexible enough to deal with inevitable changes. Contract should define the objectives of the project, qualified by its constraints. As Capper (1995) identified, 'contract parameters' in contract contain 'what the client has to do, what the contractor has to do, by what dates these various tasks have to be done and the pre-defined mechanisms for payment.' The contract type which is represented by its payment mechanism is depended on the obligation of contractor incentive and risk-sharing to the project (Smith, 1999), while contractor incentive and risk-sharing are often determined though a performance regime. These elements reflect the project requirements in terms of cost, time and quality. Their relationship is shown in Figure 4.

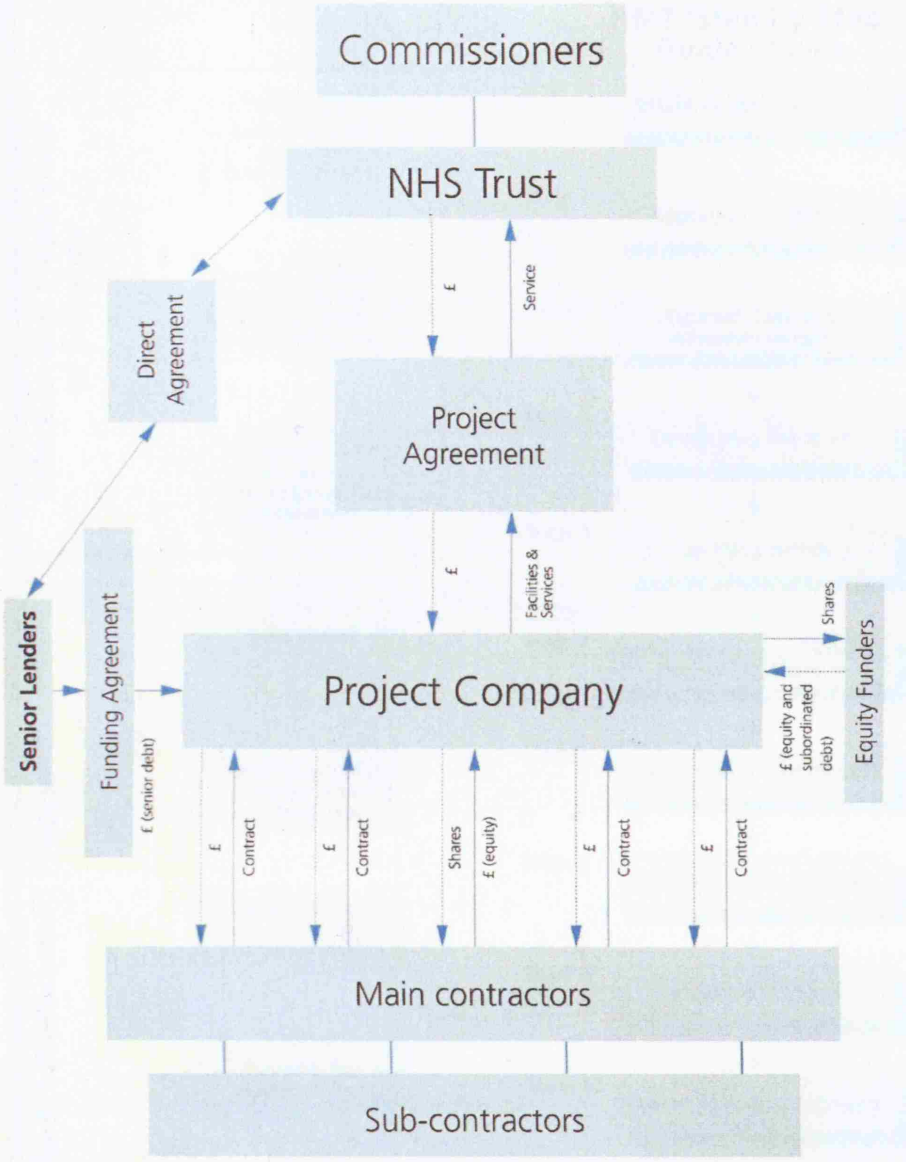


Source: Smith, 1999

FIGURE 4: MAJOR FACTORS INFLUENCING PAYMENT MECHANISM

3.3.2. ANALYSIS OF RISKS DRIVING PROCUREMENT

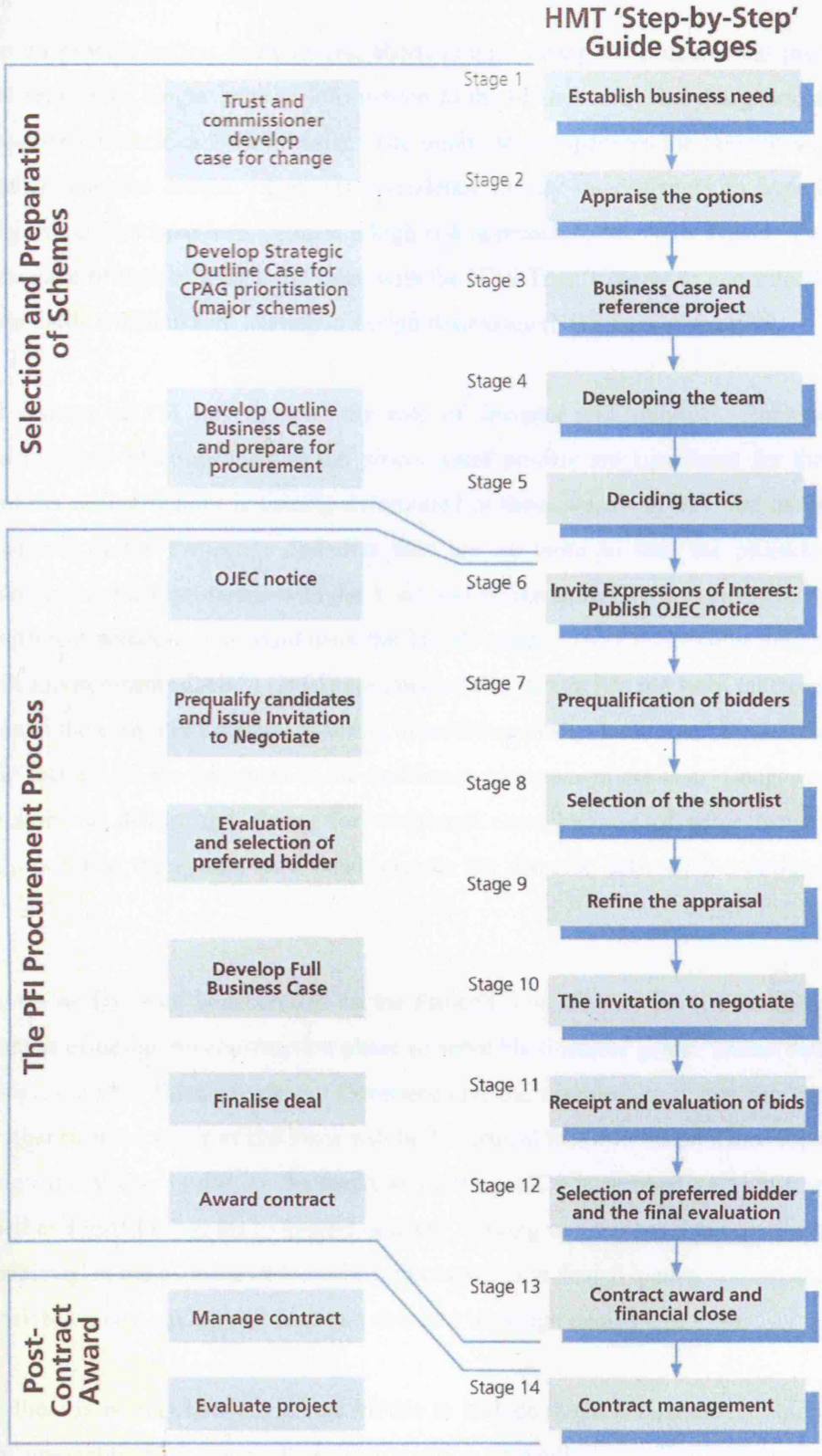
This section will move towards a focused strategic approach over procurement on all significant PFI projects in health sector. Major PFI schemes are typically DBFO in health sector (NHS Executive, 1999). Figure 5 illustrates the contractual relationship between an NHS Trust, PFI consortium or ProjectCo, and financiers for a typical large PFI scheme which is bank financed. The key relationship is between the Trust and the ProjectCo.



Source: NHS Executive, 1999

FIGURE 5: CONTRACTUAL RELATIONSHIPS UNDER PFI

The NHS PFI is governed by the principles and procedures that VFM is achieved and risk is appropriately allocated with the stage of the procurement process. The procuring entity therefore should have a strategy for allocating and managing any risk that it retains. The phases of the NHS PFI process is illustrated in Figure 6, alongside the procurement process set out in HM Treasury's Step by Step Guide to the Procurement Process. Several paragraphs will then discuss how the design, commissioning and operating, and technology and obsolescence risks are handled and mitigated in a strategic NHS PFI procurement process. Attention will be paid to the practical processes that impinge on the private sector ability to achieve best value.



Source: NHS Executive, 1999

FIGURE 6: RECONCILLIATION OF PFI IN THE NHS AND TREASURY'S STEP BY STEP GUIDE

Design Risk

The PFI design process suffers from several shortcomings during the procurement process. PFI procurement relies on a single issue of information to the bidders and their designers, albeit with subsequent scope for clarification of details. The public sector specifies the outcomes and output required, rather than the design. There is a tendency to rely on designers to hypothesise the unstated project quality objectives. This is a high risk approach to the NHS Trusts. Design team may have shortage of time to debate the issue with the NHS Trust's senior to understand the value of quality standards which in turn leading to design deficiency (NHS Executive, 1999).

Contractual context of PFI has changed the role of designer and architect. Intra-consortium mechanisms that take place throughout the procurement process are significant for the project's outcome and the design quality is usually determined in those steps. In PFI, the design team is under the control of the ProjectCo and thus they are no more to lead the project. Leading contractor dominates the discussions with the Trust and design team does not have the opportunity to explore different solutions that could meet the Trust's needs. The Commission for Architecture and the Built Environment (CABE) (2005) commented that design has not been taken into serious consideration in the early PFI projects, resulting in mediocre design buildings. Direct relationships of the public sector with the designers in the traditional procurement are lost. Longer negotiation leads to programme delays and claims for additional costs because of price increases. The operational process of the system as a result creates the distance between the designer and the client.

Financially, the design team is dependent on the ProjectCo which may be in a strong position to demand changes of design on construction phase to serve his financial goals. Detail design would only be completed after financial close. Consequently, the real danger is that the needs of the ProjectCo rather than the needs of the Trust will be the critical factor in hospital development. The lack of design innovation is due to the fact that the ProjectCo is responding to risk transfer by adopting tried and tested solutions to project delivery, leading to concerns that cost savings in PFI have been achieved at the expense of look-for improvements in design quality (Dixon et al., 2003). Over-emphasised on cost-saving will lead to a decrease in design quality and form.

In addition, there is no requirement for the bidder to include medical equipment suppliers in the ProjectCo at prequalification stage. Late incorporation of medical supplies and equipments into design is a major risk factor in design alteration. This issue will have an impact on space requirements and the level of provision of engineering services. The drawbacks of design in procurement process point out risk of design deficiency and public service delivery suffers as a result.

To make the most of the advantages offered by PFI and address the issues outlined above, risks could be mitigated during procurement contracting to ensure design quality. Advice from CABE (2005) focuses on up-front design, quality of bidders and the ability of end-users to state their requirements in output terms. The production of guidelines and standards will enable the Trust to set down criteria within output specifications and contracts to ensure that building design contributes to the efficient operation of public service as well as facilities management. Design innovation can be improved by better engaging the Trust in the design and removing barriers to entry to PFI market by some of the smaller and medium-sized design firms that are currently excluded.

Commissioning and Operating Risk

Under the philosophy of PFI projects, the quality of services is regulated through detailed monitoring and payment mechanisms. The principle of payment against performance gives an incentive to the private sector party to meet availability, quality and efficiency of management and operation, as well as maintenance and upgrade requirements. Performance regime through potential deductions is keenly analysed to judge the risks to the revenue stream. The extent of risk transfer for commissioning and operating risk is therefore intrinsic to the payment mechanisms.

