

Innovation within Private Finance  
Initiative Projects: the influence of  
governance throughout the first  
stage of post-contract  
implementation

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## **Abstract**

The objective of this research is to study street lighting Private Finance Initiative projects to determine how governance systems influence, encourage and sustain innovation in the first and subsequent stages of the project life cycle following contract award. The purpose of such innovation is to achieve further value for money from the investment programme particularly into the later stages of a project.

The research took a six-case qualitative research methodology approach. The empirical findings for the projects in the study show that the governance system for the project is shared and collaborative. Innovation found in the project was not influenced directly through the governance system. Although Schedule 18 of the Private Finance Initiative standard includes innovation as a Network Board responsibility, there is a distinct difference in perception at the project level with the authority managers viewing the projects as improvements whereas the sub-contractor views the projects as bringing innovation to the street lighting systems. This represents an interesting feature specific to Private Finance Initiatives, not previously reported.

The application of Internet of Things technology has brought disruptive change to the management, control and service delivery of the street lighting systems. Exploiting the new technology will bring opportunities to achieve additional benefits in service delivery and further reductions in energy consumption.

Contributions to governance and project management literatures and a proposal that the addition of a governance policy to the leadership and direction within the governance system promotes the creation of an environment, at the project level, to innovate where opportunities arise. A contribution to methodology is also made by using a qualitative data analysis tool to include analysis of the literature corpus.

The background and motivation for the study is presented in the first chapter. The second chapter reviews the innovation literature, considering issues in the governance of innovation and the types of innovation found in these projects. Chapter 3 reviews issues of the Private Finance Initiative, innovation and value for money and Chapter 4, the governance literature. The methodology and methods used in the research is the subject of chapter 5. Chapters 6 to 12 present the case studies from the empirical work and Chapter 13 the findings and discussion. Chapter 14 concludes the research and includes the limitations of the study and proposals for further research.

Keywords: Private Finance Initiative, governance, innovation, case study, qualitative research, Internet of Things, carbon abatement.

## Table of Contents

Abstract.....	2
Table of Contents.....	4
List of Figures.....	6
List of Tables.....	6
Acknowledgements.....	7
Declaration.....	8
Abbreviations.....	9
Chapter 1 Introduction.....	12
Chapter 2 Innovation.....	19
Introduction .....	19
Chapter 3 Public-Private Partnerships and the Private Finance Initiative.....	67
Chapter 4 Governance.....	94
Paradigm Changes in Governance.....	99
Public Value.....	100
Performance of Governance.....	106
Governance Types.....	116
Corporate to Project Governance.....	120
Collaborative and Network Governance.....	124
Sustainability Governance.....	1325
Informal Governance.....	138
Key Governance Topics.....	140
Research Questions.....	141
Chapter 5 Methodology and Method.....	144
Chapter 6 Pilot Case Study: Surrey Street Lighting PFI.....	161
Governance.....	162
Chapter 7 South Coast Street Lighting.....	170
Governance.....	172
Innovation.....	173
Private Finance Initiative.....	173
Chapter 8 Hampshire County Council.....	178
Governance.....	179
Innovation.....	134
Private Finance Initiative (PFI).....	186
Chapter 9 West Sussex County Council Case Study.....	193
Governance.....	193
Innovation.....	200
Private Finance Initiative.....	202
Further Observations.....	203
Chapter 10 Case Study: Southampton City Council.....	205
Governance.....	205

Innovation.....	211
Private Finance Initiative.....	213
Further Observations.....	214
Chapter 11 Scottish & Southern Energy Case Study.....	215
Governance.....	216
Innovation.....	219
Private Finance Initiative (PFI).....	220
Further Observations.....	223
Chapter 12 Designs for Lighting: Case Study.....	227
The Role of the Independent Certifier.....	227
The Independent Certifier Process.....	228
Reporting and Communications.....	232
Authority Driven Differences.....	232
The Pilot.....	233
Innovation Opportunity.....	234
Related Topics.....	235
Chapter 13 Findings and Discussion.....	237
Chapter 14 Conclusion.....	259
References.....	266
Appendix A.....	299
Interview Question Guide.....	299
Appendix B:.....	306
Interview Schedule.....	306
Appendix C:.....	309
Research Participant’s Information Document.....	309
Appendix D:.....	312
Letter of Informed Consent.....	312
Appendix E:.....	313
The PFI procurement process.....	313
Appendix F:.....	316
Coding Definitions/Descriptions.....	316

## List of Figures

Figure 1.1: Literature Review Domains	17
Figure 2.1: Types of Innovation	51
Figure 2.2: Schematic Diagram of the Central Management System	65
Figure 5.1: The N-C-T Cycle (adapted from Seidel 1998)	150
Figure 5.2: Coding Cycles and Assignments	157
Figure 5.3: The Snowball Sample Stemma	159
Figure 6.1: Pilot Case – “Surrey Street Lighting”	161
Figure 7.1: The South Coast Lighting organisations	176
Figure 8.1: Data Sources, Comparisons and Reports	181
Figure 10.1: SCC Three Level Governance Model	205
Figure 12.1: The IC Checking Regime	230

## List of Tables

Table 4.1 Accountability, VfM and the PFI Processes	82
Table 7.1 – Comparison with National figures (Source DfT 2003 survey.	171
Table 7.2 – Current inventory prior to the PFI	171
Table 12.1: South Coast Lighting Milestones (2010-2015)	229

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Lastly and always, I owe so much to my wonderful and courageous Wife Nicola who patiently held the space for me to do this research.

R J W Davidson

April 2021.

## **Declaration**

I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. This thesis has not been previously submitted to this or any other university for a degree, and does not incorporate any material already submitted for a degree.

Signed

RJW Davidson

Dated April 2021

## Abbreviations

ACF	Advocacy Coalition Framework
ATM	Automated Teller Machine
B2B	Business 2 Business
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
BSI	British Standards Institute
CAQDAS	Computer Aided Qualitative Data Analysis Software
CCC	Committee on Climate Change
CCTV	Closed Circuit Television
CEO	Chief Executive Officer
CFT	Call for Final Tenders
CGR	Collaborative Governance Regime
CIP	Core Investment Programme
CMS	Central Management System
CPS	Complex Product Service
CPRE	Campaign to Protect Rural England
DB	Design Build
DBB	Design Bid Build
DBFO	Design Finance Build Operate
DEG	Digital-Era Governance
DfL	Designs for Lighting
DfT	Department of Transport
DFBO	Design Build Finance Operate
DNO	Designated Network Operator
DVR	Deviation Report
EoI	Expression of Interest
FBC	Final Business Case
FM	Facilities Management
G2C	Government 2 Customer
GPRS	general packet radio service
H2M	Human 2 Machine
HCC	Hampshire County Council
HID	High Intensity Discharge
HR	Human Resources
IC	Independent Certifier
IEEE	Institute of Electrical and Electronic Engineers

IGF	Internet Governance Forum
IoT	Internet of Things
IP	Internet Protocol
ISDS	Invitation to Submit Detailed Solution
IS	Information Systems
ISO	International Standards Organisation
IT	Information Technology
KPI	Key Performance Indicator
LASER	Local Authorities South East Region
LDO	Lease Develop Operate
LED	Light Emitting Diode
LTIC	Long-Term Infrastructure Contract
LTP	Local Transport Plans
M2M	Machine 2 Machine
M2S	Machine 2 Smartphone
MCS	Management Control System
MMR	Monthly Monitoring Review
NAO	National Audit Office
NBM	Network Board Meeting
NCT	Noticing Collecting Things
NHS	National Health Service
NPG	New Public Governance
NPM	New Public Management
OBC	Outline Business Case
OECD	Organisation for Economic Cooperation and Development
OGC	Office of Government Commerce
OM	Operation & Maintenance
OSR	Operational Savings Review
PAPN	private access point name
PFI	Private Finance Initiative
PF2	Private Finance 2 (the re-launched UK PFI)
PPP	Public Private Partnership
PRDIM	Police Road Death Investigation Manual
PRG	Project Review Group
PS	Performance Standard
PUK	Partnerships UK
QDAS	Qualitative Data Analysis Software
QoS	Quality of Service

RAB	Resource Accounting and Budgeting
RFID	Radio Frequency Identification
RMS	Remote Management System
RTA(s)	Road Traffic Accident(s)
SCC	Southampton City Council
SON	High Pressure Sodium
SOX	Low Pressure Sodium
SSE	Scottish and Southern Energy
SVP	Special Purpose Vehicle
TCE	Transaction Cost Economics
ToR	Terms of Reference
TUPE	Transfer of Undertaking (Protection of Employment)
TVL	Tay Valley Lighting
UIE	International Union for Electricity Applications
UK	United Kingdom
UKRLG	UK Roads Liaison Group
VfM / VFM	Value for Money
VPAN	Virtual Private Area Network
VPN	Virtual Private Network
W3C	World Wide Web Consortium
WPAN	Wireless Personal Area Network
WRA	Wind Resource Assessment
WSCC	West Sussex County Council

## Chapter 1 Introduction

In “A new approach to public private partnerships”, the UK Government belief was expressed that private sector skills and expertise in investment, project management, innovation and risk management were among the strengths of private sector driven by market competition and should continue to play a significant role in the delivery of public infrastructure and services HM Treasury (2012, p.5 and p.6).

The Local Government National report “Seeing the Light” and published by the Audit Commission, had previously stated that local authorities would need to adapt new ways of working if continuous improvement was to be maintained Audit Commission (2007). According to the Audit Commission report, local authorities could achieve potential benefits from innovative approaches to improving Value for Money (VfM), effective service delivery, stronger community engagement and representation.

The report also listed barriers to successful innovation implementation that included a lack of effective leadership and strategic input, poor organisation and communication among senior officers.

The report also noted

*“...public sector organisations have a history of innovating ... (however) local authorities have rarely been the focus of research in this area,”* Audit Commission (2007, p10).

Chapter 2 Innovation reviews this report in more detail.

A number of sources draw attention to the issue of innovation in public services de Vries, Bekkers, & Tummers (2016;); Walker (2014); Osborne & Brown (2011); Potts (2009); Windrum and Koch (2008); and Hartley (2006). Coming from the perspective of empirical research in the public sector, de Vries et al. found from their literature research that within the

body of knowledge there was a focus on the innovation of internal administration. Walker (2014) studied the internal and external antecedents such as organisational size, administrative capacity, organisational learning and the external effects of adopting innovation. The dialogue regarding innovation in public services policy, was researched by Osborne and Brown (2011).

Potts (2009) argues that public service organisations suffer from “innovation deficit” as a consequence of the continuing demand for improved efficiency, accountability and greater transparency.

Windrum and Koch (2008) write in their Foreword to their book that innovation in public services, although important, has not been widely studied. The trend in innovation study has been concerned with the physical products and production processes of the for-profit private sector. The main focus of research in the public sector has been concerned with political science and public administration and is extensive in nature. The intention of Windrum and Koch is to encourage action, to try new and different approaches rather than a normative route of better analysis and decision-making. Rather than taking the prevailing studies of cost-benefit analysis and option evaluation, a call is made to take an entrepreneurial approach, to be creative and to learn from the experiences gained. This book is reviewed in Chapter 2.

These authors stress the importance of research in innovation in public services, despite the paucity of studies and note that most research has been on for-profit private firms, their physical products and the processes used to produce them. Research with innovations in schools, education, hospitals, medicine and professional services has broadened the range of the field of innovation research.

Hartley (2006) observes that there is little research about public-private sector innovation and that while there are similarities between private and

public innovation processes, practical and theoretical knowledge of innovation in the private sector cannot tell the whole story.

With most of the 700 PFIs running for another 20 to 25 years and some with longer timescales, innovation opportunities may be a way to offer further value-for-money (VfM) throughout their remaining life cycle. This research explores the scope for innovation during the remainder of the PFI project life cycle beyond any initial innovation of the contracted infrastructure or services.

However, in the United Kingdom, as in other countries where Public Private Partnerships (PPP) have been introduced and exploited, there has been much criticism of the failings and excesses of such programmes by the media and the public. For example, results of PPP/PFI programmes have been mixed as observed by Hodge and Greve (2007) in their performance review paper.

A National Audit Office (2011, p. 9) report stated that the Government had not achieved economies of scale by exploiting its position in the market. Political changes took place from 2010 in public administration, which affected the outcome for programs such as Public Private Partnerships and Private Finance Initiatives (PPPs / PFIs).

The lighting systems introduced in the 1950s and '60s are reaching the end of their working safe life and need to be replaced. For example, concrete lampposts installed in the early 1950s are now crumbling due to both exposure to poor quality air and corrosion of internal steel reinforcing structures thus becoming an issue for public safety.

Other lighting systems that had to be replaced used lamps that contain mercury vapour in response to a European Union regulation that came into force in 2015 banning the use of mercury vapour in lamps on environmental grounds, (Directive 2001/65/EU). Disposal of these types

of lamps is considered hazardous from the risk of contamination from the heavy metal mercury.

The UK Lighting Board is one of four boards comprising the UK Roads Liaison Group (UKRLG) which was established in 2001 with the purpose of bringing together authorities and government organisations to consider all aspects of roads infrastructure, engineering issues, and operational concerns. The UK Lighting Board succinctly states the case for improvements and re-investment in street lighting renewal programmes:

*“The importance of public lighting operation and maintenance to the integrated transport network agenda, to public amenity and safety, and to crime reduction has never been more widely recognised.”* – (“Well-Lit Highways: Code of Practice for Highway Lighting Management”, UK Lighting Board (2004, p.14).

The recommendations in the Code, perhaps surprisingly, are not mandatory. However, authorities not complying with the Code are advised to document their differences and departures from the Code that provides a defence against any potential future legal issues.

Many Local authorities have chosen to repair lights on the discovery of defects rather than embark on programmes of preventative maintenance or replacement, which over time has resulted in a steady decline of the stock and a deterioration of the street lighting network. In recent times this has as much been about the pressures on budgets and prioritisation of services.

This research study commenced when the Coalition Government of the United Kingdom had launched a review to account for the criticisms and failings of PFI, and expressed the intention to reform the PFI model that had been governing public-private partnerships in the UK over the preceding nineteen years, HM Treasury (2011). The UK PFI model was

re-launched in 2012 with the publication of “A New Approach to Public Private Partnerships,” and is reviewed in more detail in Chapter 3 HM Treasury (2012).

A pilot study with Surrey County Council was used to develop and confirm the research design and the process. In 2011, a notice was sent to residents in Surrey informing them that streetlights were to be replaced as part of an innovative new programme procured under a Private Finance Initiative. An attempt to interpret this leads to questions such as what is innovative about this programme; how does this offer value for money to residents; how is the programme governed, and does that governance encourage innovation?

There was an emphasis in the notice of innovation in both execution and technology that the project would introduce.

From the sources shown in this chapter, the prevailing key concepts or dominant influences bearing on the research question are, the properties of governance, the PFI model and the nature of the innovation relevant to projects in the external lighting environment.

From UK Treasury documentation and Audit Commission reports, it is clear that innovation is important to, and will continue to be, essential to the continuing 700 UK PFI projects and to UK PPPs in the future.

From the literature, much has been made of the transition from government to governance and innovation in governance. However, little is found to explain the nature of governance in PFI projects with particular interest in how that governance encourages innovation the products and services specific in these projects. This research explores how a governance system influences innovation in a PFI project. This is achieved by studying a PFI project and interviewing the public and private project managers responsible for the delivery of the largest street lighting replacement project in the United Kingdom, i.e., South Coast Street

Lighting. Documentation published by the authorities involved will be included in the data corpus.

The review of literature is presented in the following chapters 2 Innovation, 3 and 4. Figure 1.1 shows the main literature domains that reflect the thesis title and are used to indicate the context of the study and key literatures in the region bounded in black that contributed to informing the research questions.

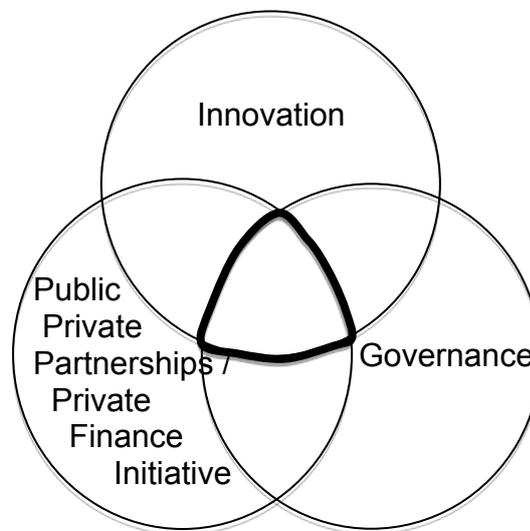


Figure 1.1: Literature Review Domains

The second chapter reviews the innovation literature, considering issues in the governance of innovation and the types of innovation found in these projects. Chapter 3 reviews issues of the Private Finance Initiative, innovation and value for money and Chapter 4, the governance literature. Chapter 5 describes the methodology and methods used in the research.

Chapters 6 to 12 present the case studies from the empirical work;  
Chapter 6 Pilot Case Study: Surrey Street Lighting.  
Chapter 7 Case Study: South Coast Street Lighting.  
Chapter 8 Case Study: Hampshire; Chapter 9: West Sussex;  
Chapter 10 Case Study: Southampton; Chapter 11 Case Study: Scottish &  
Southern Energy; Chapter 12: Case Study: Designs for Lighting.  
Chapter 13 is the Findings and Discussion from the research and Chapter  
14 Conclusion; concludes the research and includes the limitations of the  
study and proposals for further research.”

Developing a testable proposition from the foregoing leads to stating that a governance system influences innovation in a PFI project. Given the life-span of a typical PFI project of 25-30 years, the investigation is inevitably restricted to a particular stage of the life-cycle. This research took place in the post-contract stage implementation also called the investment phase in which the financial investment or credit is used to fund the replacement of the obsolete lighting system.

## Chapter 2 Innovation

### Introduction

This first chapter of the literature review considers two main aspects of innovation with a view to revealing what external lighting innovations may be found in the projects supporting the research. The first considers issues in the governance of managing innovation. Attention is restricted to developments in governance as it influences innovation, theories, models and frameworks devised to assist understanding of the types of innovation and the innovation dependencies leading to the implemented generation of street lighting applications. The second literature field covers the technological innovations that are exploited in modern street lighting systems and shows a series of innovations on which succeeding innovations can be built an innovation dependency chain - and may contribute to sustaining value for money throughout the PFI life cycle. However, to open the review, definitions of innovation are considered to serve as a reference from an academic viewpoint and as a guide to understand empirical findings.

The first definition simply states

*“Innovation is the generation, acceptance and implementation of new ideas, processes products or services”* Thompson (1965, p. 2).

Similarly, West & Anderson (1996) quoting West & Farr (1990), who suggest that

*“Recently, innovation has been defined as the introduction and application, within a group, organization, or wider society, of processes, products, or procedures new to the relevant unit of adoption and intended to benefit the group, individual, or wider society”* West & Farr (1990) in West & Anderson (1996).

Both of these definitions avoid the product versus services debates that mark much of the innovation literature while remaining useful.

Van de Ven (1986) defines innovation taking into account the agents involved in the changes

*"As long as the idea is perceived as new to the people involved, it is an "innovation," even though it may appear to others to be an "imitation" of something that exists elsewhere"* Van de Ven (1986, p. 592).

Van de Ven's definition is useful as it recognises that innovation is a subjective concept and the real-life experiences and thoughts of the agents interviewed in this study about what constitutes innovation form an important part of the empirical research.

The next section considers issues in innovation governance and establishes the need for innovation in bringing value for money in public services.

### **Issues in innovation governance**

In Chapter 1 of this thesis, an Audit Commission (2007) report was noted that advocated the benefits of innovative approaches to improving Value for Money (VfM), effective service delivery, stronger community engagement, and representation. The report observed that incremental change might not be sufficient for regional and local authorities to meet the increasing demands for new and improved services and in a climate of continuing budgetary constraints.

The report proposes that value for money needs innovation in both the application of technology and in service provision listing seventeen recommendations for local authorities to consider. Among the recommendations and of interest in this research is a call for authorities to routinely consider the role that innovation has to play in service

improvement, and be willing to countenance innovative approaches where incremental improvement may not deliver the results required. This, in turn, depends on authorities developing organisations that support and sustain a culture of innovation particularly developing and empowering customer-facing staff who are best placed to recognise and act on change opportunities.

Besides having the ideas to feed innovation, a supportive environment and change management capabilities are also essential. The Audit Commission (2007) saw central agencies, such as themselves, as ideally placed to help disseminate and share innovative practices from their overarching view of councils and authorities. However, it should be remembered that not all innovative practices 'travel,' in other words what is successful in one organisation may be less so in another. An essential review of the organisational structures is suggested to ensure that the departmental silos and hierarchies do not inhibit the generation of innovative ideas.

The fieldwork underpinning the Audit Commission (2007, p. 20) report identified five drivers of innovation; (1) a focus on greater efficiency within the organisation; (2) pressure from central government for performance improvement; (3) local political pressure for change; (4) the 'bottom-up' demands of local communities; and (5) examples of successful innovations within other organisations. Of the five drivers, efficiency was shown to be the strongest in local authorities, with approximately 80% of respondents claiming it to be 'very important or essential'.