The main purpose of ProjectCo is to reduce the whole life cost of buildings by optimising the relationship between capital, revenue and life cycle replacement costs for building fabric and services. On-going maintenance activities and replacements are part of the overall PFI building package. Longer leases mean that the life-span and maintenance costs of the products used are important factors to be considered in conjunction with the initial capital cost. Durable products and materials offer better life cycle benefits. In building hospital projects, optimum balance between design and construction, life cycle as well as maintenance decisions should remain a strategic goal (Akintoye, Beck and Hardcastle, 2003).

Under PFI deals, FM operators are appointed by project managers to maintain the building and provide cleaning, catering and other services. Although they are paid a flat annual fee, they are allowed to invoice the trusts for any additional jobs not specified in the contract. The hospital is obliged to use its contractor and thus contract variations often works out more expensive in operational and maintenance phases. The contract charges are higher mainly because PFI hospitals do not have enough maintenance staff to do the job on site and have to call out the contractor's staff. The delivery of outsourced services may not satisfy the VFM approach.

Some operational issues relating to space have to be considered in the procurement stage. The NHS Trust should have a clear idea before it commences the procurement of the extent to which it will need to approve the financial functionality of the designs provided by the ProjectCo to

financial close. These kinds of operational risks may due to rationalisation of resources by use of flexible facilities, the grouping of facilities and extending the working day; access arrangements for staff and patients; the links with community care providers and potential scope for integrating the use of facilities; the utility connections in place; mismatched building space to new equipments, and most importantly, obsolescence of both space and infrastructure.

Operational risks in hospitals are the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. They include risks that are outside the control of the operator, weaknesses in the business operation, and business risk such as prosecution and reputation. Commissioning and operating risk should be actively managed by the ProjectCo. However, the transfer of risk inherent in a PFI deal cannot protect the Trust from the risk that the ProjectCo simply fails to deliver what may be a key public service (House of Commons, 2003). The PFI remedies available cannot fully compensate for the disruption and operational risks that would inevitably follow. Some of these risks are the complexity of operations and the inexperience of sub-contractors. Also, PSC does not include operating risks which are not transferrable and therefore some of them are retained to the Trust.

Technology and Obsolescence Risk

Under DBFO projects, the purpose of including a separate MES contract are to transfer the risk of providing technologically up-to-date major clinical diagnostic and treatment equipment, and some key risks that relate to the interface between the building and equipment elements of the facility to the appointed MSP. One major dividend of MES is that there is no longer an internal competition for capital funding because MES contract completely ring-fences the money and thus the risks from the main project agreement. The guarantee funding approach ensures that the medical equipment reverts to the Trust in good working order whilst there is sufficient financial reimbursement to take back responsibility for replacing and maintaining the equipment (Dipper, 2008).

A newer form of MES PFI contract has developed as the Trust requires a major shift in the way assets are acquired and managed within the health service. There is no construction or development of buildings under TEMM. The whole life costing of assets tends to be more complete as the exact term of the contract is influenced by issues which only have impact on affordability and VFM of equipment. Replacement profiles must be taken into consideration to ensure that the best time to end the project term is that residual value risk is lowest. (Dipper, 2008).

No matter which method of MES is procured, MSP should commit to the concept of provision of technically up-to-date equipment. The effective method is to group equipment into technology bands to ensure equivalency. On replacement of the initial equipment, the Trust chooses a new

machine in the same technology band as the one being replaced. The banding of machines is an established currency in the industry. The contract allocates the responsibility of updating the banding of new machines available in the market to an Investment Committee consisting of both Trust and project co-representatives. Annual Review Process (ARP) is more likely to deal with changing technologies where the Trust needs to consider wider service issues before replacing an item, and Equipment Replacement Plan (ERP) pre-determines the life-cycle replacement at agreed intervals. These procedures and plans enable MES contractual terms to consistently offer VFM benefits. (Dipper, 2008).

As mentioned above, technological change is managed by the MSP with the Trust scrutinising their plans and proposals. The performance regime is then the key incentive to availability. Risk on failing to meet performance standard will lead to penalties for non-availability of the equipment. Certain level of uptime which reflects the age of equipment and the way it is being maintained should also be ensured. It is also important to ensure vendor independence so that MSP can offer impartial advice and clinical choice across all equipment suppliers, matching the Trusts' needs to the best technology solution and to deliver the best value MES in the market place (Dipper, 2008).

PFI route often heavily favours the larger schemes and the large and developed medical equipment companies which have abilities to add value and deliverability experience. For international technology company, these risks may be subject to short-termist pressures from shareholders, anxious to maximise dividend income and stocks, and therefore it may be reluctant to undertake long-term planning and innovation. Another main aspect of risk is related to the potential weakness of private sector provision. MSP is naturally a profit maximiser. They may take commercial decisions to reduce their costs artificially to make them more attractive to the Trust so that they will be able to reinstate some costs if they are chosen as the preferred bidder. When a company is in the business of maximising profits, it has more incentive to be efficient or innovative in completing for contract but may reduce incentive to provide a quality service in a long term contractual relationship (Dipper, 2008).

3.4. SUCCESS OR FAILURE OF PFI

Record of PFI procurement in the NHS appears to be ambiguous to the challenges of best value. PFI in hospitals have been criticised for complex and opaque decision making during the planning phase, low standard of physical facilities provided once the project was completed, and lack of cost effectiveness (Pollock, 1995; Gaffney et al., 1999; Pollock, Shaoul and Vickers, 2002). Major criticism of PFI hospitals design has been focused on a reduction in the number of beds in the new built facilities. Pollock (1995), Gaffney et al. (1999), Pollock, Shaoul and Vickers (2002), Asenova et al. (2001, 2007) all doubted that these cutbacks genuinely arise from the choice of PFI as procurement method for hospital, while PFI main contractor rather than the Trust is responsible to determine the number of beds from an output specification in England. Whilst there is little information about the impact of PFI contracts on the performance and the profit level of the procurer, the future private sector participants will find their involvement in PFI hospital schemes to be more challenging than what they experience in non-NHS projects.

Shaoul, Stafford and Stapleton (2008) criticised in a recent report that PFI route creates 'budget inflexibilities that increase pressures on the NHS to cut its largest cost on the jobs, working conditions and pay of staff and thus access to quality of healthcare services'. 'PFI heralds an emerging conflict between capital and labour in healthcare.' They also found that NHS Trusts' annual payments to their private sector partners are higher than expected. The financial difficulty for the Trust has led them to sell assets and cut service capacity to offset the shortfall (Hellowell and Pollock, 2007). This problem is even more serious with Trusts with large or multiple schemes. 'Because of the high cost and intractable nature of PFI contract, local health officials are considering focusing cuts on Trusts with cheaper public, rather than expensive PFI assets.' (Hellowell and Pollock, 2007) It is believed that plans for reductions to service capacity are affecting health economies more widely.

CHAPTER 4 RESEARCH METHODOLOGY

4.1. RESEARCH PROCEDURE AND METHODOLOGY

The overall research programme is divided into four phases. The first phase is initial activities, which include a literature review about the subject, exploration of the problem, establishment of the aim of the research and its objectives, development of qualitative research interviews and preparation of the research proposal.

The second phase focuses on a literature review. The literature review in this study has two sections, dealing with PFI procurement as well as risk and risk management. The content of PFI covers mainly the subject related to the health sector. Risk and risk management have been reviewed mostly in the construction management and minority in the financial management literature. Sources of PFI risks are identified and critical risk factors for PFI healthcare projects are investigated. The results are used to develop the research tool for phase three, dealing with qualitative research interviews.

The third phase is about research interviews and questionnaire survey. Several one-on-one interviews with key professionals in the two hospital projects are arranged. The semi-structured interviews are taped with the consent of the interviewees and professionally transcribed for ease of analysis. The second primary data collection instrument is questionnaire survey. The respondents have been asked to select the type of PFI NHS projects they have done and provide information on it. This project specific information can be regarded as a 'case study'. Another data sources are books, journal articles, internet articles and official government reports.

The fourth phase is the implementation of a risk management model for PFI NHS projects. Research findings from case studies will be used to understand better the risk involved in PFI NHS projects and if those risks can be transferred and managed by current risk management model successfully.

4.2. CASE STUDIES

Two case studies are selected from two different types of PFI projects for comparison:

- Barnet Hospital (BH) Modernisation Project; and
- Airedale NHS Trust (AT) – Medical Equipment Modernisation Project.

They are classified as DBFO and TEMM in categories of PFI projects. Involving projects with different capital requirements will provide better insights of the range of problems faced by the NHS trusts. Chosen projects have been into their operational phases and therefore the research is possible to monitor if risk transfer operates in the way expected by the contract and thereby obtain VFM. Members of ProjectCo or MSP in these case study projects have entered into the PFI market and their considerable amount of knowledge would enable this research to capture a more analytical account of risk transfer in PFI procurement process.

4.3. INTERVIEWS WITH EXPERTS AND RESPONDENTS' INFORMATION

The research is a qualitative based study. It makes use of a combination of methods to collect data. Planned stages of research include:

- design structure and content for questionnaire in order to achieve the study aims and objectives;
- design interview questions;
- select and recruit participants into the study;
- conduct semi-structured interviews;
- analyse data; and
- write up findings.

The main source for data for the case studies is obtained as interviews. 4 semi-structured interviews are conducted with:

- project manager;
- NHS Trust employee;
- legal advisor; and
- MSP business development manager.

All interviewees have been involved in the two selected PFI hospital projects at different stages. The interviews explore the procurement of the case study projects in general. The average length of an interview is about 1 hour. This method provides rich and well-grounded descriptions and

explanations of the research topic. Descriptive and interpretive approaches are used to analyse the interview data. A list of the interview questions is attached at Appendix III.

110 questionnaires are sent out in email to companies. Purposeful sampling techniques are used to select respondents for the questionnaires. Specifically, a total of 110 respondents from 22 companies in the UK are selected to make up the sample. The questions of the questionnaires are focused on the risk transfer techniques and risk management. Descriptive approach is used for gathering prevailing conditions. The survey as shown in Appendix IV is divided into three parts:

- design risk;
- commissioning and operation risk; and
- technology and obsolesce risk.

A total of 29 questionnaires have been returned and the effective return rate is 26%. Considering the limited time available, the response rate though well below 50% can be considered to serve our purpose. These responses are being supplemented with interviews. The return rate is because of lots of encourage telephone calls and emails. However, 12 questionnaires are not completely filled due to the partial role of the respondents in projects. The participants are either director or managers and their organisations are very diverse. Large organisations occupy the largest percentage of participation in both public and private sectors. The result also indicates that the type of PFI NHS projects that the organisations have mostly had involvement in is DBFO model. It confirms that traditional DBFO hospital building programme is popular for PFI procurement in this sector.

Information gathered in interviews and questionnaire surveys are supplemented by documentary material such as project memorandum and general project information which are available in the public domain. As expected, commercial sensitivity is a major issue in obtaining access to the ProjectCo or the MSP issued documentation such as contracts between ProjectCo and its members.

Relevant books, journal articles, internet articles and official government reports are used to gather information and to broaden the range of secondary research. With the use of the interviews, questionnaires as well as published documents and literatures, this study takes on the combined quantitative and qualitative approach of research and possible to overcome their limitations.

CHAPTER 5 CASE STUDY RESEARCH AND ANALYSIS

This section considers the impact and allocation of risk in two PFI type of procurement in health sector. The aim of risk management is to achieve the optimum allocation of risk and not simply transfer all the risks. This is fundamental to the delivery of VFM in PFI procurement. The background of the projects, a close examination of the contracts and the risk management implications will be given below and summarised in Tables 3 and 4. Only design, commissioning and operating, as well as technology and obsolescence risks will be investigated and it is coherent with the literature review regarding risk analysis of NHS PFI projects. The following case study analysis will identify if any of these risks were transferred to ProjectCo and if a suitable framework set in place for the management of risk throughout the lifetime of the projects.

5.1. BARNET HOSPITAL MODERNAISATION PROJECT

Barnet and Chase Farm Hospitals NHS Trust (BCFHT) provides a full range of acute hospital services at Barnet Hospital (BH) in Barnet and Chase Farm Hospital in the London Borough of Enfield. Its location map, key location of hospital's campus and photos are attached as Appendix V. BH was the first hospital in the UK to include a MES. Its PFI development was built on budget and transferred weeks before schedule. BH was officially opened in 2003.

BH has seen dramatic improvements in the late 1990s with the building of a £28 million scheme, known as Phase 1a, including a new Accident and Emergency department, theatres, surgical wards, day surgery and maternity and children's wards. In 1999, the second phase of the redevelopment, Phase 1b, containing a new building of 30 departments on 4 levels of outpatients, medical wards, pathology and a IT centre, was procured by PFI. The new building was linked to Phase 1a and greatly improved access for patients. The PFI agreement included a separated MES contract which was signed with SHS for 34 years to install, maintain and replace the hospital's medical, computer and telecommunications equipment with a new Electronic Patient Record (EPR) and the necessary back up and support. The new hospital cost £40 million.