A limitation is that it is rare for organisations in the public sector to have a research and development capability, unlike the private sector where these capabilities are more commonplace. No 'innovation departments' were found in fieldwork conducted in the preparation of the Audit Commission report. Case studies in the Audit Commission report identified a number of ways in which innovation was delivered in

partnership with examples that include working with other authorities, other local public bodies, across the tiers of local government, and the private sector.

The Audit Commission took further evidence of the rarity of innovation research from a report written by Mulgan and Albury (2003) who state,

*"... there is a dearth of high-quality research on innovation in the public sector"* Mulgan and Albury (2003, p. 6).

Mulgan and Albury discuss the issue of what innovation means in the context of public services and acknowledge that there is a plethora of varying definitions. They take as a working definition:

*"Successful innovation is the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes, efficiency, effectiveness or quality"*  
Mulgan and Albury (2003, p. 3).

This definition includes processes and services as well as technology, however, while acknowledging the point that efficiency is seen as the strongest driver of innovation, Potts (2009, p. 34) points to the paradox that the drive for efficiency, the elimination of waste and the uncertainties surrounding risk inhibits risk taking when providing public services innovation.

Mulgan and Albury also propose that the low level of research in innovation in public services might be due to the apparent low level of innovation in public services. The majority of innovations are not radical or systemic, but are just as important as incremental changes and adaptations to existing services or processes.

Another, definition, from Mulgan (2007), offers that innovation in the public sector is new ideas that can work to create public value and social benefit.

The ideas, therefore, have to be implemented and not just a "good idea." The essential point here is that the innovation needs to be more than just "a good idea." It has to have been implemented sufficiently long enough for an assessment to be made of the value created. In the context of the street lighting project, having been in place for a little more than five years during the core investment programme, the value created was progressively realized from the beginning. This in turn can offer further value when the replacement programme has been fully completed. This example meets Mulgan's criteria.

The street lighting infrastructure installed from the late 1950s and into the 1960s, gave the lighting authorities three or more decades of stability during which schedules of maintenance and emergency repair regimes were able to keep pace with failures. However, as the 1990s progressed the faults and failures increased as the infrastructure reached the end of its expected operational life. The degradation in performance suddenly became apparent particularly as the maintenance and repair budget allocations were no longer able to meet the demand. The lighting authorities now experienced abrupt or sudden change – discontinuous change and on a number of major fronts, particularly, political (introduction of PFI), technological changes (changes in lighting technology), budgetary restraint and austerity, infrastructure deterioration, new regulations (in lighting standards and banning materials e.g., mercury), new policy commitments (carbon abatement, 2020 targets.) It can be argued that the combination and accumulation of these changes have brought severe challenges to the councils and lighting authorities whose experience becomes that of frequent discontinuous change, in what has been considered to be stable and routine operational environments. This is the environment and context in which this research study is situated.

Tether (2003) records that although there is a large volume of innovation literature, public services have seen little or no scholarly attention because of the prevailing view that they have almost no ability to change and that

any innovation depends upon using technological innovation to improve existing services or to introduce new services. The later Audit Commission report in its summary states that UK Local Authorities

*“...are already innovating extensively.”* Audit Commission (2007, p. 4).

According to Potts (2009) the public sector needs to innovate if only to maintain the current state. The technological innovations so adopted have been developed externally to the service providers and are likely to be innovative in their own right Tether (2003). Tether uses the evidence from the second European Community Innovation Surveys (CIS-2) that was gathered in 13 countries during 1997 to better understand innovation and technical change within services.

Services have properties that are not necessarily found in manufacturing. They may be invisible and they can be interactive between provider and user. Widespread exploitation of information technology in the few years since Tethers' paper does find manufactured goods being used by consumers in ways the manufacturers did not originally envisage. During this period, the rise of firms offering not only manufacturing but also services began to grow and is now a relatively commonplace occurrence. The service providers in the street lighting PFIs studied in this research have both the products and the subsequent management, repair and maintenance of the lighting stock, and therefore have been involved in design and manufacture and now offer these services. Tether sees services as "dynamic and fluid, constantly changing to meet customer requirements," and this may be true for certain services, but street lighting service provision is much more restricted, with few degrees of freedom for change. Tether restricts the analysis presented in the paper to the five services, Transport, Wholesale, Technical, Financial and Computer from the CIS-2 survey, thus reducing the value of the paper to this research. However, it does add to our understanding of service innovations

properties that are not necessarily shared with innovations in manufacturing.

Tether observes the expansion of services and the contraction of manufacturing (at least in the UK) whose base has been used to aid our understanding of innovation and therefore queries the "adequacy" of that understanding where service economies are beginning to predominate. Research on innovation in services in the early 1980s took an approach that considered service providers were dependent on suppliers, i.e., they were "supplier dominated" and it was within the supplier's domains that innovation occurred and therefore that was where research should be conducted. Services rarely, if ever, developed their own technologies. This is completely true in the example of street lighting services. Councils and their authorities do not have the capabilities to design, nor have the capacity to manufacture the volumes of items needed to replenish their stock. However, as research in the supplier domain progressed, it was observed that suppliers did not dominate all services. For example, the emergence of technical consultancy services, but these types of services will not be pursued in this research. As noted earlier, street lighting falls into the earlier understanding of supplier domination. The introduction of PFI and the various markets that emerged and matured are dependent, if not dominated, by the service providers.

The use of PFI introduces top-down governance and is addressed in more detail in Chapter 4. In the next section, governance of innovation is reviewed opening with a brief review of innovation in governance.

Moore and Hartley (2008) note the growing interest in innovation in public services, not just as a means of improving quality in the delivery of these services, but also to bring about large scale change in efficiency and effectiveness in public organisation and services. A critical observation made in the paper is that the innovation in governance is not explained by the innovation literature that tends to be situated in the private sector.

Furthermore, the private sector has placed emphasis on innovation in new technologies and products. Each of the cases in the article presented innovation that may have caused different production and service innovations, but in Moore and Hartley's view do not provide a full account of innovations in governance and are different from those found in the private sector. Findings from the case studies identify five inter-related properties that express differences between public sector governance innovations from those found in the private sector product and process innovations, and are

*“Bursting the boundary of organisations / creating network based production systems,  
Tapping new pools of financing, material resources and human energy,  
Exploiting government's capacity to convene, exhort and redefine private rights and responsibilities,  
Redistributing the right to define and judge the value of what is being produced, and  
Evaluating the innovations in terms of justice, fairness and community building as well as efficiency and effectiveness”* Moore and Hartley (2008, pp. 12 - 16).

However, to fully agree that the differences that Moore and Hartley describe apply only to the public sector is not the point that they are making. Moore and Hartley agree that the governance innovations have dimensions of production and service innovation. For example, creating a network based production system is well within the capabilities of a private sector organisation by creating a network of suppliers feeding a production system such as car manufacture that was not prompted by the public sector. Equally, tapping new pools of financing, material resources and human energy and defining and judging the value of what is being produced are also within the private sectors' strategic intent through governance.

The nature of governance innovation proposed by Moore and Hartley is that of innovations in the governance of society and social conditions and not just in government operations.

Moore and Hartley's list may have potential additions from Caldwell and Howard (2011 p.11) who conclude that innovation might in the future, be determined not just by the design or service, but that supply networks, the inter-firm relationships and the level of knowledge shared between them could also be considered. Importantly, services should be added to the list of future innovation determinants that Caldwell and Howard have presented in the introduction to their book. Starting with the content and context of their research, Caldwell and Howard identify three governance challenges spanning purchasing complex performance, namely contractual, relational and integration. They define a Complex Product Service (CPS) as a focus on procurement and supply where customer value is delivered as an integrated product-service. Creating value for the client by joint value relies on strong relationships between the partners and contractual governance.

The characteristics of this definition will be seen in the target project of this thesis, in that the PFI was focused in the procurement phase and concerned with the best value for money as the project partner implemented both the core investment phase of the project and the subsequent management and maintenance support solution. Customer value is offered as an integrated product-service, from the physical products supplied and the full maintenance support solution. As will be seen later, the client authorities and the SPV's primary contractor have a close working relationship during the core investment program.

Key to making the transition from more traditional ways of product and service procurement is how the participating organisations learn, from each other, from the requirements and how to work together. Caldwell and Howard derive a framework for analysing organisational learning built

on a number of streams of research. In terms of the research in this thesis, the pre-contract activities had already been completed and the core investment program had started thereby losing the opportunity to study the early learning behaviours and experiences of the client and provider organisations. For the moment it can be assumed that the nature of organisational learning changes with the changing phases of the project, but this researcher's presence in proximity to the target PFI programmes is not sufficient to obtain empirical data that might reveal these changes, or the effectiveness of the analysis framework these authors have developed.

Leiringer (2006) addresses four subjects often used at macro level to promote PPP or PFI projects - collaborative working, design freedom, long-term commitment and risk transfer. This article is focused on the construction sector particularly in UK in connection with PFI projects and takes a different perspective from the usual policy, risk management and relational studies by considering how large construction companies have adjusted to working in the PFI marketplace.

Leiringer observes that the parties involved in the PPP have to take steps to reduce the effect of the contract conditions. The effect of the output specification is to cause the private actors to adopt an approach that exploits their current expertise, the consequence of which results in current or "best practice" solutions rather than bringing new technology to the project. This has the benefit to the contractor of reducing their risk exposure. Acceptable risk may be taken if the result is to reduce their working costs in the operational phase if they remain the operator for the contract. Leiringer's research and findings indicate that it might be more appropriate to look at the client-contractor communications that was found to be more important in determining the outcome than the output specification that seems to be of secondary importance. Leiringer in conclusion urges caution in accepting the claims made for the advantages of taking the PPP route to infrastructure provision. But it is by no means

fair to say that innovation is inhibited, it is just limited in what can be achieved.

A large proportion of the innovation literature is given to innovation in products, technology, and management. Within this body of literature, Christensen (1997) reported the effect of disruptive change on markets, products, and the firms that supply them. Christensen's research is based on products and manufacturing and therefore may help to understand the behaviour of the private partner or contractor in the target PFI at the centre of the research for this thesis. The contractor is a large company. As Christensen's 2nd principle states, small markets do not meet large companies' growth needs. PFI street lighting markets are small, although the unit volumes in them are high. Christensen identifies three options or mechanisms to create new capability.

It can be appreciated that during the 25-30 year life of a PFI, change will be inevitable. Central government will introduce change in terms of policy and new or amended regulations, for example, further changes to carbon abatement targets. In street lighting, the basis of this study, technology has played a significant role in the lighting 'solutions' proposed in the current round of street lighting PFIs, but policy changes can be anticipated, particularly in the context of carbon emissions targets and continuing economic circumstances. The implication of this for the contractors is that they may need to adopt new technologies and develop new capabilities to be able to respond to additional requirements.