This DBFO new build programme with MES is one of the DBFO type (Category A) projects. The organisation structure of this PFI scheme is illustrated in Figure 7. Bouygues (UK) Limited (BUKL) together with Ecovert FM Limited (EFL), Siemens Healthcare Services Limited (SHS), London Financial Group and HSBC Infrastructure Company Limited (HI) formed the Metier Healthcare Limited (MHL). BUKL and EFL are both subsidiaries of a French company, Bouygues Construction S.A., which is the largest contractor in Europe.

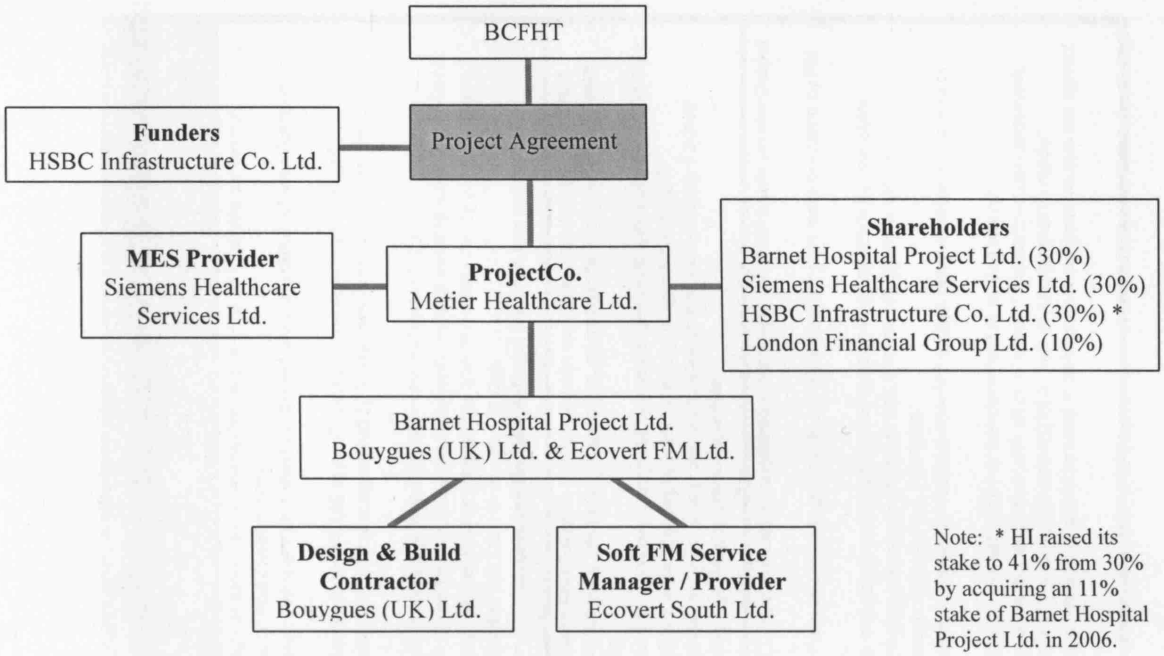


FIGURE 7: RELATIONSHIP OF BCFHT AND MEMBERS OF THE METIER CONSORTIUM

Design Risk

During the initial scheme design development stage, BUKL placed building services and structural design contracts with project architects, Percy Thomas Partnership (PTP). PTP began to work for BUKL at risk and would receive its full fees only if the project reached financial close. The designers had therefore an incentive to complete the design and in particular to purse BUKL's objectives in the design development. The designers had full responsibility for designing the building needed to meet service requirements and for adapting them during the lifetime of the contract. The challenge was to capture the BCFHT's requirements and the BUKL's proposed design, construction and operational solutions at the same time.

PTP began to develop the scheme design solution for BH. Space planning within buildings was shown on 1:200 and 1:50 plan drawings. 1:50 plan drawings were more important to show precise location of each function in rooms. In association with room data sheets, they provided the key design guide for the building. The challenge of the plans was to get decisions and approvals from the BCFHT as BCFHT always had different expectations than PTP for some aspects of design quality objectives. The lack of shared language was the factor of design risk. Such risk could possibly be mitigated by involvement of experts from professional organisation such as CABE by BCFHT as advisors. However, it was the responsibility of PTP to provide the design of infrastructure to satisfy BCFHT's requirements. Redesign arising from design developments in its fixed-price design contracts was an important risk for MHL and PTP. The risk consequences of

TABLE 3 RISK MANAGEMENT FOR BARNET HOSPITAL MODERIZATION PROJECT

Sources of Risk	Risk Drivers	Possible Consequences	Risk Mitigation Reported
Design	•Misunderstanding of quality standards •Lack of shared language •Design change or variations from the public sector	•Increases in cost from redesign •Time overrun •Failure to provide agreed quality and form •Reduction of numbers of bed	•Important aspects of design were reviewable by the Trust to finalising design e.g. especially in clinical and public spaces •1:50 plan drawings and room data sheets provided precise location of each function in rooms •Involvement of experts from CABE as public sector advisors was encouraged •Output specification or brief was signed-off by senior clinicians to carry out clinical functionality •Earlier engagement of MES on key discussion of design was crucial •Supervisory role of the Trust prior to the commencement of building work was enforced •Flexibility of design allowed minor adaptations and alterations during construction •Strong engagement of the Trust in design was met •Sufficient communication between the designers and the Trust was committed
Construction and Development	•Incomplete design development •Inconsistent performance of subcontractors •Construction change or variations from the public sector •Unforeseen ground/site conditions under the footprint of existing facilities	•Increases in construction cost •Time overrun •Unsatisfied quality of work •Increases of construction works	•Materials used were selected after in-depth option appraisals that considered factors including cost, buildability, life cycle, programme, maintenance, environmental impact and sustainability •ProjectCo retained single-point responsibility and avoided multi party direct involvement •Significant variations were covered by insurances e.g. pragmatic approach •Revised construction program was proposed to eliminate or reduce delay if actual program had fallen significantly behind schedule
Commissioning and Operating	•Unexpected changes in the cost of equipment, labour, utilities and other supplies •Uncertainties in labour supply •Poor performance of maintenance and replacement works •Reluctant to undertake long-term planning and innovation	•Uncertain fluctuations in operating and maintenance cost •Unavailability of services facilities •Increases in costs from unexpected works •Decreases in quality of work	•Performance of the services were monitored according to those set out in Service Output Specification •Proposed PPM Programme and updated 5-year maintenance plan were prepared by FM operators •Ability to review and adjust maintenance plan to reflect actual needs by operators •Monthly performance management report was used to adjust actual UP •Partnering approach was used e.g. openness •Separate regime of Inspection of facilities ensured certain residual value by the end of contract •Soft FM services were market tested or benchmarked at agreed intervals •Services facilities were in compliance with all provisions of the contractual agreement, and with the ProjectCo`s proposals submitted as part of its response to tender •Dispute Resolution Procedure would be used if maintenance programme was not agreed by parties

TABLE 3 — RISK MANAGEMENT FOR BARNET HOSPITAL MODERIZATION PROJECT

Sources of Risk	**Risk Drivers**	**Possible Consequences**	**Risk Mitigation Reported**
Technology and Obsolescence	•Relocation of existing equipment •Rapid changes of medical technology as reviewed by R&D •Lack of control on costs due to improved diagnostics to meet patients' need •Reduction of equipment reliability during its life cycle •Increases in inflation rate	•Large equipment downtown •Increases in costs of upgrading equipment to meet future technology •Increases in installation costs •Failure to meet maintenance and upgrading requirements •Inequivalency of new equipment in terms of functionality	•Liaison with designers and ProjectCo to ensure technical specifications of equipment satisfactorily housed inside new building •Equipment were updated and replaced according to a rolling replacement programme set out in ERP and benchmark studies •Service failures attracted UP deductions for non-availability of equipment •Grouping equipment into technology bands to ensure equivalency and updating the bands to meet up-to-date standard •Annual Review Process and vendor independence approach ensured wider services •Volume adjustment reflected the demand of equipment e.g. larger clinical activity and extended opening times impinged upon availability for maintenance •Market testing of service reflected the true cost of operational service provision •Renegotiated contractual details to review optimum allocation of risks if needed •Retained inflation to MES by UP indexation and market testing
Contract Agreement and Regulation	•Misunderstanding of contractual terms •Error of legal documents •Continual expansion of legislative and regulatory requirements of PFI / MES •Inability to manage the public's expectations •Loss of public reputation	•Under-enforcement of acts and provisions •Inability to meet service levels and agreements •Increases of litigation •Political pressures resulting from negative public opinion	•Strategic communications was used •New guidelines were set up to assist with implementation of new regulations •Increasing transparency of decision-making with user groups to prevent legal problems from occurring •Procurement timetable ensured that statutory consultation requirements were completed before bidding process began •Variation and termination procedures / clauses were included in contract •Key information were published on the department's web site
Investment and Variance in Revenue	•Uncertainty in priority-setting payment mechanisms used for risk allocation towards PFI investments •ProjectCo as profit maximizer financing the project by equity investment •Higher Interest rates and long-term financing costs to reflect current market conditions and inflation expectation	•Funding pressure from higher level of specialization of medical equipment •Failure to generate the cashflow necessary to service debt and provide return on equity •Over-emphasised on cost-saving •Poor risk-return ratio	•Incentive of operational cost minimisation as operational cost reductions subject to successful service delivery increased the profit it made from operation •Clear evaluation weights for performance regime was sorted out •Early preparation on commercial issues was required e.g. equivalent of PSC required to be practical and prioritisation
Residual Value	• Poor maintenance •Inadequate investment in upgrades	•Lower residual value •Increases in decommissioning cost	•Effective payment mechanisms was used for reduction in price or increased flexibility over the life of the contract to reflect the residual value that accrued to suppliers

concern here were acknowledged to be risks of time overrun, failure to provide agreed quality and form, and reduction of numbers of beds. SHS was involved early in design stage. Equipment selected by BCFHT such as Magnetic Resonance Imaging (MRI) scanner and Linac had impact on design and the early engagement of SHS on key discussion of design was a successful factor on this project. Early designation of MES in design had been recognised to reduce the risk exposure in design changes, installation of equipment, and on-going maintenance of building.

In BH, not every single space was correctly designed before proceeding to construction. Generic spaces as shown in 1:200 plan drawings could be finalised during construction. Flexibility was the other key area that BCFHT had to ensure when developing the contract at the time of the initial design conception. It was an in-built feature of the design, to allow for minor adaptations and alterations to be undertaken without incurring excessive costs. Design variation was therefore a risk for PTP who was not certain all design and its cost and affordability before construction. However, late design changes were found to be easily accommodated as good quality team members integrated to reduce design errors.

In order to ensure the output specification to be met, important aspects of the design were reviewable by BCFHT prior to finalising the design. During the entire designing process, BCFHT indeed played a supervisory role of design prior to the commencement of building work. BCFHT particularly had an interest on clinical and public space because their focus was on design quality of function rooms and facilities which had a direct impact on patients' health outcomes. Design innovation was improved by the strong ability and engaging BCFHT in the design in this first wave NHS PFI scheme. The need to meet BCFHT's capital cost affordability constraint was seriously concerned. There were sufficient communication between the Trust and the designers, which was not the case in other PFI hospital projects. Once construction had commenced, there was a constant need for PTP to make rapid decisions in order to be available to achieve an uninterrupted flow of materials, components and assemblies.

In order to define functionality, project objective was broken down into simple functionality statements that described the level and quality of expected benefits of BCFHT. These functionality statements were then broken down into clear statements that communicate to PTP about those things they must take into account when developing the design. This technique was very powerful to define desired outcome as objectives were transferred down from ProjectCo. Design risks were well-managed in a way that designers had incentive to develop designs according to project objectives and budget. Both service specification led and capital cost led whole-life costs driven design solutions were appropriate approaches for hospital projects. Functionality improvement was the key to achieve whole life cost in this case because improved functionality would reduce operational cost through efficiency savings. During the design phase, it was achieved by early

involvement of major project member who had significant impact on the design such as MSP. Moreover, better functionality was delivered when design team cooperated with representatives of the relevant clinical service providers who would use the space in order to discuss the draft designs.