If taking Christensen's second mechanism for creating new capability is about the internal development and creation of capability, then Popadiuk and Choo (2006) make a systematic exploration of the relationship between innovation and knowledge creation. For the public client to be an "intelligent" customer the implication is the need to develop knowledge in governance, management, and finance as well as the technology.

The virtues of innovation in the public service sector have perhaps suffered from misunderstanding about the phenomenon of innovation. Osborne and Brown (2010) identify three key problems that they contend have damaged public policy directed at public service delivery - using innovation in manufacturing rather than innovation in services, mistaking innovation for continuous improvement, and assuming innovation is what is needed and driving it by policy.

Osborne and Brown relate how the reform of public services and public service delivery falls under the term New Public Management (NPM). NPM recognises the capabilities of the private sector, particularly the market differentiator which suggests that private companies are good at innovating and managing innovation and their capabilities. It was considered that the introduction of market disciplines into the public sector would bring innovation from competition resulting in more efficient service delivery from innovation.

Furthermore, Osborne and Brown acknowledge the substantial influence of Porter on policy making and exploiting his “competitive advantage” views that are exclusively rooted in manufacturing Porter (1985). This in turn resulted in a manufacturing view of innovation that does not effectively address the needs of public service innovation. These views are expressed in “Modernising Government” Cabinet Office (1999) White Paper, reviewed in Chapter 3 . This helped establish continuous improvement as opposed to discontinuous innovation and change. Osborne and Brown (2010) acknowledge the need to have both discontinuous and incremental (continuous improvement) innovation in the reform of or improving public services. Organisational capabilities to manage change resulting from these two types of innovation are reviewed in more detail in the Innovation section of this chapter in Bessant and Francis (2004).

An initial point of departure for the governance of innovation may be found in the foreword to Deschamps and Nelson (2014) which identifies five fundamental reasons for failure to innovate from

*“...a lack of direct engagement of the CEO and clarity around leadership of innovation, an absence of a sound, well-established innovation process with a failure to distinguish clearly between science, product engineering, and innovation. Risk aversion and low tolerance for failure, and an unwillingness to support innovation budgets during near-term performance shortfalls also accounted for failure to innovate.”* George (2014), foreword in Deschamps and Nelson (2014).

George draws attention to the lengthy debates regarding the need for leadership vs. process in how to advance innovation in organisations and that Deschamps and Nelson combine them in their approach to innovation governance. Although Deschamps and Nelson’s book is addressed to the private sector and agrees with George’s viewpoint, many of their remarks appear just as relevant to the public sector. The scope of innovation governance is expressed as building a vision and strategy, discovering opportunities, developing capabilities, and steering execution. Under the discovering opportunities perspective, a company would consider its value chain strategy and possibly the creation of new business. A public enterprise or authority could reasonably consider new services under this heading. Deschamps and Nelson describe the scope of innovation governance asking three foundation questions that boards need to consider when developing an innovation strategy; (1) why innovate, (2) where to innovate in their business or services and (3) how much to innovate? Key to answering these questions is an organisational capability to track the market in the case of private companies or the emerging need of services in the public sector. Having answered these questions, effort must be made to ensure that the organisation is aware of the strategy; this is the promotion of strategic direction, which should be a key role for the board.

Another responsibility for a governance system is to address the problem of resistance to innovation initiatives that can be found in organisations, private or public. Bason (2010) reminds us of Wilson's "Bureaucracy" that organisations resist innovation for that is their purpose by using the stability of routine to reduce uncertainty Wilson (1989). Bason proposes that co-creation may be the paradigm shift needed to encourage and promote innovation in public service but delivering this with the public rather than dispensing it for or to the public. Divergence and execution are the primary and significant benefits of co-creation. Divergence means that many more ideas are available to consider as potential solutions to new or improved public services if more of the public who are to use the services are involved in offering their ideas. At the heart of divergence is the liberation of new knowledge from the every day experiences of the public. Involvement should not end with the surfacing of ideas during divergence; it is the continuing involvement, the execution, of the emerging solutions with the public who will use the service.

In his book "Creating Public Value" Moore (1995), argues that the public sector would have to be innovative if they were to be efficient, effective and responsive to the frequently changing policies and directives of central government and the demands of the public. Moore proposed that there were, at least, three ways public value could be increased through innovative approaches - improving the performance of existing services, innovating to tailor or customise services, and offering new services. The omission in the book, by Moore's own admission, was that his findings, advice, and encouragement, targeted at the individual manager so as to inspire and guide them toward greater performance, ignored the prevailing governance system. What did the governance system do or what policies did it have to encourage all managers? It is interesting to note that the managers that Moore met in the Kennedy School management programmes thought they had little latitude for innovation in their roles.

Moore's position implies that the managers in the street lighting PFI cases might not realise that they are introducing innovation in their work.

Moore speculates that even if some individual managers in the public arena had discovered and learned how to innovate, it might be that the whole system in which they worked was not creating a sufficient number of innovations to achieve responses to the demands for efficiency, effectiveness, and responsiveness. The pace of innovation development and fiscal cycles and the demand attention span of the public might also prove inhibiting factors to innovation uptake. The purpose of Moore's book is to understand the public institutional structures used to develop, sustain and support the diffusion of innovation that creates public value in the public sector. The first model describes what Moore calls 'break-through technologies' that are large and are able to solve performance issues.

The Cambridge English Dictionary offers “an important discovery or event that helps to improve a situation or provide an answer to a problem.”

NASA describe a breakthrough “when the performance limits of an existing device (product) or method (process) are exceeded by a new, different device (product) or method (process)”

([nasa.gov/centers/glenn/technology/warp/breakthru.html](http://nasa.gov/centers/glenn/technology/warp/breakthru.html)). In the context of this research Light Emitting Diodes (LEDs) are a breakthrough technology as they exceed the performance limits of the existing high pressure sodium lights in similar or better lighting levels for far less electrical energy consumption and longer operational life.

In a later article, Moore (2005) proposes two models of the institutional settings in which innovation takes place. The first model describes institutions dominated ideally about how innovation should occur in the public sector. This approach is to take an industry break-through model of innovation and the view that this is needed to improve performance – a big break-through change (see also Christensen (1997)). It is not clear if by break-through technologies Moore meant disruptive technological

innovation, however, for the purposes of this review the disruptive interpretation will be taken. The main thought in the first model is that required improvements in performance would come from big fundamental innovation, an innovation to achieve a step-change in performance. To achieve this, criteria were needed to evaluate innovations so as to assess their impact, and to understand the processes that encouraged or inhibited subsequent dissemination. It could be considered that the second criteria has to happen following an implemented instance of an innovation, but as such might be too late to have further influence on or for successful dissemination. For example, characteristics that Moore identifies in the paper, include simplicity, low cost and self-financing, but the quantitative data needed to illustrate these characteristics is redacted on commercial grounds in the publicly available data rendering this difficult to assess in the target projects. Note that in the first model, the aspiration is to achieve innovation at an 'industry break-through' level, meaning that the approach industry takes is a model that needs to be considered for use in the public sector.

The second model concerns learning organisations that are able, through a large volume of small innovations to achieve performance improvements, that is, continuous improvement. Moore's preference for research is to examine four distinct innovative processes -

- "Process 1: How big and important ideas are produced?
- Process 2: What is the process that causes important ideas to be taken up and diffused throughout an industry?
- Process 3: What conditions, created by leaders and managers of organisations, allow those organisations to become continually innovative?
- Process 4: What processes, at the industry or organisational level, operate as a screen for distinguishing success innovative ideas from unsuccessful experiments?" Moore (2005).

### ***To Risk or not to Risk?***

The innovation process requires experimentation, taking risks and may fail completely and generally there is an appreciation of these characteristics. However, these characteristics seem to be the antithesis of responsible and financially prudent management. Potts (2009) explains that lack of innovation in public services is a consequence of the imperative for the public sector to strive for efficiency. It could be argued further that an assumption the public will not tolerate a waste of public money can be made, but as Potts points out this only holds meaning for services that already exist. The efficiency of a brand new service is difficult to establish because there is no standard or comparison to be made to determine if there has been an improvement or otherwise inefficiency. Potts acknowledges that "there are no simple solutions" to this dilemma and tries to show possible ways to progress the issue, by first examining the need to match economic evolution with related policy evolution.

New knowledge, technologies, products and services entering the markets change the nature of the economic system and alter the coordination of organisations in the creative-destructive processes described by Schumpeter (1942). The rates of change are not uniform, some are successful and promote growth, but others are less successful and slow or reduce growth with an evolutionary progress rather than regular positive growth. The study of these changes is known as evolutionary economics and has a detailed literature in Nelson and Winter (1982); Metcalfe (1998); Loasby (1999); Potts (2000); Beinhocker (2006); Dopfer and Potts (2008).

The evolving economy theory discussed by Potts might lead to the false impression that the economy is expanding, however, events in the past decade show that contraction is also likely. If economic evolution is accepted, then policy can be considered entropic, and whether an expansion or contraction, innovation in policy and hence direction from governance is needed to maintain the status quo if necessary.

Potts concludes that if in an evolving economy, policy and government services are to remain effective continuous innovation is required.

To remedy the problems of loss aversion, Potts suggests that public education is necessary to explain the need for policy change and the need for experimentation. Another remedy, it is suggested, is that failure of a policy needs to be accounted for at the beginning or introduction of any policy change. Potts contends that this approach would assist in reducing aversion to risk. Furthermore, if there is learning from failure, then the loss has created some value.

## **Theories, Models, Frameworks**

### ***Theories***

Innovation is not just the province of technological capabilities. Djellal et al., (2013) state that innovation in the public sector has been neglected in mainstream innovation studies. The paper notes that innovation research has its main emphasis on manufacturing, especially high-tech industries, to the neglect of innovation in services with public sector service innovation neglected the most. A relevant point made by these authors is that public service research has not so much been neglected as omitted because of its effective monopoly. These researchers posit that service innovation should not be studied in isolation, but as an integrated set of innovation perspectives. This position has informed the research within this thesis. Unlike Ordanini and Parasuraman, (2011) Djellal et al. consider four theoretical views; they add "inversion" and "integration" to assimilation and demarcation.

The "inversion" view is concerned with examples of service innovation that bring or encourage innovation across the whole economy. Gallouj (2010) as referenced in Djellal et al., who use inversion to identify those innovations that are led by service industry sources, contrary to the

conventional sources of innovation, hence “inversion”. The technical solution to the street lighting projects does not appear to fall into this category if only considering the target research subjects as they did not introduce the approach.

An “integrative” view, alternatively called “synthesis”, attempts to develop a framework that includes both manufacturing and service industries. The street lighting PFI example in this research may profit from examination through these viewpoints. From the assimilation perspective, the street lighting PFI does lean on recent developments in lighting and other technology. That exogenous technology has diffused into street lighting services can be speculated upon, but this certainly needs empirical work to resolve and demonstrate that the assimilation perspective can be used in this case.

An important and helpful observation made by Djellal et al. (2013) is that innovation in public services will vary and also change over time although there are likely to be common core characteristics. For example, the innovation patterns associated with knowledge bases will be common, but the contents and uses will depend upon the service-use being made; hospitals and schools have knowledge bases, but the uses are essentially quite different in application. Established studies, theoretical frameworks, and metrics can generally be used if adopting an assimilationist view of service innovation in what might be described as industrialisation of services. We might view that the word “industrialisation” arises from a meaning and sense making process among the actors involved. For example, in the financial sector, the providers, banks, offer financial “products” in their services to the public. These products often take the form of investment arrangements or savings accounts; there are no physical products as such. A differentiator in distinguishing services and service innovation from innovation in goods and technology is to consider what services are intangible, while goods are physical artefacts, although the latter may be part of the former. The idea is not a new one and Djellal

et al. remind us that Adam Smith made this distinction in “The Wealth of Nations”, (Smith 1776).

Gallouj and Weinstein (1987) see innovation in the service sector as increasingly important because of the growing role of services. However, they state that analysis of innovation in services is beset by two difficulties Gallouj and Weinstein (1997). The first problem is that the theory of innovation that is available at the time this article was published is based on the analysis of technical innovation in products or processes in manufacturing. The second problem is the recognition that services have some characteristics that are substantially different from the more traditional manufacturing ones. The differences are mainly attributable to the difficulties in assessing the value of the indeterminate aspects of services.

These problems are taken as the point of departure for two sets of studies whose details are to be found in Gallouj and Gallouj (1996) and Gallouj (1994), and summarised in Gallouj and Weinstein (1997). In Gallouj’s study, Barras ‘reverse product cycle’ model where the adoption of the ‘new’ technology enabled incremental changes in the processes of the service organisations is used to analyse the deployment of technology into service organisations Gallouj (1994). This theory of innovation is really more on the effect of technology diffusion, but is nevertheless a valuable entry into understanding innovation in services.

The second group of studies deals with innovation in services that are non-technological in their form. They may, however, rely on technology to achieve their outcome. An important aspect of Gallouj and Weinstein’s research is to appreciate the hypothesis that there is convergence between services and manufacturing. This is used to shape their approach to lead an attempt to reformulate the analysis of innovation by establishing the characteristics of services.

## **Models**

Deschamps and Nelson (2014) describe a broad-based innovation model that

*“recognises bottom-up innovation, and requires different management mechanisms than disruptive innovation - which most often happens in top-down mode”* Deschamps and Nelson (2014b, p. 109).

Deschamps and Nelson (2014a) present findings from a survey they conducted which showed that a large proportion of the respondents had a “hybrid” type of innovation governance system, i.e., that they had a number of subsidiary innovation models that supported the main one for the organisation. Other organisations however, were found to use a number of “supporting models” that fit together to complete their innovation-driven image and their “vision.” It is clear however, is that the governance system itself needs to evolve as the organisations change and market and environment challenges are confronted.

A frequently found model is the top management team or a subset of it and is a rational formation. Innovation is considered to be a cross-functional multi-disciplinary activity. A weaker form of innovation governance is that as a subject, innovation is included alongside all other items in the top management regular schedules meetings.

A finding made by Deschamps and Nelson (2014b) is that just over a third of respondents has access to a dedicated budget to support their innovation activities.

Djellal et al. (2013) acknowledge that the sophistication of public demand together with the ever present financial pressures bring challenges in the provision of public services. They note that the early studies of service

innovation continued to employ the approaches developed in the field of industrial innovation, an approach labelled as 'assimilationist'.

Djellal et al. (2013) also note that in the first edition of the Oslo Manual, OECD (1992), the assimilation model was dominant.

As Djellal et al. explain, the reverse product cycle model should be noted, as it was a first attempt to develop a theory of innovation in service industries and importantly was developed from empirical research that included public services, in particular, local government services. They continue to explain that Barras' model is not a general theory in the fullest sense, dealing as it does with the diffusion of IT from manufacturing to service industries Barras (1986). However, the model's utility rests in that it goes beyond the more traditional concept of diffusion to include learning processes. The model's first phase is largely incremental and radical innovation, followed by the second phase of predominantly product innovation. Barras saw this a learning process within the service organisation as it increasingly understands, through usage, the capabilities and potential of the technology it is adopting. This is a critical distinction between 'traditional' models of innovation and an emergent service innovation framework.

In the third phase of Barras' model, attention moves to the provision of government to customer (or client) (G2C) services. These are e-services that permit greater government-citizen interaction and includes in the UK for example, income-tax return forms and completion, motor-car road tax and so on. However, as budgets tighten and as more responsibility is passed to councils from the devolution policies of central government, councils are increasingly adopting a more business-oriented approach to their role and management of the services they offer. Hampshire for example has a corporate strategy and a strategic plan describing how the strategy will be met as shown in "Shaping Hampshire: modern public services for the future, Strategic Plan (2013-2017)." Although completely directed at business, the model has value in assessing the needs of public

organisations with the apparent convergence in needs and approaches. For example, South Coast Street Lighting client authorities had Scottish and Southern Energy (SSE) for their Key Partner who offered the Value Proposition of “Getting the job done”, cost and risk reduction, design and performance. SSE also offered physical resources, intellectual property, employee capabilities, financial resources, and software as the Key Resources. Topics such as cost structure, revenue streams, key partners, activities, and resources, for example, are very relevant to the operations and conduct of UK county councils (Dijkman et al. (2015)).

However, Barras' model has a strong technological bias and does not cover non-technological innovation. So whilst it is an improvement over the traditional models of service innovation, it is still incomplete. The problem is that Barras' model is fully technologically based, but PPP / PFI projects maybe / are a hybrid of technology and process. Gallouj's research work confirms that Barras succeeded in developing a theory of innovation, but is not wholly based in services and seems more to do with the migration of manufacturing technological innovation to services particularly those depending on information processing of which Barras considered financial services to be in the vanguard of the IT revolution. At the time the research was undertaken, public administration was not considered. Gallouj (1994) suggests that Barras' model is not rejected, but rather “compliment the model through studies that place emphasis on the least technologist aspects of this type of innovation.”

Study of innovation in the manufacturing arena has tended to work on two lines of research. The first draws a distinction between product and process and the second between disruptive (radical) innovations and incremental innovations. To expand on explaining disruptive, Christensen (1997 p. 227) uses electric vehicles as an example stating that there will be no significant market without a breakthrough in battery technology. Electric vehicles are potentially disrupters in the motor vehicle market as their performance improves from battery technology breakthrough “Electric

Car Sales Double in the UK” (Financial Times, September 4<sup>th</sup>, 2020, ft.com.)

Gallouj and Weinstein (1997) show that Lancaster's 1966 product definition in terms of groups of characters helps to uncover these driving forces behind innovative processes in *services*, and they use this approach as an example in their article. Having adopted Lancaster's model, there is a need to adapt it to support analysis of service innovations. Ironically the approach taken started by using a product viewpoint, but this was not at the expense of ignoring process or technology innovations.

As seen from the foregoing, a number of attempts have been made to characterise innovation in service industries. Gallouj (1994) recognises that services have a significant employment and financial presence and cannot be excluded from a Schumpeterian consideration of “innovation phenomena.” Gallouj identifies three different responses to domain-specific interpretations, three models reflecting different academic perspectives; service-oriented approaches, integrative and technologist. Gallouj studied and reports on an understanding of the reverse product cycle developed by Barras. The first stage of the model presents improvement of service efficiency from incremental process innovation. The second phase sees radical process innovation that brings improvement in the quality of service (QoS). In the third and last phase of the cycle, there is innovation in the product that in turn potentially opens up new markets. As Gallouj found, the model is limited and if we are to consider PPP / PFI applications there are a complex set of issues to reconcile including vanguard sectors, financial, business, and professional services, and pre-industrial services such as mass information, banks, insurance, public administration, and audit firms.

Saviotti and Metcalf (1984) in their original work and subsequently by Saviotti (1996) essentially showed that any product can be described in terms of its internal structure and its external properties. The external

properties represent the type of service being offered to the end users. In the case of street lighting, these characteristics would be the reductions in road traffic accidents and in fear of crime and the general aesthetic of the environment.

Gallouj and Weinstein (1997) show that a vital, perhaps the vital characteristic missing from the concept of 'product' is the morphism between the 'product' and the client or end user. They offer a range of descriptive titles for the morphism - Interface, Interaction, Co-production, Servuction'. Socially regulated service relationship, and Service relationship. Gallouj and Weinstein point out a difficulty lies in the problem of marking the difference between the product and the process, however, they state that is not true for services in which 'product' can mean process. The parameters that characterise services have issues on their designation, but this does not detract from their usefulness in service innovation analysis. The characteristic of goods or products of interior tangibility cannot be matched by similar characteristics in services. Although, as Gallouj and Weinstein illustrate, there are some services that do have internal physical elements, for example, automated teller machines (ATMs).

In services, technical and process characteristics may be taken as the same in both tangible and intangible features and if that is accepted then innovation may be identified as a change in one or any number of the characteristics technical, service, or competence.

Gallouj and Weinstein identify the following 'basic mechanisms' that bring about change, from evolution or variation, disappearance, appearance, association, and dissociation. Perhaps surprisingly they make no mention of renewal or obsolescence. Although for the street lighting PFIs, it might at a stretch be considered to be evolution for the infrastructure and appearance and association for the 'service', it might be better to think of 'necessity' as a basic mechanism or driver for change - as the saying goes 'necessity is the mother of invention (or might it be innovation?)'.

However, to formalise the output from their research a summary of the modes and models of innovation is presented next.

The creation or introduction of a new service is called 'radical innovation' and is 'unconnected' with the old service but Gallouj and Weinstein see this as “the narrowest and most exacting” (definition) and note that the term is also used frequently to those innovations that introduce new competencies and technical characteristics. The definition may be sufficiently relaxed to permit the service characteristics to remain unchanged up to a point.

Incremental innovation is perhaps not so obvious since the nature of the change or changes may be wide-ranging. Incremental 'types' identified are improvement innovation, incremental innovation by substitution or addition of characteristics, ad hoc innovation, re-combinative innovation, formalisation innovation, and improvement innovation. A 'simple' improvement to one or more characteristics of the service may overall be the result of learning processes within the service providers, but the accumulation of small improvements over time can make significant differences to the delivery of the service.