Commissioning and Operating Risk

BUKL and EFL established Barnet Hospital Project Limited (BHPT) with joint ownership to provide hard FM service. Another subsidiary of Bouygues Construction S.A., Ecovert South Limited (ESL), is responsible for soft FM. BHPT and ESL were to enter into a DBO contract with BCFHT to operate the building and non-clinical support services. They would keep its operational cost minimisation incentive as operational cost reductions subject to successful service delivery would increase the profit it would make from operation.

One interviewer said that risks in operational phase were dynamically reduced because most risks related to the construction period have been treated in this project. Since annual UP was performance related, BUKL had incentive to specify the most durable materials and components in construction in order to offset the expense against longer life spans and to achieve lower overall life cycle costs. BUKL used a concrete frame on which the brick wall was built, thus reducing construction time and adding value coming in at £1,200 per square metre as compared to the modern average of £1,500. At commissioning, ESL resolved outstanding minor deficits on the snagging list.

At BH, PFI contract costs split between payments made by the NHS Trust for the occupation and provision of services within the hospital. Part of the payment was linked to the number of patients seen at the hospital. The more patients the NHS Trust treated the more the Trust might pay because services were used more intensively and the building would require greater maintenance. This monthly payment included three items which were comprised of a rent for occupation of the building, the usage fee, based on the numbers of in-patients and out-patients using the hospital; maintenance and engineering services through the maintenance usage fee; and a fee for facilities management services such as cleaning, catering and portering.

In this project, a proposed Planned Preventative Maintenance (PPM) Programme and an updated five year maintenance plan would be prepared by the FM operators. Maintenance and operating risks were transferred to the FM operators. They would carry out works in accordance with the plan and the cost would be met from the MHL. The challenge was that the FM operators would be responsible for meeting the performance standard of maintenance and / or replacement works and the cost incurred while they were only paid an annual flat fee. Operators would review the need and adjust their plans for major maintenance and replacement annually in order to reduce risks of having unexpected works throughout the year. BCFHT had agreed its right to change schedule of

maintenance and agree in advance the costs to optimise the non-clinical support services if necessary. In this case, BCFHT was necessary to renegotiate some of the contractual details and would finance variations. Any subsequent necessary changes required by BCFHT could be expensive as they would invariably require the involvement of MHL, who had a better and exclusive control on such alterations.

BCFHT acted as an informed client and partner during the operational phase. MHL had to provide details of performance failures to BCFHT every four weeks. BCFHT inspected the adequacy of the contract performance monitoring arrangements and carried out sample checks for a monthly performance management report. UP would then be adjusted according to it. Furthermore, a separate regime of inspection of the facilities took effect towards the end of the contract to ensure the assets were handed back to BCFHT in a satisfactory condition.

In the case of BH, only soft FM services were market tested or benchmarked at agreed intervals. These were tools to ensure that UP continues through time to reflect the true cost of operational service provision. The higher risks of ESL's failure were minimised by identifying all commercial points, confirming affordability and testing ESL's assumptions in market conditions.

ESL arranged for the delivery of guarantees from its parent company who could guarantee the service performance obligations. This could be an advantage to operation as they knew each other well and could fully contribute to the project objectives. Risk regarding reputation was therefore not significant.

The major risk retained by BCFHT was the responsibility for energy consumption. Force majeure events were shared by BCFHT and FM operators.

From the experience of BH, the interviews revealed a number of criteria that were used to define the success of delivering the non-clinical support services by the ProjectCo. These included the services should be in accordance with the Trust's requirements; in accordance with all provisions of the contractual agreement; and in accordance with the ProjectCo's proposals submitted as part of its response to tender. Poor performance in services could result in contractual financial deductions. Financial incentive is the driver of better performance of PFI during the operating phase. However, the level of deductions varies between each of the PFI projects and could affect the incentive of ProjectCo in terms of performance and quality. Moreover, if at any time the ProjectCo commits a breach of the Trust's requirement and the contractual terms, the Trust has the right to give warning notice prior to termination of the contract. The ProjectCo is responsible for the additional expenses. This efficient and effective incentive solution defines the value and the contribution of services providers.

Technology and Obsolescence Risk

The contract to be used in the project was a MES contract between BCFHT and SHS. BCFHT has spent almost 4 years on negotiating the details of the contract with SHS, as it was one of the first contracts of its type to be signed in the healthcare sector in the UK.

Minimising equipment downtown was an obvious priority in this project and therefore large downtown was considered as an important technology risk factor. In this project, SHS and other suppliers such as Philips, Toshiba and Lister Bestcare had to maintain and extend existing services, throughout a 3 year hospital demolition and re-build, in the heart of the existing hospital complex. This required the relocation of many existing hospital departments without causing disruption to clinical services. SHS have liaised with PTP and BUKL to ensure that the technical specifications of the equipment could be satisfactorily housed inside the new building. The objective was to sequence procurement based on design interface needs and long delivery scheduled items so that design liability risks were resolved.

The entire contract included various scopes of services. One important service was the Medical Equipping and Maintenance Service which included an immediate ownership transfer and ongoing management of BCFHT's existing asset base, and covered equipment / systems in all imaging modalities with performance and availability standards linked to payment reductions. In terms of technology innovation, equipment would be updated and replaced according to a rolling replacement programme set out in the ERP and benchmark studies for clinical equipment. A specific example was the Benefits Opportunity Assessment study which evaluated the potential benefits of the proposed EPR to define an agreed level of benefits to support the affordability model. Such study had avoided the problem of VFM downplay in the future.

At BH, technology advances was partly covered in the capital cost price and partly in an overall risk premium. It allowed the correct value to be shown when there were required variations during the course of the project. Trust-wide medical technology was reviewed by R&D groups in BH to consider the provision of technology against clinical service requirements. It increased the transfer of technology advance risk to SHS and should be represented on SHS's proposal accurately. However, problem of under-estimating of updating and replacing equipment costs due to unexpected rate of technology change was concerned to SHS.

Throughout the contractual agreement, the UP was adjusted to reflect the performance of the SHS. The standard provision of the MES contract provides that volume adjustment was necessary for technology and equipment services as increased clinical activity and extended opening times impinged upon availability for maintenance. However, interviewees felt that MES has become much more resilient and it was unnecessary for the Trusts to concede such adjustments.

Furthermore, service failures would attract deductions from the monthly service payment. The payment mechanism model identified the 'weightings' for rooms and equipments. The weight attributed to the rooms and / or equipments would be calculated its share of the UP. For example, the share for the room would not be paid if the room was not available because the equipment has failed. In addition, MES was market-tested once every 10 years to achieve knowledge of the likely true cost in the market. Both public and private parties recognised the importance of market testing for the achievement of long term VFM.

At BH, all items of equipment in one department were aggregated to assess as a grouped as compared to more recent contracts where each items is assessed individually for 98% uptime. There were occasions that downtime was occurring while financial penalties were not sufficiently imposed. Therefore, SHS's incentives to repair faults rapidly were lower. Moreover, equivalency terms were not strict enough and thus leaving some room for argument over what technological advances were included. The incompleteness of the contract gave conflict with those required to deliver a public service at a high level of accessibility, quality and efficiency under PFI.

Regarding to improvement of DBFO PFI contract, one interviewee commented that the basic structure of the main PFI contract would be retained while certain elements needed to be amended to fit a MES deal such as provisions for variations.

5.2. AIREDALE NHS TRUST – MEDICAL EQUIPMENT MODERAISATION PROJECT

Airedale NHS Trust (AT) provides acute and specialist outreach services for local people who live in an extended area from the fringes of North Bradford to parts of the Yorkshire Dales National Park in West Yorkshire. AT operates radiology services at Airedale General Hospital (AGH), Bingley Hospital, Castleberg Hospital, Coronation Hospital and Skipton Hospital. AGH was commended as the best small hospital in the 2005 Dr. Foster Guide. AT and AGH's location map is attached as Appendix VI.

Since the late 1990s, these hospitals' physical infrastructures were considered operational but in need of significant technology and equipment modernisation. In 2001, AT and SHS signed a MES PFI deal worth over £15 million for 15 years for the supply and management of 39 items of all the diagnostic imaging equipment and x-ray at the four of the sites. The contract helps AT to choose from the wider range of high technology solutions because of the vendor independent approach. It was the first Trust Direct MES contract in the hospitals in the UK. This PFI scheme is a TEMM (Category B). As shown in Figure 8, the single point of contract is simple and straight-forward.

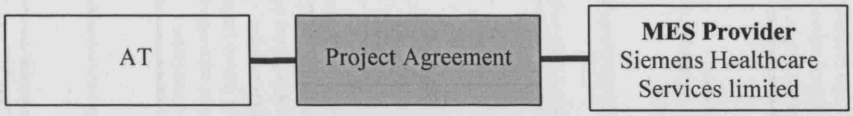


FIGURE 8: RELATIONSHIP OF AT AND MES PROVIDER

Technology and Obsolescence Risk

AT emphasised that this smaller asset management schemes in healthcare sector was a more flexible and scalable PFI that had the ability to provide efficient and manageable financing from unit and ward level right up to the NHS Trust level. The deal was shorter and less complicated. It was a simplest form of partnership for managing a particular aspect of a municipal service. However, AT recognised that this approach would carry some risk as there was no existing model or guidance. In this case, additional terms had been written to ensure maximum availability of equipment to clinical practitioners and transfer of risk was increased to SHS. Clear boundaries and interfaces between the Trust and the MSP were set up in an early stage.

TABLE 4 RISK MANAGEMENT FOR AIREDALE NHS TRUST – MEDICAL EQUIPMENT MODERNISATION PROJECT

Sources of Risk	Risk Drivers	Possible Consequences	Risk Mitigation Reported
Design	•N/A	•N/A	•N/A
Construction and Development	•N/A	•N/A	•N/A
Commissioning and Operating	•N/A	•N/A	•N/A
Technology and Obsolescence	•Relocation of existing equipment •Rapid changes of medical technology as reviewed by R&D •Lack of control on costs due to improved diagnostics to meet patients' need •Inefficient design space of existing building •Reduction of equipment reliability during its life cycle •Increases in inflation rate •Use of expensive spare parts e.g. tubes on scanners	•Large equipment downtown •I Increases in costs of upgrading equipment to meet future technology •Increases in installation costs •Failure to meet maintenance and upgrading requirements •Inequivalency of new equipment in terms of functionality	•Additional terms were written to ensure maximum availability of equipment to clinic •Liaison with the Trust to ensure technical specifications of equipment satisfactorily housed inside existing building •Equipment were updated and replaced with software according to a rolling replacement programme set out in ERP and recommendations of the Society of Radiologists •Service failures attracted UP deductions for non-availability of equipment •Grouping equipment into technology bands to ensure equivalency and updating the bands to meet up-to-date standard •Annual Review Process and vendor independence approach ensured wider services •Volume adjustment reflected the demand of equipment e.g. larger clinical activity and extended opening times impinged upon availability for maintenance •Market testing of service reflected the true cost of operational service provision •Renegotiated contractual details to review optimum allocation of risks if needed •Retained inflation to MES by UP indexation and market testing
Contract Agreement and Regulation	•Misunderstanding of contractual terms •Error of legal documents •Continual expansion of legislative and regulatory requirements of PFI / MES •Inability to manage the public's expectations •Loss of public reputation	•Under-enforcement of acts and provisions •Inability to meet service levels and agreements •Increases of litigation •Political pressures resulting from negative public opinion	•Strategic communications was used •New guidelines were set up to assist with implementation of new regulations •Increasing transparency of decision-making with user groups to prevent legal problems from occurring •Procurement timetable ensured that statutory consultation requirements were completed before bidding process began •Variation and termination procedures / clauses were included in contract •Key information were published on the department's web site
Investment and Variance in Revenue	•Uncertainty in priority-setting payment mechanisms used for allocation of risks towards PFI investments •ProjectCo as profit maximizer financing the project by equity investment •Higher Interest rates and long-term financing costs to reflect current market conditions and inflation expectation	•Funding pressure from higher level of specialization of medical equipment •Failure to generate the cashflow necessary to service debt and provide return on equity •Over-emphasised on cost-saving •Poor risk-return ratio	•Incentive of operational cost minimisation as operational cost reductions subject to successful service delivery increased the profit it made from operation •Clear evaluation weights for performance regime was sorted out •Early preparation on commercial issues was required e.g. equivalent of PSC required to be practical and prioritisation
Residual Value	• Poor maintenance •Inadequate investment in upgrades	•Lower residual value •Decommissioning cost caused by asset vacating at the end of contract	•Effective payment mechanisms was used for reduction in price or increased flexibility over the life of the contract to reflect the residual value that accrued to suppliers

SHS was chosen over competitors after short-listing a number of companies. The selection was based on the ability of SHS on the assurance of equipment uptime of 98% and a bidding price lower than PSC cost estimate. The Health Department was convinced that there were accurate estimates in the PSC allowance risk which was around 13% of the construction costs in order to achieve VFM. This MES contract provided for the supply and upgrade of equipment at the existing rather than new hospitals. The replacement of equipment was linked to a refurbishment of the x-ray department. AT had upgraded, refurbished and extended the department to enable the equipment to be installed. In other words, AT had to ensure design of the building did not pose any risks to the initial installation of equipment. MES contract would not cover any design risk of infrastructure.