Incremental innovation: the general structure of the service is substantially the same but some product and or service characteristics are changed by the addition or subtraction of new 'internal' products, new competencies or new technical characteristics. Ad hoc innovation is perhaps best described as an interactive socially constructed change addressing a requirement from an individual client or end user of the service. Predominantly this type of service innovation can be found in the consultancy service industry.

Recombinative innovation: this innovation arises from new and different combination of already existing service characteristics. Although there is essentially no 'new' characteristics there may be new services from the re-combinations of characteristics. Special cases may see the splitting of an

existing product or combination of characteristics from two or more existing products.

Formalisation innovation: Gallouj and Weinstein call this model 'formalisation' because its purpose is to define the service characteristics and make clear the relation between the service characteristics and the technical characteristics. In some cases, the various components of the service have already existed, and through a process of social construction, the service is defined and made explicit. A good example of this type of service is the ATM that offers precisely defined services that have replaced over-the-counter banking services.

### ***Frameworks***

As noted earlier in the chapter, an analytical framework is presented by Djellal et al. (2013) to assess innovation in both private and public goods and services which they describe as - an integration perspective. The basis of the model is founded on a theory proposed by Gallouj and Weinstein (1997) whose work was underpinned by Lancaster's (1966) definition of product as a set of service characteristics briefly described in the previous section. The literature shows evidence of partial convergence between goods and services, with IT being often the catalyst and enabler for this change. Gallouj and Weinstein also record that in addition to the blurring of the boundaries between goods and services, there has been growth in firms, formerly designers and manufacturers of goods offering services associated with their goods, to manage and maintain the goods on behalf of their owners and operators. There is a strong body of literature on this phenomenon taking examples from aerospace and construction industries and in addition it is likely that examples may also be found from Private Finance Initiatives. In this research it will be shown that the private sector designs and integrates the goods, i.e., the street light systems and then manages and maintains the service over the remaining years of the contract. It can also be shown that

developing this combined design, manufacturing and integration capability has enabled the private firm, the Special Purpose Vehicle (SPV) to offer and win other street lighting PFI contracts which is consistent with the research findings in the literature, Davies, Brady, and Hobday (2007); Brady, Davies, and Hobday (2006); (Brady & Davies (2004); Nightingale, Brady, Davies, and Hall (2003); Davies and Brady (2000).

Three main sources are needed to form a conceptual framework for service innovation according to Ordanini and Parasuraman (2011) - collaborative competencies, a dynamic capability of customer orientation and knowledge interfaces. The developers of this framework observe that mainstream literature in this field position innovation drivers as being similar in both product and service contexts with an emphasis on technology-based innovation. However, Ordanini and Parasuraman recognise other researchers, such as Fitzsimmons and Fitzsimmons (2000), and Edvardsson and Olson (1996) who have tried to separate the differences between goods and services, a “demarcation” approach, but nevertheless the approach is more to consider service innovation as a special type or case of product innovation. Outside stakeholders and knowledge management mechanisms have received little attention to their relevance to service innovation.

### **Innovation Types**

In the introduction to their book, Windrum and Koch (2008) make a connection with the motor manufacturing industry, and how the public sector enables and supports it. In the public sector at all levels, there are policies and services geared to ensuring the efficient operation of private cars and commercial vehicles by providing parking space, traffic management, road maintenance, traffic signals, sign and road and street lighting. This is a mere fragment of the socio-economic impact of public services and hence the further rationale for research in public service innovation. Six types of innovation are identified in the book in a

taxonomy of service innovation - Service innovation, Service delivery innovation, Administrative and organisational innovation, Conceptual innovation, Policy innovation, and Systemic innovation.

The authors' view is that the last three types have been ignored, but are discussed in the book where they are also defined as follows.

Conceptual innovation: "is the development of new world-views that challenge assumptions that underpin existing service products, processes, and organisational forms."

What can be said regarding the street lighting cases under examination is that they are consistent with PFI, at least for the duration of the contract, if PFI is considered to be a new concept?

Policy innovation: "changes the thought or behavioural intentions associated with a policy belief system" Sabatier (1987) and (1999). The Advisory Coalition Framework (ACF), developed from a call from Sabatier to integrate the findings from public policy research and analysis, is a substantial analytical tool to use to study the policy innovation that led to PFI. However, to stay within the scope of this research, interest will be restricted to what PFI has to say about innovation in the project in focus rather than the innovation that became PFI. Chapter 3 examines PFI in more detail.

Systemic innovation: "involves new or improved ways of interacting with other organisations and knowledge bases." The South Coast Street Lighting project will offer an opportunity to study public and private organisations that come together to deliver the project both in terms of joint learning and how they develop their working practice.

Windrum and Koch (2008) list generic factors such as incentive structures, public sector entrepreneurs, bottom-up innovation, top-down innovation, the impact of NPM on innovation and the implication of consumerism and the potential to guide the identification of successful innovation in the

public sector. When and how success is achieved also depends upon these factors. A number of case studies in the book show that innovation in public services has a problem driven focus.

Bloch and Bugge (2013) present some definitions of innovation in the public sector. Their generic definition of innovation recognises that it is “significant” change in the implementation of goods and services provision that represents innovation in the public sector. They list four types of innovation - Product, Process, Organisational, and Communication based on the results of a research project “Measuring public sector innovations in the Nordic countries” (MEPIN). Bloch and Bugge acknowledge that the literature has a number of definitions of innovation in the public sector but especially value the definition of Moore et al. that states

*“An innovation is any reasonably significant change in the way an organisation operates, is administered or defines its basic mission.”*  
Moore et al. (1997).

Bloch and Bugge find this definition helpful to isolate changes in public sector organisations that are different from the organisation’s previous working practice. Innovations, sourcing, cooperation and objectives are distilled from the MEPIN report as

### **Innovations**

Product innovation

Product innovation new compared to others

Process innovation

Process innovation new compared to others

Product or process innovation

Organisational innovation

Communication innovation

### **Sourcing R&D or consultancy services**

From private businesses

From universities, governmental research

From Public service organisations

Innovative procurement

### **Innovation cooperation**

Any cooperation with the business sector

Universities, governmental research

Other public organisations

### **Innovation objectives**

Address social challenges

Fulfil new regulations

Increase efficiency

Improve quality of services

Improve user satisfaction

Improve online services

Improve working conditions

Mortensen and Bloch (2011); and adapted from Bloch and Bugge (2013, Table 2, p. 120).

The results shown in the paper indicate that a high number of respondents considered their product and service introductions to be innovative. Bloch and Bugge speculate that there may be a number of potential explanations for the high shares of innovations reported.

Bloch and Bugge show, that in all the Nordic countries the most common objectives for innovation activities are 'increased efficiency', 'improved goods and services' and to 'improve user satisfaction'. These objectives are no different from those found in the UK from our respective authorities.

While these researchers record “lack of funding” as a barrier to innovation, we by complete contrast as shall be seen, have found that it was funding issues that caused our authorities to consider and adopt an innovative solution to their funding problem to make the investment to replace their street lighting stock.

There is an expectation from both businesses and the public that the public sector must increase productivity and be more efficient in the use of taxpayer's money and this inevitably leads to the need for innovation to achieve these ends.

Returning to definitions, the OECD describes innovation in the public sector as

*“...significant improvements to public administration and/or other services.”*

They define it as

*“...the implementation by a public-sector organisation of new significantly improved operations or products,”*

and from definitions used in the business sector, in the Oslo Manual

*“An innovation is the implementation of a new or significantly improved product, good or service or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations”* Oslo Manual (2005, p. 47).

The first and second edition of the Oslo Manual used the Technological Product and Process (TPP) definition of innovation with organisational and non-technical innovations left to an annex. The third edition emphasises relations (called linkages in the Manual) with organisations and firms in the innovation process, and recognises that innovation can occur in services by modifying the framework's definition and activities to reflect these changes. Relationships (linkages) are emphasised with the rationale that

they enable knowledge flows between the participating firms and organisations. It is recognised that a range of interactions are likely from distant exchanges to close collaboration.

The definition of innovation is also expanded in the third edition reflecting the need to widen the scope of innovation to services. It is also acknowledged that innovation in services is different from that in manufacturing industries and again includes updates to reflect this realisation.

Innovation policy is seen as an amalgam of science and technology policy and technology and industry policy. Innovation is also seen as a complex and systemic phenomenon requiring a systems approach to understand it. The Oslo Manual identifies four types of innovation, product, process, organisational and marketing innovations. The Oslo Manual's four types of innovation are aligned with the commercial or private sector, unlike, for example, Windrum and Koch's innovation types that are derived from the public or service sector Windrum and Koch (2008).

It must be noted that the Manual's definition of 'product' encompasses physical product and service, a construct that is increasingly used in the literature.

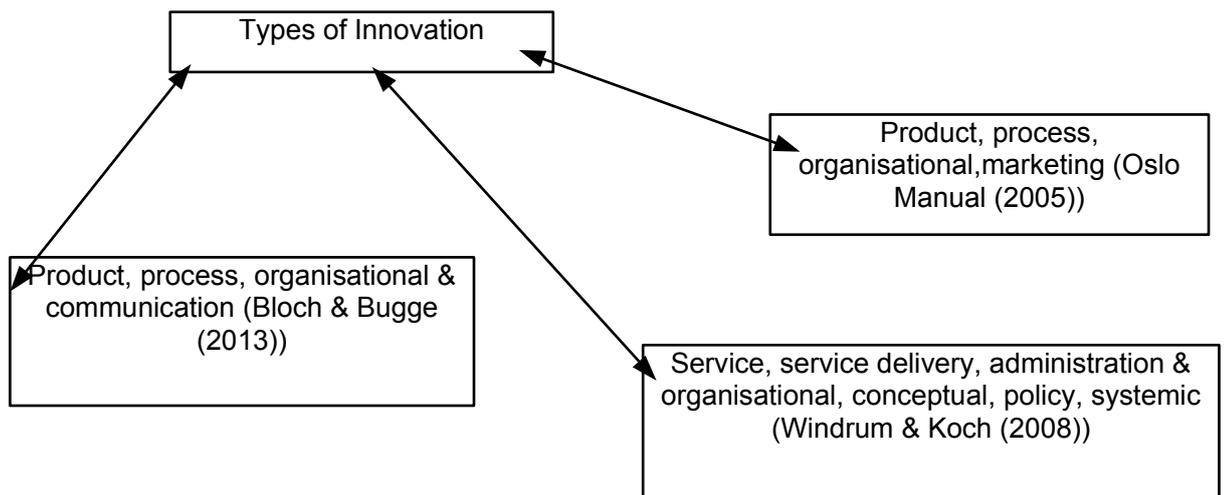


Figure 2.1: Types of Innovation

The concept of 'marketing innovations' is interesting in the context of public sector services, including as it does, changes in product design, packaging, product promotion and placement, pricing methods for goods and services.