MSP accepted the major risk of renewal of obsolete assets during the concession period. Old equipments were replaced with technology cycles in accordance with the Society of Radiologists' recommendations. This resulted in lower equipment maintenance costs and higher equipment functionality and performance. There were also software upgrades throughout the life of individual pieces of equipment. The implementation of rolling equipment replacement plan and structured maintenance programme based on contractual lifecycle programmes. Therefore, it was important that financial data on the whole-life cost of assets were well-collected and in a consistent way. The overall characteristics of an equipment management regime addressed risk management and clinical governance issues.

In this project, the payment mechanism model applied fixed tariff to equipments and identified the deduction amount per day for the failure of equipments. The methodology would be subject to rectification period which was practicable to allow the appropriate personnel from SHS to attend each incident. If a failure was not rectified by the end of that period, then an unavailability deduction would be made. SHS has notified that a higher level of resources was needed to service the MES contract in two particular sites where a shorter rectification period was put in place. In addition, while equivalency was achieved by sufficient clauses in the contract to describe how equivalency was to work and to commence with updating the equipment specification, grouping equipment into technology bands was used as a facilitator for equivalency to support the clauses. Interviewee viewed banding was not a real 'driver' of the provisions.

It was recognised that some negative effects of MES contract was found in this project. Outcomes for equipment and technology that were subjective in nature were difficult to write in contractually effective ways and had caused AT monitoring difficulties. Additional monitoring costs had increased AT's costs and thus reduced VFM compared with the original expectations. In addition, SHS received payment according to contract. It was admitted that AT needed to work with SHS to make the transition from what was written in the contract to what was needed in reality. The aim

was to create a seamless team, however, it took a while for AT to develop with such a new way of working and risk transfer mechanism had not been optimised in the initial operational stage.

AT had expanded its x-ray services after this MES contract was signed. However, AT recognised that increases in capital investment on this scale would make achievement of a level of return on that investment very difficult. Only by transferring asset ownership and 'pay-by-use' financing options AT would reduce the risk of ownership of clinical equipment, while at the same time greatly improving cashflow. Therefore, AT determined to procure additional equipment via the same route. Also, it was the interviewers in AT and SHS belief that ongoing risk management process was designed to identify the principal risks to the achievement of the NHS's objectives, to evaluate the nature and extent of those risks, and to manage them efficiently, effectively and economically. Ideas of formal risk management process in early contractual development stage existed at these sites.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6.1. KEY FINDINGS

For the purposes of this research, three different risk categories have been studied for two kinds of PFI model, DBFO and TEMM, in healthcare sector. The two case studies in the previous chapter have showed which risk factors are best assigned to the public sector and which to the private sector and how they respond to the risks. There are clearly a combination of generic risks in PFI and those that are project specific. The major findings show that design, commissioning and operating, and technology and obsolescence risks encountered in NHS PFI projects can be allocated quite readily between the public and private sector parties. PFI procurement results in a more structured approach to operating, maintaining and replacing physical assets than might have prevailed under traditional procurement. The strength and weakness of these two models can be summarised as follows:

(a) In a complex DBFO PFI NHS project, the strength of the model lies in the innovation of the performance and availability standards through a well-defined monitoring system and associated rights in the payment mechanism during the operational phase. The long-term operational strategy involves the delivering services in an efficient, seamless and dependable way in the procuring entity in order to achieve better quality. The second strength of the model is related to the management and maintenance of medical equipments and technologies. Medical equipment services are given early consideration within the PFI process in order to reflect its impact on price and affordability of the scheme. The costing for equipment within the PSC are therefore detailed enough to avoid affordability problems.

(b) However, as stated in the case study, the risks occurring at the operational phase of traditional DBFO schemes were not fully transferred in practice. The transfer of operating risk is neither so complete nor so clear cut. The reason includes inadequate special provisions added in contract to take into account dynamic changes in the medical services environment. Moreover, the process of performance monitoring system has been judged not to be open, transparent, inclusive and conducted in partnership. Reporting and communicating progress is also challenging because of the volume of data and difficulties in clearly collating every attribute of monitoring program's various elements. The actual economic efficiency improvement in the procurement was found to be smaller than proposed by economic theory.

(c) Optimum risk transfer and risk management can be influenced by the risk attitudes adopted by the private sector. The DBFO case study confirms the above statement. Risk was under-

reacted. Members of ProjectCo have entered into the NHS PFI market at the time they ran and operate the project. They did not have incentive to make a good impression and build credibility compared to other newly-joined companies. This is a problem that they did not focus to deliver the Trust's value and requirement when they put effort on their profit margins protection.

(d) It is clear that operating, maintenance and lifecycle costs are associated with the daily running of the capital asset. They relate directly to the operation, maintenance and upkeep of the asset and the provision of related services to meet the output specifications over the contract period. ProjectCo pass its objectives to its members. Risks of defining output specifications are also passed out to appropriate parties through robust sub-contracting arrangements and insurance. The complicated organisational structure of DBFO projects would be able to invoke hold-up and make it difficult to develop a high level of partnering and decision support for solving complex strategic issues. The barriers of the structure include trust issues, the possible rise in transaction costs and the possibility that suppliers may behave opportunistically.

(e) Under TEMM, the risks are related to the availability of the key medical equipment, its ability to keep pace with technological change, and its performance. In this procurement route, a good MES contract provides a mean to identify, evaluate, transfer and manage risks. Market testing mechanism and penalty performance points system are used to motivate the employees, adjust the payment and thus minimize the risks in the operational phase. Banding of equipment, R&D from the Trust and vendor independency of service provider ensure equivalency and wider service to the Trust so that they are influencing the operating and maintenance costs. It is clear that the robustness of the assumed costs and any key features affect the analysis of operational risk. Special provisions associated with price adjustments had been added to the contract that was considered to be realistic and manageable. This is essential to effective risk management as a good contract should have the ability to clarify definitions of risk and their allocation, include incentives linked to risk allocation, and emphasise good management practice (Chapman et al, 1989).

(f) Comparing two kinds of PFI model, DBFO PFI hospital construction projects generally involve more and higher risk for the ProjectCo. The main reason is that design risk and technology and obsolescence risk emerged from DBFO projects are co-related and their impact is significant to the success of the project. "In technology-led schemes, advanced equipment should be influencing design rather than designing around current processes." (Burton, 2008) It is critical that whole life and operating costs are seriously considered during the early design development stage and therefore improved outcomes through effective design are secured in hospital projects.

(g) The transfer of technology and obsolescence risks to the private sector is fundamental to the delivery of VFM in PFI procurement in health sector. Contracts for TEMM seem to be more complete because of good specification practice (See point (e)). Savings in whole life costs is priority as the exact contract term is based upon the issues which only have impact on affordability and VFM of equipment. On the other hand, DBFO construction projects involved unimaginable future possibilities and uncertainties because the contract terms to provision of MES were loose and rigorous. ProjectCo thus implied a rather loose definition of 'well managed' since the contract was not strict on specifying technological advance, performance penalty in operation and service delivery standards. This resulted in a large number of negotiations of risk allocation during the contractual period as new service requirements become clearer. However, if the post-contractual power relation favours the MSP, it will be difficult for the Trust to negotiate those variations effectively. Any loosening of contract management practice is likely to be exploited for private gain. Variation provides a way to the private sector to increase the returns if their required profitability of the contract is starting to be uncertain. It eventually increases the cost of the PFI project.

(h) To conclude, this research recognises that risks for TEMM are transferred and managed by the current risk management model successfully. This is consistent with the interviewers' beliefs that TEMM showed cost saving compared to other PFI hospital projects because of the better allocation of technology risk. On the other hand, not all the significant risks for very complex DBFO projects are managed appropriately. While design risk is managed properly, commissioning and operating as well as technology and obsolescence risks are difficult to be managed fully (See points (b), (c), (d) and (g)). Its procurement strategy was well thought through but was not delivered in full. This project has not achieved the 'best practice' criteria as identified on the current relevant OGC guidance on PFI projects. Although it is impossible to reach a conclusion on the eventual success of TEMM project at such an early stage, it is apparent that performance since the partnership began has been better than that of DBFO in the preceding period.

6.2. RECOMMENDATIONS FOR RISK MANAGEMENT OF PFI PROCUREMENT

The process of examining PFI procurement processes helps to identify areas for improving the way risks are transferred and establish recommendations for managing risks in the NHS:

(a) A successful PFI project needs to be technologically practicable and should be socially welcomed by both the end users and the shareholders. Its effective risk management system should require the public and private sectors' long-term commitment, mutual understanding

and a high degree of enthusiasm. They should set up mechanism to share knowledge on how best to maximise benefits.

(b) Change management should be required across the ProjectCo and senior leaders need to champion the change in such as long term contractual agreement. Planning, implementing and managing change in a fast-changing environment is increasingly the situation in which ProjectCo work. Dynamic environments such as these require dynamic processes, people, systems and culture for managing change successfully.

(c) Further training to staff is necessary to reinforce consistent working practices and maximise the benefits of risk management.

(d) A close relationship between the Trust and the initial design team should be created. It helps to engender a better understanding of both of the Trust's requirements, thereby promoting innovation and enhancing design quality. Clear specification of quality standards in absolute terms is necessary.

(e) Design teams should take technology into deeper consideration on space requirement. Early engagement of MSP should be an essential term in scheme design development stage.

(f) Involvement of professional bodies must be encouraged for the acquisition of cross-professional skills that reflect the changing reality of PFI design, procurement and construction.

(g) A narrowing of project scope and increased project definition with clearer guidance to the project should be provided. Requirements uncertainty arises not just from the Trust, the internal requirements flowdown from the ProjectCo or the MSP provided as much of the uncertainty in the end.

(h) A detailed output specification describing what the facility must do to enable service should be provided effectively by the Trust. This is also a core principle of value management and in essence it is a form of function performance specification.

(i) Technology innovation can be improved by encouraging new entrants to the market bringing greater competition through reduced bid costs and times and by pre-tender confirmation of affordability.

(j) Financial mechanism and revenue scheme should continue to be improved for valuing risk transfer. The procedure and process for valuation should be transparent and in consistent. A clear methodology for assessing data and a clear timetables, roles and responsibilities, aims and outputs must be agreed at the outset.

(k) High quality of contracts can considerably reduce the time taken to close a deal, especially to the newly MES contract (See point (d) of section 6.1). The Trust will close a sufficient number of deals and should improve the quality of the contracts based on experience.

(l) A successful implementation of risk management should truly embed risk management into the consciousness and culture of the public and private sectors and its people. Developing and

retaining skills on risk management is important to enable organisations to response to a series of risk management events.

(m) While there is no guarantee that all PFI projects are an unequivocal success, there are scope for improving risk management of PFI by learning lessons from previous projects, and sharing experience and good practice.

6.3. FURTHER RESEARCH

The analysis of this research allows a more efficient understanding of allocation and management of risk for both public and private sector. While the experience of PFI is very limited in healthcare sector at the moment and there have been some negative aspects posed on the PFI procurement, this study suggests scope for further research in the following areas:

(a) Opportunities to deliver sustainability objectives. The main objectives of sustainable design are to avoid resource depletion of energy, water, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle, and create built environments that are liveable, comfortable, safe, and productive.

(b) Evaluating VFM from PFI projects with greater transparency in compiling PSC.

(c) Opportunities to bridge the gap between traditional construction and FM roles.

(d) The role and importance of payment against performance mechanism.

(e) Improvement of long term output-oriented contracts to allow flexibility to adapt forms of service provision. Longer-term, output-oriented contracts would enable service providers to dimension their capacities accordingly and to increase efficiency as a result of a steeper learning curve.

(f) Investigation of contract forms to improve incentives to take account of new technology.

(g) Comparison of public sector and private sector's attitudes in open partnership in PFI projects.