Amendments have been made to the definitions used in the Manual. For example, "technological" has been removed because of a concern that it might be interpreted as meaning the use of high technology systems but which might not be appropriate for product and process innovations. This could be a problem as a result of combining physical product and service in the word "product."

Despite the UK government's insistence on innovation in public services, the OECD's observation that "*Public-sector innovation is rarely institutionalised in government budgets, roles and processes...*" appears to be equally valid. It could be argued that innovation is bought by the client during the procurement phase of the project and is therefore part of the product or service solution and if bid successfully, remains as a benefit throughout the contract term. It would not necessarily mean that no further innovation is possible during the contract.

The OECD has developed a means of classifying the elements of innovation processes in the public sector. The classification is used to understand how to support the development of innovation and to help assess the "as-is" situation. The trend for public sector partnerships with the private sector from PPPs to fund capital in addition to the construction and maintenance of services is also acknowledged by the OECD.

As noted from Osborne and Brown (2010) both types of innovation need to be accounted for in the reform or improvement of public services and as Bessant and Francis, (2004) argue that for firms the need "to learn how to manage innovation" is necessary, but two types of learning are needed which they call "adaptive" and "generative". Their paper focusses on firms

attempting to innovate in both process and product manufacturing. It may inform service delivery innovation that applies to both private and public sectors and potentially in this research PPP / PFI projects. These issues apply directly to the private partner who is still engaged with their industry and market sector but also engaged through their PFI projects, in a (relatively) long-term relationship with their public partner. A key point from this paper is to remind us that successful innovation “needs to get close to the customer.”

The approach described in the paper is for a stage gate, risk management approach that generally works well in stable or slowly changing conditions, “steady state” as referred to by Bessant and Francis. But what happens when there is abrupt or sudden change – discontinuous change? As Bessant and Francis observe in their paper, a serious challenge for the organisation is to be able to build and have the capability to deal with such discontinuities and to manage the threats and opportunities that they bring. One suggestion is to create a group whose role is to deal with these emerging situations, the so-called “skunk works”, a name that was used to describe the Research and Development offices founded by Clarence (Kelly) Johnson of the Lockheed Corporation. However, this does not fit easily with local authorities, although for the collection of all local authorities this may take the form of “pioneer projects” where one or two authorities pilot a project and share the outcomes and learning before the other choose to adopt the project for themselves. The paper proposes that two types of learning are needed by the organisation; for “steady state” conditions “adaptive” learning is more appropriate while for discontinuous innovation a “generative” approach is needed.

### **Innovation in Enabling Technologies**

The preliminary stages of this research revealed the significant use of new technologies. One technology area would not immediately be thought of

as having anything to do with lighting and particularly street lighting. This technology is the Internet of Things (IoT).

### **A Brief Summary of Disruptive Innovations in Lighting**

Street lighting has some notable disruptive innovations from no lighting at all to oil lamps and in the late 1700 early 1800s with the introduction of gas lighting in Pall Mall London to the introduction of the first electric street lights in Godalming, Surrey in 1881 that depended on the world's first public electricity supply from the water-powered Godalming Power Station also established in 1881. The development of the public electricity supply enabled the introduction of street lighting in Godalming and illustrates that there are dependencies that lead to innovations creating further innovations in different applications, which leads to the growth in technological changes that are rapidly emerging. In terms of technology, Boyce points out in his editorial that there are a number of endings in the lighting profession and its technology, the end of an era fast approaches and the end of an era often heralds a new one, and for lighting this is the introduction and adoption of solid-state technology Boyce (2015).

This is the exploitation of local wireless technology used to connect each street light in a network, thus enabling central control of lights for dimming, switching off or on as required and for data collection and analysis to aid performance and diagnostic purposes. If a light has failed, notice of this is achieved through the network and a repair team can be dispatched. The lighting units themselves, in practice called “luminaires”, use current lighting technology that enables dimming and exhibits a “white light”. This has important implications for safety, as it can be demonstrated that human colour discrimination and reactions are better in white light as opposed to the “orange/ yellow” light of the older low energy sodium lights of the previous generation of street lighting Well-Lit Highways (2004).

Gil-de-Castro et al. (2012) acknowledge in their LED power quality comparison paper that lighting in cities is recognised as a “basic and vital service for city councils and public administrations.” The authors note that high-pressure sodium lamps are currently the main types of lamps used in public lighting.

Belmans et al. (2004) prepared a report for the Union of the Electricity Industry - EURELECTRIC and the International Union for Electricity Applications (UIE), with the primary purpose of raising awareness, of the significant benefits of electric technologies and their energy savings potential. The report showed that between 30% and 50% of electricity used for lighting could be saved by investing in energy efficient lighting systems. In most cases, such investments are not only profitable and sustainable but also improve lighting quality. In the “Street Lighting” section of the report, policymakers are informed that the benefits employing more efficient lighting systems besides energy efficiency, are environmental, by reducing light pollution, financial cost reduction and simplification of maintenance, safety improvements of driver and pedestrian safety and decreases in crime and the aesthetic considerations of improvement of urban scenery and better colour rendering. It was noted that LEDs were an exception in that they would be widely used in the future.

The current capabilities of the Internet (Business to Business (B2B) applications, social networking, browsing the web, emailing, including “smart” physical objects known as the Internet of Things (IoT)) represent another illustration of the dependency among innovations, one innovation leading another innovation. Use of the IoT in street lighting is described later in this chapter.

The introduction of new street lighting sources and the ability to reduce lighting levels mean that new assessments will be needed to ensure that levels are no worse than the older systems being replaced and that

dimming does not reduce lighting to impractical levels. Such assessments will need to consider changes in lighting level assessments.

Research in photometry by Berman (1995) has shown that the appropriate mode of vision needs to be taken into account when evaluating lighting and lighting levels. Three modes of vision have been detected in the human eye, photopic, mesopic and scotopic vision, whose functions depend on the types of cells in the eye. Two types of cells are found in the human eye, namely cones and rods. Photopic vision is enabled under well-lit ambient lighting conditions, its function depending upon the cone cells of the eye. Mesopic mode functions in lower levels of light, relying on both cone and rod cells. Scotopic mode vision functions in very low levels of light and are mainly due to the rod cells in the eye. The effectiveness of lighting is measured using photometry tools such as luminance meters. Photometry aims to measure light in close correlation with human vision. Therefore, when evaluating the effectiveness of street lighting systems using photometric measurements, care is needed to use the appropriate conversion factors to account for the scotopic mode functions and the prevailing lighting conditions when measurement is made. This process is described in Berman's research, Berman (1995).

Another, completely different approach, but again a technological diffusion, stems from the Highways Agency commissioned research

*“... To identify sustainable solutions to minimise the energy used to light traffic signs without impeding their performance or comprising road safety”*  
Atkins (2010).

Although, a quite technical paper in places, this research is readily accessible, and it illustrates well the large range of technologies and approaches that are brought to bear on the positioning, lighting and the materials used in road signs. Using reflective materials or coatings, use is made of the ambient light available to illuminate the signs. The ambient

light may come from car headlights or street lights. The reflective material technologies may have potential in street lighting, but this appears to be an as yet un-developed application.

### **The Internet of Things**

In their editorial to “Computing”, Feki et al. (2013) express the view that the Internet of Things will become, if it is not already, the next technological revolution, enabling as it does a number of research disciplines and technologies to connect and interact with physical objects in the real world. The potential of this is to bring researchers and practitioners from business, industry, and government to explore and exploit the potential this new technology may bring.

Taking an ‘in the beginning’ approach to IoT, Greengard (2015), in his book “The Internet of Things,” begins with personal computers and the Internet, and assuming the earlier phases of the development of computers and software are already sufficiently mature and reliable to sustain the development of IoT. The significant achievement of his choice of phase is that it enabled large-scale real-time communication and data sharing. As will be seen a governance system and standards are still evolving for IoT.

From that start point, the rise of mobility and cloud computing establish both a conceptual and practical framework that enables global connectivity. When thinking of mobility, one should consider mobile ‘phones, whose capabilities have moved on beyond the simple person-to-person communication. These devices have a variety of semiconductor chips that can record voice, video and data, motion, location and importantly, the ability to connect to other machines. By means of these devices, new types of data can be collected and recorded and used to correspondingly create new information and knowledge. Greengard does offer a word of caution, more a reminder, that this remarkable technology

will bring as yet unimagined benefits, but it will also bring many unintended consequences not the least of which is a plethora of abbreviations and acronyms. Ones worth mentioning as they are likely to be used here are machine to machine (M2M); human to machine (H2M); and machine to smartphone (M2S).

What governance systems and standards prevail for the emerging IoT networks? Apart from a standard promoted by the Institute of Electrical and Electronic Engineers (IEEE), and the potential of exploiting this technology, there is currently no agreement on how such a global infrastructure can be realised although Almeida et al. observe the technical literature is replete with the engineering, emerging standards and technical aspects of IoT. However, there is a paucity of studies on the social and political fields according to Almeida et al. (2015).

In other words what type or kind of architecture would bring all the devices together into a coherent whole. The IoT has taken some of its inspiration from radio frequency identification (RFID) technology. In the supply chain of a wide range of goods, it is almost taken for granted that the movement of the goods will be monitored and tracked. This is achieved by means of uniquely identifying objects, humans, or animals. Anything that requires tracking can carry a chip or a tag in the form of a label or card that enables movement of the tagged object to be detected. Addressing is a standard governed by the Internet Protocol (IP) that has enabled the use of computing devices such as mobile telephones. The protocol defines the format of the data packets, sometimes called datagrams, which are exchanged between computers. The standard IPv4, i.e., Internet Protocol version 4, has been updated to IPv6 to allow for the increase in address space that IoT needs.

Kortuem et al. (2010) use RFID technology as a working example of the emerging capability of IoT. They show that the RFID system architecture has two major structures formed from simple RFID tags and a large set of

RFID readers. It is using these simple objects that enables goods movements within warehouses to be tracked. By increasing the power of transmission and reception and using different sensors the systems can monitor environmental conditions such as air quality or salinity or contaminants in rivers and streams. Three smart-object types are identified in this paper. A smart object is an autonomous physical device that carries a sensor (or sensors), has data processing logic and software code and can be connected to a network. These devices are considered the building blocks of the Internet of Things.

The object types are *activity-aware objects*, *policy-aware objects* and *process-aware objects*<sup>1</sup> which the authors believe “*represent fundamental design and architectural principles*” Kortuem et al. (2010 p. 45).