(h) Further investigation of current NHS initiatives for smaller scale TEMM projects. Where PFI procurement is under serious consideration for TEMM projects, the potential for a PFI solution should be assessed in more depth. The PFI assessment should include detailed analysis of the scope of risk transfer, the approaches to risk transfer valuation, the affordability of PFI option, and the output specification.

REFERENCES

Akintoye, A. and Black, B. (1999) Profitable Partnering in Construction Procurement. *Procurement Systems: CIB W92 and Culture in Construction: CIB TG23*. E&FN Spon, London.

Akintoye, A., Beck, M. and Hardcastle, C. (2003) *Public-private Partnerships: Managing Risks and Opportunities*. Blackwell Science, Malden.

Akintoye, A. and MacLeod, M. (1997) Risk Analysis and Management in Construction. *International Journal of Project Management*, 15(1), 31-39.

Akintoye, A., Mcintosh, G. and Fitzgerald E. (2000) A Survey of Supply Chain Collaboration and Management in the UK Construction Indsutry. *European Journal of Purchasing and Supply Management*, 6159-168.

Akintoye, A. and Taylor, C. (1997) Risk Prioritisation of Private Sector Finance of Public Sector Projects. Procurement a Key to Innovation. CIB W92. Montreal.

Akintoye, A., Taylor, C. and Fitzgerald E. (1998) Risk Analysis and Management of Private Finance Initiative Projects. *Engineering, Construction and Architectural Management*, 5(1), 9-21.

Allen, G. (2001) *The Private Finance Initiative (PFI)*. House of Common Library, London.

Asenova, D., Beck, M., Akintoye, A., Hardcastle, C. and Chiyio, E. (2001) Standardised Framework for Risk Analysis and Management in PFI Projects. GCU, Glasgow.

Asenova, D., Stein, W., McCann, C. And Marshall, A. (2007) Private Sector Participation in Health and Social Care Services in Scotland: Assessing the Risk. *International Review of Administrative Sciences*, 73(2).

Asteral (2008 March). What Risk Transfer is Achieved through a MES. Retrieved from March 2008, from http://www.asteral.com/mes/q_and_a.htm#three

Bajaj, J. (1997) Analysis of Contractors' Approaches to Risk Identification in New South Wales, Australia. *Construction Management and Economics*, 15, 363-369.

Baldwin, E. (2003) The Private Finance Initiative – What Opportunities for Facilities Management? Journal of Facilities Management 2(1), 54-67.

Bing, L., Akintoye, A. Edwards, P.J. and Hardcastle, C. (2005) Critical Success Factors for PPP / PFI Projects in the UK Construction Industry. *Construction Management and Economics*, 23(5), 459-472.

Burton, N., E-mail Communication, Siemens UK Limited, 28 May 2008.

CABE (2005) *Design Quality and the Private Finance Initiative*. CABE, London.

Capper, P. (1995) *Overview of Risk in Construction*. King's College, London.

Chapman, B., Ward, S. and Curtis, B. (1989) *Risk Theory for Contracting*. King's College, London.

Corry, D. (1997) *Public Expenditure: Effective Management and Control*. Dryden Press, London.

David, A.K. and Fernando, P.N. (1995) The BOT Option: Conflicts and Compromises. *Energy Policy*, 23(8), 669-675.

Dawood, N. (1998) Estimating Project and Activity Duration: A Risk Management Approach Using Network Analysis. *Construction Management and Economics*, 16(1), 41-48.

Dipper, D., Personal Communication, Orchard PPP Limited, 25 June 2008.

Dixon, T., Jordan, A., Marston, A., Pinder, J. and Pottinger, G. (2003) *Lessons from UK PFI and Real Estate Partnerships: Drivers, Barriers and Critical Success Factors*. BRE Bookshop, London.

Gaffney, D, Pollock, A. Price, D. And Shaoul, J. (1999) NHS Capital Expenditure and the Private Finance Initiative – Expansion or Contraction. *British Medical Journal*, 319, 48-51.

Gaffney, D. and Pollock, A.M. (1999) Pump-priming the PFI: Why are Privately Financed Hospital Schemes being Subsidized? *Public Money and Management*, 1, 55-62.

Hardcastle, C. and Boothroyd, K. (2003) Risks Overview in Public-private Partnership. In Akintoye, A., Beck, M. and Hardcastle, C. (Eds.), *Public-private Partnership: Managing Risks and Opportunities* (pp. 31-57). Blackwell Science, Oxford.

Hellow, M. And Pollock, A. (2007) *A Report on the Cost of PFI and its Impact on Health Services in England*. The Centre for International Public Health Policy, University of Edinburgh, Edinburgh.

Hickman, D. (2000) *PFI and Construction Contracts*. Chandos Publishing, Oxford.

HM Treasury (2000) *Public Private Partnerships: The Government's Approach*. The Stationery Office, London.

HM Treasury (2007, April). PFI Signed Projects List. Retrieved from April, 2007, from http://www.hm-treasury.gov.uk/documents/public_private_partnerships/ppp_PFI_stats.cfm

House of Commons (2003) *Public Accounts – Twenty-eighth Report*. House of Commons, London.

Julie, F. and Jean, S. (2001) Appraising and Evaluating PFI for NHS Hospitals. *Financial Accountability and Management*, 17(3), 247–270.

Jüttner, U., Peck, H. and Christopher, M. (2003) Supply Chain Risk Management: Outlining an Agenda for Future Research. International Journal of Logistics: Research and Applications, 6(4), 199-213.

Kopp, J.C. (1997) *Private Capital for Public Works: Designing the Next-generation Franchise for Public-private Partnerships in Transportation Infrastructure*. Master Thesis, Department of Civil Engineering, Northwestern University, USA. http://iti.acns.nwu.edu/clear/infr/kopp/index.htm

Lam, K.C. (2005) *The Management of Multi-headed Clients in Design and Construction – The Case of Hospitals*. Hong Kong Polytechnic University, Hong Kong.

March, J. and Chapira, Z. (1987) Managerial Perspectives on Risk and Risk Taking. Management Science, 33(11), 1404-1418.

McDermott, P. (1999) Strategic and Emergent Issues in Construction Procurement. In: Rowlinson, S. and McDermott, P. (Eds.) *Procurement Systems – A Guide to Best Practice in Construction*. CIB W92. E&FN Spon, London.

McKim, R.A. (1992) Systematic Risk Management Approach for Construction Projects. *Journal of Construction Engineering and Management*, 118(2), 414-415.

Miller, K.D. (1992) A Framework for Integrated Risk Management in International Business. *Journal of International Business Studies*, 2, 311-331.

NAO (1999) *Examining the Value for Money of Deals Under the Private Finance Initiative*. The Stationery Office, London.

NAO (2003) *PFI: Construction Performance*. The Stationery Office, London.

NAO (2003) *PFI: Meeting the Investment Challenge*. The Stationery Office, London.

NHS Executive (1999) *Public Private Partnerships in the National Health Service: The Private Finance Initiative: Good Practice*. The Stationery Office, London.

Nielsen, K. (1997) Trends and Evolving Risks in Design-build BOT and BOOT Projects. *The International Construction Law Review*, 14(2), 188-197.

OGC (2008, June 18) Risk Management Strategy. Retrieved from 18 June, 2008, from http://www.ogc.gov.uk/documentation_and_templates_risk_management_strategy_.asp

Payne, W. (2008, May 29). PFI Beyond DBFO. Retrieved from 29 May, 2008, from http://findarticles.com/p/articles/mi_qa3873/is_199809/ai_n8824797

PMI (2000) *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. Project Management Institute, London.

Pollock, A.M. (1995) The NHS Goes Private. The Lancet, 346(8976), 683-685.

Pollock, A.M. and Price, D. (2004) Has the NAO Audited Risk Transfer in Operational Private Finance Initiative Schemes? *Public Money and Management*, 28(3), 173-178.

Pollock, A.M., Price, D. and Dunnigan, M.G. (2000) Deficits before Patients: A Report on the Worcester Royal Infirmary PFI and Worcestershire Hospitals Reconfiguration. *School of Public Policy*, UCL, London.

Pollock, A.M., Shaoul, J. and Vickers, N. (2002) Private Finance and Value for Money in NHS Hospital: A Policy in Search for a Rationale. *British Medical Journal*, 324, 1205-1209.

PPP Forum (2008, Jan 14). Labour Party Policy on PFI. Retrieved from 14 Jan, 2008, from http://ppp.squareeye.com/government/article.asp?p=263

Price, D., Gaffney, D. and Pollock, A.M. (1999) *The only game in town? A report on the Cumberland Infirmary Carlisle PFI*. UNISON, London.

Pyra, J. and Trask, J. (2002) Risk Management Post Analysis: Gauging the Success of a Simple Strategy in a Complex Project. *Project Management Journal*, 33(2), 41-48.

Rutherford, J. (2008, March 28). Is that all, Mr. Pocklington? Retrieved from 28 March, 2008, from http://www.guardian.co.uk/commentisfree/2008/mar/28/isthatallmrpocklington

Salzmann, A. and Mohamed, S. (1999) Profitable Partnering in Construction Procurement. *Culture in Construction*. CIB W92. E&FN Spon, London.

Shaoul, J., Stafford, A. and Stapleton, P. (2008) The Cost of Using Private Finance to Build, Finance and Operate Hospitals. *Public Money and Management*, 28(2), 101-108.

Smith, H. and Tott, N. (1999) *The PFI Handbook*. Jordan, Bristol.

Smith, N.J. (1999) *Managing Risk in Construction Projects*. Blackwell Science, London.

Svensson, G. (2002) A Conceptual Framework of Vulnerability in Firms' Inbound and Outbound Logistics Flows. *International Journal of Physical Distribution and Logistics Management*, 32, 110-134.

Tiong, R. and Alum, J. (1997) Distinctive Winning Elements in BOT Tender. *Journal of Engineering Construction and Architectural Management*, Blackwell Science and Loughborough University of Technology, 4(2), 83-94.

Treasury Taskforce (1999b) *How to Construct a Public Sector Comparator*. HM Treasury, London.

Walker, C. and Smith, A.J. (1995) *Privatized Infrastructure: The Build Operate Transfer Approach*. Thomas Telford, London.

William, P. (1995) A Regulation Evaluation System: A Decision Support System for the Building Code of Australia. *Construction Management and Economics*, 13, 1997-208.

Woodward, D. (1995) Use of Sensitivity Analysis in Build-own-operate-transfer Project Evaluation. *International Journal of Project Management*, 13(4), 239-246.

APPENDIX I

ASSESSMENT OF THE SIGNIFICANCE OF A RISK

Risk Level	Scale of Impact	Description	Value (% of Activity Cost)
5	Very High	Critical to continued service Likely to occur	Impact > 50% Probability > 10%
4	High	Serious Impact Likely to occur	Impact 5-50% Probability > 10%
4	High	Critical to continued service Occasionally occur	Impact > 50% Probability 1-10%
3	Medium	Small impact Likely to occur	Impact < 5% Probability > 10%
3	Medium	Serious impact Occasionally occur	Impact 5-50% Probability 1-10%
3	Medium	Critical to continued service Unlikely but possible	Impact > 50% Probability <1%
2	Low	Small impact Occasionally occur	Impact < 5% Probability 1-10%
2	Low	Serious Impact Unlikely but possible	Impact 5-50% Probability <1%
1	Very Low	Small impact Unlikely but possible	Impact < 5% Probability <1%

Source: DELG, 2000

APPENDIX II

RANKING OF PFI RISKS BY CONTRACTORS, CLIENTS AND LENDERS

	Ranking of Risks			
Risks	Contractors	Clients	Lenders	All
Design risk	1	5	10	1
Construction cost risk	2	6	6	2
Performance risk	4	2	8	3
Risk of delay	7	3	7	4
Risk of cost overrun	3	9	3	5
Commissioning risk	17	1	5	6
Volume risk	8	10	2	7
Risk of operating / maintenance cost	9	4	13	8
Payment risk	10	14	1	9
Tendering cost risk	6	17	9	10
Contractual risk	5	11	15	11
Legal risk	11	19	12	12
Market risk	14	16	11	13
Residual value risk	16	12	14	14
Planning risk	13	18	19	15
Environmental risk	15	8	23	16
Safety risk	21	7	20	17
Financial risk	12	22	18	18
Credit risk	25	24	4	19
Possible change in government	20	20	16	20
Project life risk	19	13	26	21
Changes in European legislation	24	15	22	22
Development risk	18	21	24	23
Bankers' risk	23	26	17	24
Debt risk	22	25	21	25
Land purchase risk	26	23	25	26

Source: Akintoye et al, 1998

APPENDIX III

INTERVIEW FOR PFI HEALTHCARE PROJECTS IN THE UK

Topics: PFI, Health Sector, MES, Barnet Hospital, Risk Management

Name: _____

Organisation: _____

Experience in PFI projects: _____

Part 1 Hospital Clinical Equipment Procurement and Installation

1. In standard DBFO PFI projects, what types of works did 'Operations' include?
2. Did 'Operations' include all building utilities, hard facilities and hospital clinical equipment?
3. Were clinical equipments like x-rays or cardiology machines listed in a separate contract?

PART 2 Awarding Of MES Contracts Within PFI Contracts

1. Is the procedure similar to traditional DBFO contracts?
2. What are the changes if any?
3. Did the MSP Siemens's bid compare with PSC?
4. How to estimate risk premium to be added to the PSC for evaluation purposes?

Part 3 MES in Health Sector

1. What is the normal duration of MES contracts within a PFI in health sector?
2. Is there a special relationship between the PFI contractor and the PFI Consortium (ProjectCo)?
3. How to ensure that the building services are suitable for MES installations?
4. Are there any special legal features in MES within PFI contracts?
5. What are the newer areas of concern in legal aspects of MES contracts?
6. What are the equivalency and replacement provisions of services?
7. How to ensure vendor independence in service provisions?

Part 4 Equipment Plan / Expenditure Plan

1. In standalone MES contracts, how to plan for future budget in terms of upgrades or replacement of machines due to obsolescence and technology advances?
2. Is it estimated up front and included in present value terms within the Siemens's bid?
3. When will Siemens replace or upgrade equipments?
4. How much does the upgrading and replacement cost as a percentage of Siemens's bid?
5. What is the maintenance cost as a percentage of initial investment in clinical equipments?
6. Does Siemens have definite periods for replacement, say once in five years. Or is it market tested?
7. Does Siemens revise the PFI services plan submitted initially to the NHS regularly?
8. What are the main areas of revisions?

Part 5 Barnet Hospital

1. In terms of technology innovation and equipment maintenance and operations, what are the features or problems Siemens met for general hospital PFI or Barnet Hospital project?
2. How to make sure the best equipment is provided if the costs keep rising?
3. Is PFI contract annual premium not flexible?
4. Does Siemens market test regularly the quality of their services?
5. In practice can Siemens make high profits due to technological advances? For example, the non-invasive angiogram for heart patients recently developed cost only about 10-20 of an invasive conventional angiogram?
6. Will the profit then accrue to Siemens if the cost of services is less?
7. How is R&D efforts and expenditure necessary for upgrading clinical services managed?

Part 6 Risk Management in PFI

1. What are the most important risks in your point of view?
2. What is the most effective method to reduce the risks in clinical services provision?
3. Who should be responsible for it?

Part 7 Others

1. Referring to Anne Croft's article, MES PFI contracts enable NHS to unlock the extensive value currently hidden in many Trusts' assets. What is your opinion to this statement?

APPENDIX IV

QUESTIONNAIRE FOR PFI HEALTHCARE PROJECTS IN THE UK

Topics: PFI, Health Sector, MES, Hospital, Risk Management

July 1, 2008

Dear Respondent,

I am an MSc student in Project and Enterprise Management at University College London under the supervision of Dr. Sivaguru Ganesan. I am inviting you to participate in a research project to study Risk Management of PFI Healthcare Projects in the UK.

Along with this letter is a short questionnaire. I am asking you to look over the questionnaire, complete it and email it back to me. It should take you about 15 minutes to complete. The results of this project will be part of my MSc Dissertation. Through your participation I hope to understand more on risks drivers, consequences and how to manage the risks in PFI healthcare projects. *Questions will be based on the PFI projects in Barnet Hospital and Airedale Hospital. However, your answers may not be necessarily based on them if you have experiences on other PFI projects.* I hope that the results of the survey will help to assess the main risk management techniques to deal with PFI projects and the extent to which these techniques are appropriate to tackle complex healthcare PFI projects.

Please be assured that all the information provided will be treated in absolute confidence and used solely for the purposes of this research project. No individual respondents will be identified in the report to Department Office. You may choose to answer one or all sections, or selected questions across the section. This is an important study and your co-operation in providing the information will be invaluable in ensuring a true picture to be formed.

Thank you for your assistance. If you have any questions or concerns about completing the questionnaire, you may contact me at 07942 610669. This project has been approved by the Department of Construction and Project Management at University College London, UK.

Yours sincerely,

Florence Wong

Department of Construction and Project Management
Bartlett School of Graduate Studies
University College London

How to complete the questionnaire

There are a few tips to answering the questionnaire:

1. There is no right or wrong answer.
2. Please check the answer that best describes your feeling or experience.
3. Please answer all the questions relevant to you.
4. Please simply highlight your choice when you answer the questions.
5. Please give the information in the blank, if necessary.

Example:
□ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree

How to send back the questionnaire:
After completion please return the questionnaire by Wed 23th July 2008 to: ucftfwo@ucl.ac.uk. Thank you for your co-operation.

Personal Profile

Name: _____

Organisation: _____

Position: _____

Your experience in PFI projects: _____

Part 1 Design Risks

1. The principal risks encountered during the design processes are:
   - ☐ Design of the building override equipment solution
   - ☐ Failure to translate the public requirements into the design
   - ☐ Significant design change or variations from the public sector
   - ☐ Time overrun
   - ☐ Over emphasised on cost saving
   - ☐ Rely on designers to hypothesise the unstated design quality objectives
   - ☐ Misunderstanding of quality standards
   - ☐ Late incorporation of MES
   - ☐ Others:

   Are all of these selected risks transferred from the NHS to the PFI consortium? □ Yes □ No
   If no, please explain:

2. The risk of failing to translate the requirements of the Trust into the final design lies with the PFI consortium.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

3. Important aspects of the design are reviewable by the Trust prior to finalizing the design.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

4. Space planning within buildings is shown on 1:200 and 1:50 plan drawings and will be submitted for approval.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   If yes, what is the biggest challenge of the plans?
   Please explain:

5. 1:50 plan drawings are more important to show precise location of each function in rooms.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

6. Redesign arising from design developments in its fixed-price design contracts is an important risk for PFI consortium.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

7. Rooms should be correctly designed before proceeding to construction.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

8. Improved functionality will reduce operational cost through efficiency savings and thus increase profit from the project.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

9. Design team must meet with representatives of the relevant clinical service providers who will use the space in order to discuss the draft designs.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

10. The Trust plays a supervisory role of design prior to the commencement of building work.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

11. Involvement of experts from professional organisation such as The Commission for Architecture and the Built Environment are necessary.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

12. Early engagement of medical equipment services providers on key discussion of design is necessary.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

13. Achievement of the performance and availability standards will remain the designer's risk and will be reflected in the payment mechanism
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

14. Package costs to the designers hinder design innovation as the designers have to develop an engineering system design solution to meet the main Design and Build contractor's budget.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

15. Designers do not have access to the main Design and Build contractor's capital cost estimate and this influences design quality.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

16. What type of whole-life costs driven design solutions is the most appropriate approach for hospital projects?
    □ Operation and service specification led □ Construction and capital cost led
    □ None of them □ Both of them
    Please explain:

Part 2 Commissioning and operation risks

1. The principal risks encountered during the commission and operation processes are:
    ☐ Ineffective design and construction of infrastructure
    ☐ Lack of capital for on-going necessary maintenance, enabling and installation works
    ☐ Very different clinical, political and financial agendas of Trusts and competing demands on revenue and capital budgets
    ☐ Unexpected changes in the cost of equipment, labour, utilities and other supplies
    ☐ Uncertainties in the supply of labour
    ☐ Unclear rights and obligations about operation of general equipment and MES
    ☐ Reduced input quality
    ☐ Others:
    Are all of these selected risks transferred from the NHS to the PFI consortium? □ Yes □ No
    If no, please explain:

2. When providing the non-clinical support services by the PFI consortium, what are the 3 most important issues (please select 3 answers):
    ☐ In compliance with all laws and consents
    ☐ In accordance with the Trust's requirements
    ☐ In accordance with all provisions of the contractual agreement
    ☐ In accordance with the PFI consortium's proposals submitted as part of its response to tender
    ☐ Where no express standard is set, in relation to good industry standards
    ☐ In accordance with the PFI consortium's or its subcontractor's quality manuals
    Please explain:

3. Prior to completion of construction, an independent certifier will inspect the building and notify the parties of any outstanding matters. When any such matters are completed, the independent certifier will issue a certificate stating the building is complete and the Trust will begin to pay for the PFI consortium. Commission and operation risk, therefore, can be minimised.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

4. The Trust will not be forced to accept inferior service facilities.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

5. If the parties are unable to agree on the appropriate programme of maintenance, then the matter may be referred to the Dispute Resolution Procedure.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

6. If the Trust defers the planned maintenance of the PFI consortium, the Trust will compensate the PFI consortium for any additional costs incurred by it and no performance deductions can be made if the reason for the PFI consortium is directly attributable to deferral of the maintenance works in accordance with the Trust's instructions.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

7. Where the need arises for maintenance works not set out in the agreed programme, the PFI consortium must agree on the time and duration of these works with the Trust.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

8. Where an emergency occurs which requires immediate maintenance, the PFI consortium has to notify the Trust of the action it is taking and seek to minimise any disruption caused.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

9. Non-clinical support services such as linen and laundry, patient food services, housekeeping and waste services are market tested or benchmarked at agreed intervals.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

10. It is important that the Trust be able to monitor the maintenance of facilities to ensure and enforce compliance and to allow any appropriate deductions to be made from the payments to be made to the PFI consortium.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

11. It is important that the Trust be able to monitor the performance of the services according to those set out in the Service Output Specification.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

12. The PFI consortium must provide details of performance failures to the Trust, and the Trust can inspect the adequacy of the contract performance monitoring arrangements and carry out sample checks.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    If yes, how do they do so (e.g. performance scorecard every month)?
    Please explain:

13. If at any time the PFI consortium commits a breach of the Trust's requirement and the contractual terms, the Trust is more likely to give warning notice prior to any termination of the contract. However, the PFI consortium is responsible for the additional expenses.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

14. The monitoring and associated rights are in addition to the financial incentives set out in the Payment Mechanism.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

15. The Trust is obliged to ensure that all employees performing non-clinical support services undergo both pre-employment and ongoing health screening to ensure that person does not pose a health risk to any persons at the facilities.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

16. Partnering approach and openness to the parties are important skills used in PFI healthcare projects.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

Part 3 Technology and Obsolescence Risks

1. The principal risks encountered at technology and obsolescence processes are:
    ☐ Rapid changes of technology especially brought about by the internet and digital technology
    ☐ Lack of control on costs due to improved diagnostics to meet patients' need
    ☐ Poor design quality and inefficient design space
    ☐ Use of expensive spare parts e.g. tubes on scanners
    ☐ Under-performance by MSP
    ☐ Reduction of equipment reliability during its life cycle
    ☐ Large downtime with MES
    ☐ Lack of detailed equipment plan
    ☐ Lack of experience in delivering PFI services in the UK
    ☐ Others:
    Are all of these selected risks transferred from the NHS to the PFI consortium? □ Yes □ No
    If no, please explain:

2. Throughout the contractual agreement, the unitary payment will be adjusted to reflect the performance of the Trust.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

3. Service failures will attract deductions from the monthly service payment.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    If yes, how are service facilities documented and how is the deduction being calculated?
    Please explain:

4. Volume adjustment is necessary for technology and equipment services.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

5. The Trust is bound to accept the most economically advantageous bid received via market testing.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

6. Detailed Equipment Replacement Plan is set up for interval of replacement and penalties for non-availability of equipments.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

7. Services are market tested to reflect the true cost of operational service provision.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

8. Technology advances is partly covered in the capital cost price and partly in an overall risk premium and should be represented on Medical Equipment Services Provider's proposal accurately.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

9. Grouping equipment into technology bands is used to ensure equivalency and updating the bands is for meeting up-to-date standard.
   □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
   Please explain:

10. Annual Review Process by the Trust is used to consider wider service issues.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

11. Better standard contract is required in PFI standalone MES projects.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

12. Better standard contract is required in PFI healthcare projects with MES or MTS.
    □ Strongly Disagree □ Disagree □ Unsure □ Agree □ Strongly Agree
    Please explain:

THANK YOU FOR YOUR CO-OPERATION

APPENDIX V

BARNET HOSPITAL

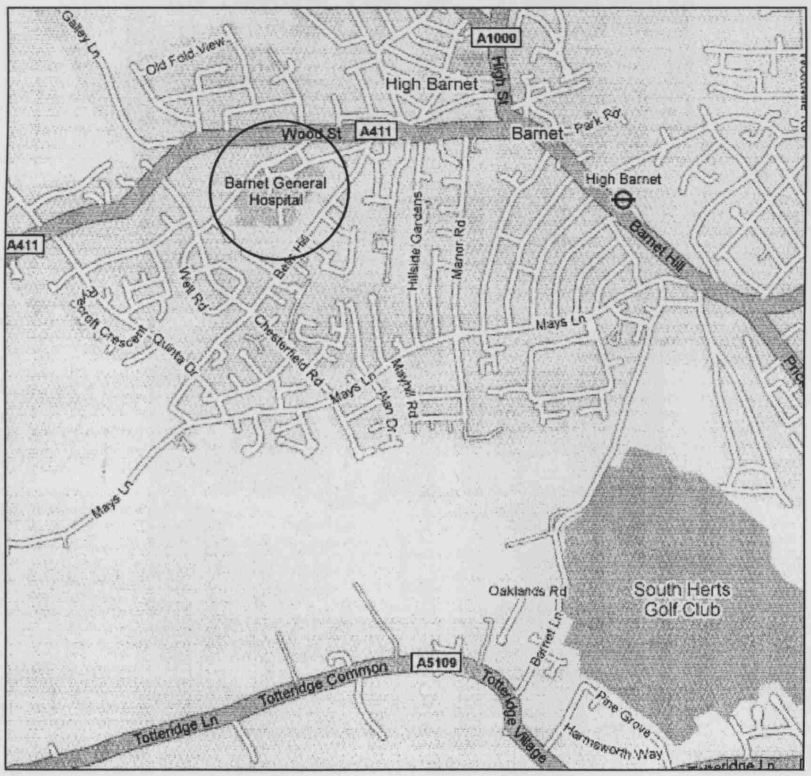
Barnet Hospital from the East

Interior of the Building

Interior of the Building

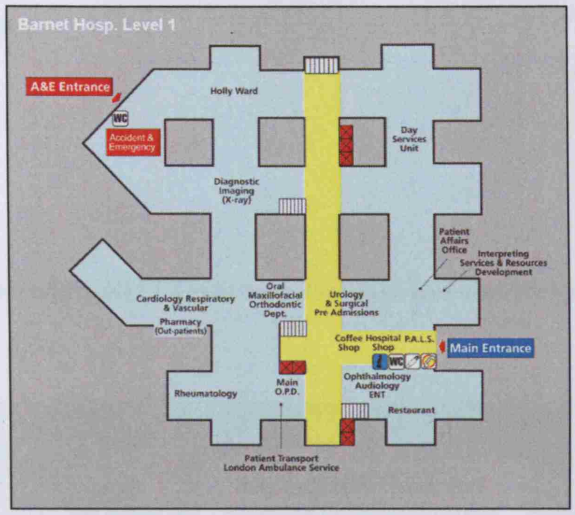
Location of Barnet Hospital in the UK

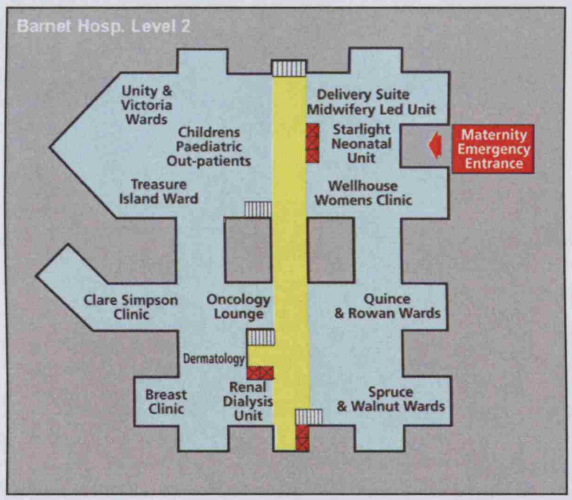
Source: http://maps.google.co.uk

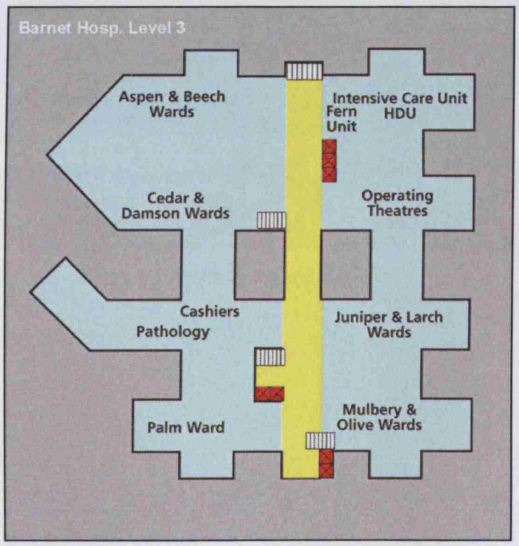


Source: http://maps.google.co.uk

Floor Plans of Barnet Hospital





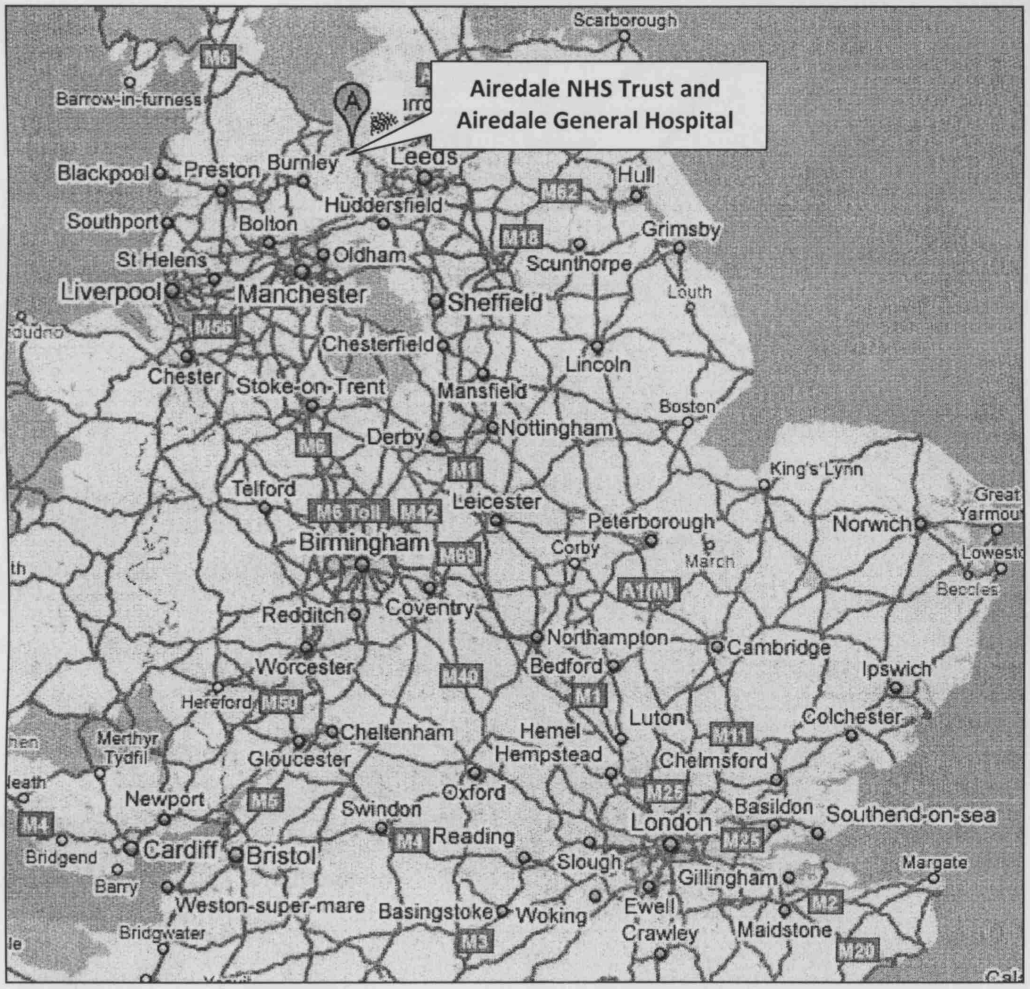


Source: http://www.bcf.nhs.uk

APPENDIX VI

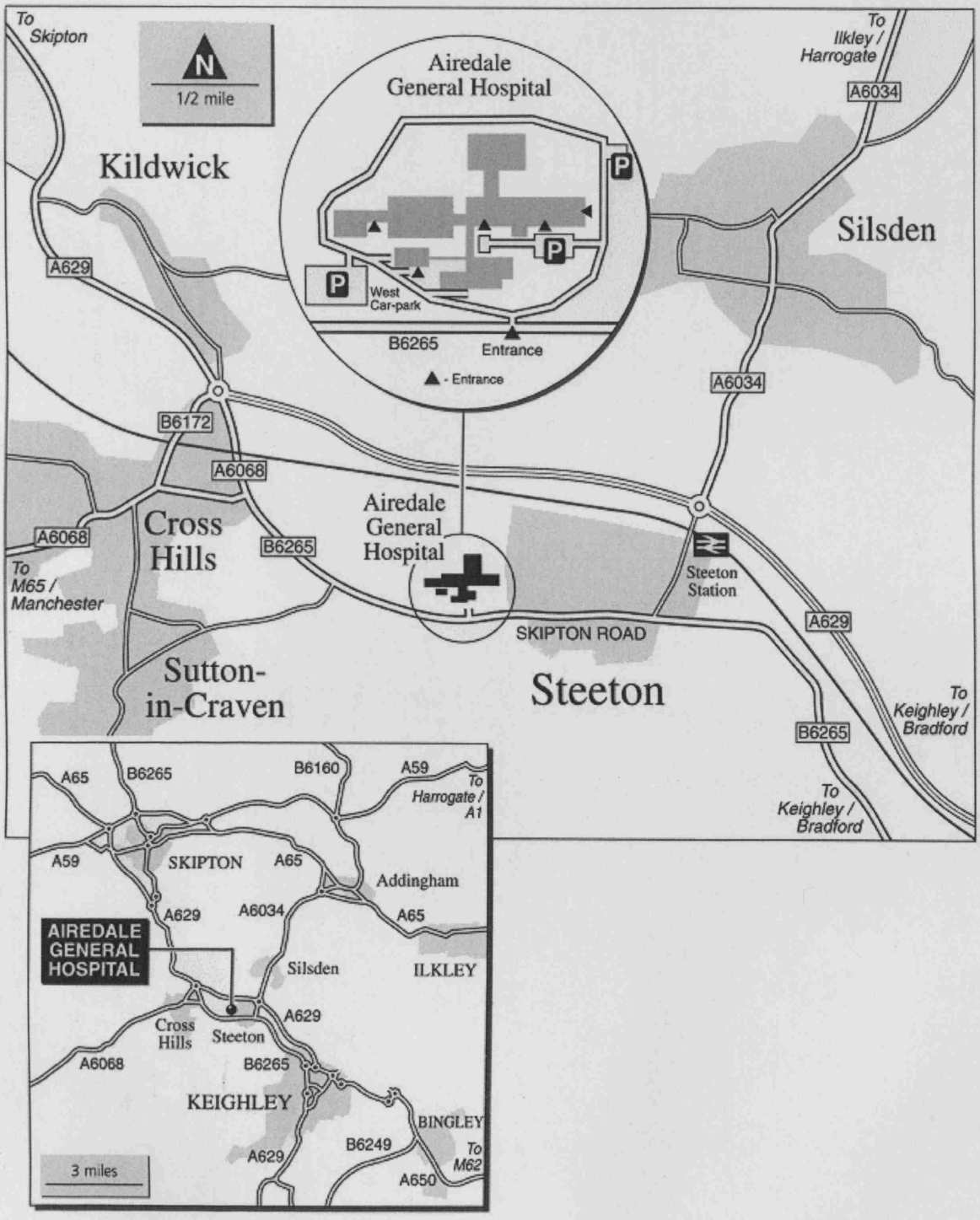
AIREDALE NHS TRUST

Location of Airedale NHS Trust and Airedale General Hospital in the UK



Source: http://maps.google.co.uk

Location of Airedale NHS Trust and Airedale General Hospital



Source: http://www.airedale-trust.nhs.uk