A European Commission study published in 2013 identifies the possible IoT governance systems European Commission Report (2013). The report is not a formal official position of the European Commission and concluded that there is no consensus found for the need and coverage of public intervention by IoT governance. The report also observes that at this early stage of IoT development, inappropriate governance may hinder development and calls for flexibility in policy intervention. This is not to suggest a lack of control because there is a necessity to protect end-users' rights such as data protection, but with rapidly forming installations estimating 25 billion devices in 2015 and rising to 100 billion within a few years, concerns over safety, security and illegal exploitation are emerging from deployment of this technology.

IoTUK, the British Computer Society and the Chartered Institute for IT commissioned the RAND Corporation to study the need for support for a process that by feedback to policy thereby would inform the development and uptake of IoT in the UK. This stems from the recognition that IoT is the

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<sup>1</sup> Activity aware objects can record data and process to produce information about work activities. Policy aware objects are activity aware that can interpret events and activity with respect to the compliance with organisational regulations or safety policies. Process aware objects have basic roles in industrial and manufacturing operations.

basis for strategic-level infrastructure and the impact that this has on economic growth (RAND 2016). This report concludes that IoT is developing with great rapidity, but is not yet stable or mature and this is the right time for policy to shape IoT development. One of the case studies used in the report to demonstrate IoT in action is the smart street lighting project on the south coast and is the subject of this research study.

Many IoT systems will not be accessible by the public because they are running on an Internet called a wireless personal area network (WPAN). The standard for WPANs is met by IEEE 802.15.4 that defines the physical and media access controls IEEE (2011). The standard is called Zigbee® and is developed by the Zigbee Alliance of some 400 member companies and organisations. If IoT is to be as pervasive as Feki et al. suggest it might not be unreasonable to consider that it should be able to support or host business models and perhaps point the way to new business models in the future.

Dijkman et al. (2015), like many others, refer to the current phase of exponential growth of this technology. How can the technology be exploited for business purposes? From a short review of IoT business models, they drew up the following list of components that appeared in the models: *Key partners, Key activities, Key resources, Value propositions, Customer relationships, Channels, Customer segments, Cost structure, and Revenue streams.*” (Extracted from Dijkman et al. 2015, Table 1 p. 674).

Almeida and colleagues offer four principles to assist in developing and deploying IoT applications. The first of these deals with 'notice and choice', which in implementation takes the form of a statement and a menu that the end-user can choose their required option. The immense number of sensors suggests that implementing notice and advice applications for IoT may be a significant problem. Another principle is 'data minimisation.' This is about the protections needed to ensure that as

little personal data as possible is collected. This is in direct contrast with the IoT capability which is to collect as much data as possible. A third principle, allied to data minimisation, is to regulate who can gain 'access to personal data' and the rights of end-users or subjects who are represented by the data. Finally, there is the principle that recognises the need to ensure accountability to safeguard the data and the event of data misuse.

Miorandi et al. (2012) report that the IoT research communities are somewhat fragmented and this may hamper the successful exploitation of IoT technologies. However, this fragmentation could be expected at this early stage of development and as other communities and applications are exploited, wider cross-collaborations will ensue.

However, from a governance perspective, IoT is best integrated with Internet governance rather than managed as a separate topic, for example through the Internet Governance Forum (IGF) or the World Wide Web Consortium W3C, and as these authors succinctly point out

*“Privacy and ethics aren't natural aspects to be considered in technology's agenda” Almeida et al. (2015 p. 58).*

In terms of the street lighting case, these design and architectural principles are represented by the activity-aware lighting operations of switching on and off, dimming and collecting data such as “on-time / off-time” and energy consumption. The policy-aware principle is found in the dimming regime to be operated.

A wide variety of research challenges are reported by Miorandi et al. in their 2012 paper, from the development of the means to embed computing, communication and identification technologies into common everyday artefacts to scaling issues related to large distributed systems. Of concern are the issues surrounding data integrity, security, and privacy. For example, the IoT can significantly contribute to the trend to support

patients in their own home by monitoring relevant health parameters and sending that data to remote aggregators for medical analysis and treatment recommendations. That private data must have protection against misdiagnosis, confusion with other patients and exploitation by criminal elements. The large quantity of data that is produced by and with IoT suggests that we are on the verge of innovation in many applications and services. In terms of road and street lighting, the security issue is that any illegal access to the network (commonly called “hacking”) would at least take the form of denial of service, i.e., turning the lights off.

None of the above will be possible until standards have been agreed and universally adopted. One area of a lack of standards reported by Miorandi et al. (2012) addresses those related to data models, ontologies and data formats that are likely to be used in IoT applications. These are essential to ensure operational service-level interfaces between devices. A few of these have been agreed such as the Internet Protocol and Zigbee described above, and as will be seen, are in enabling the control and operation of the street lighting networks.

McKinsey and Company commissioned Osram, a company that designs and manufactures lamps and lighting sources, to research the global lighting market. The purpose of the commission was to provide an independent view of the extent of the whole lighting market and its future trends. McKinsey, in their report on the global lighting market, state that the lighting industry is facing “fundamental disruption...along the entire value chain” due to the rise of Light Emitting Diode (LED) technology McKinsey (2011). The growth here will be significant in the domestic lighting sector; however, LEDs are also being introduced into street lighting applications, in particular for illuminated signs and bollards. Street lighting applications are positioned within the ‘Outdoor’ sector, which the report estimates in 2010, was 7% of the total market. By 2020, the market share is expected to rise to 11%. The major light sources in the outdoor segment are High-Intensity Discharge (HID) and fluorescent lamps. HID

lamps are mainly mercury vapour, metal halide, high-pressure sodium and low-pressure sodium. Lighting fixtures have also changed to accommodate new lamp designs.

Shaw (2014) observes the politicised nature of street lighting provisions emerge from technological developments, the austerity politics stemming from the global financial crisis and the devolved ecological responsibilities and therefore asks - should streetlights be dimmed or not. The paper shows that technological developments, namely the change from high pressure sodium SON lighting sources to LEDs, present local authorities with the opportunity of meeting some financial and ecological responsibilities. The study notes that local authorities in PFI contracts would have to re-negotiate or amend their contract if LEDs were to replace their recently installed SON infrastructure. Shaw's empirical examples are based on local authorities in the northeast of England where the uptake of LEDs was limited due to cost and although costs have fallen and are still more expensive than SON or CosmoPolis luminaires. The surveyed local authorities were prepared to experiment in some cases comparing luminaires as individual units or as whole streets with sample types and recognising that the new lighting technologies as a means of reducing light pollution. One Local authority in the northeast participates in Europe's Dark Sky Park (Kielder in Northumberland).

The significance of all these changes in technology to the current thesis is that the Central Management System, adopted by street lighting authorities has a high dependency on the development of innovative technologies and standards, and continues to depend on the development of a wide variety of components. The standards have taken a few decades to mature but lead to an innovative way of managing and controlling road and street lighting systems. The impact of IT in these PFI projects can be expected to displace jobs through automation, particularly those tasks of a routine clerical nature.

## **An Overview of the Central Management System**

What then is the Central Management System enabling monitoring, switching on and off, and light output to be controlled for individual street lights and the whole network? What has this to do with the Internet of things and therefore depends on all the innovations and technology developments presented in the foregoing? As described earlier the IoT is a collection of physical objects. These objects are connected together via wireless network technology and the Internet. Because of the potentially large number of objects that are likely to form a network, an essential element is an addressing system. Each item connected to the network or joining the network must have and does have a unique identification or address. This enables the item to share data and be controlled remotely through the Internet.

The South Coast Street Lighting PFI private partner is Scottish and Southern Energy. The design for the new lighting system included a central management system designed by Mayflower Complete Lighting Control. The components of this system are nodes, which can be either internal or external, antennas, sub-masters, the back office system and a socket (S6000).

The system holds a patent, number GB2372160. Figure 2.2 is a schematic of the configuration of the system.

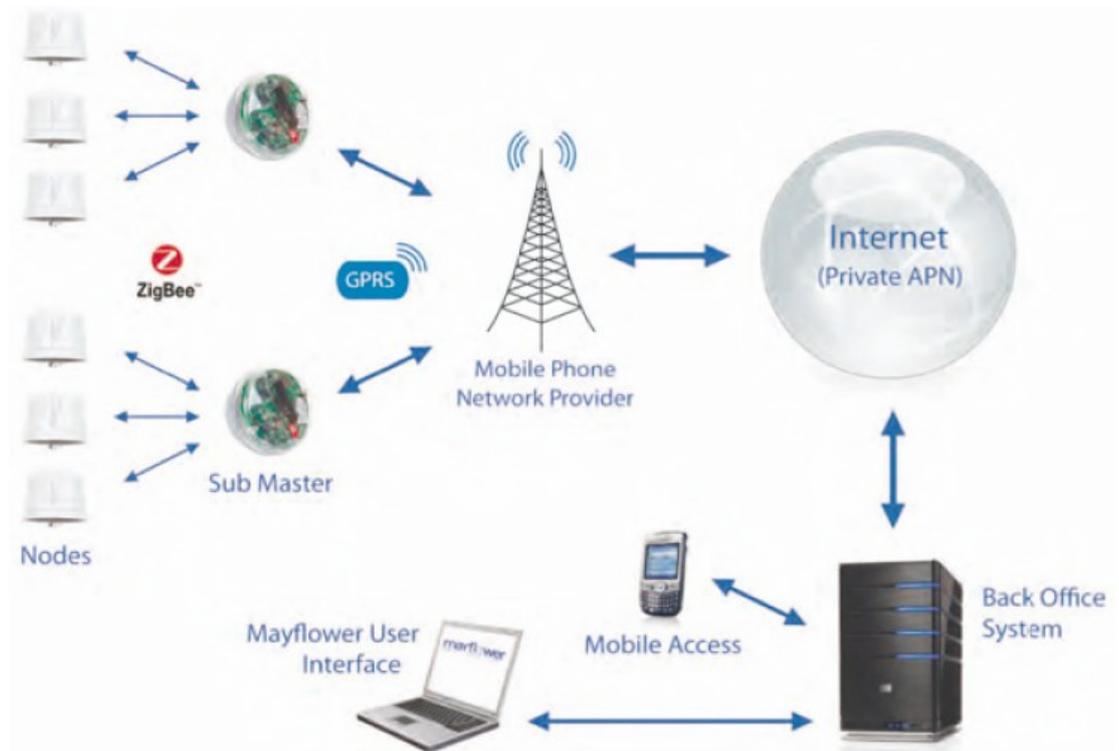


Figure 2.2: Schematic Diagram of the Central Management System (Acknowledgement to Mayflower Complete Lighting Control a trading name of SSE Contracting Limited.)

The growing exploitation of LEDs for domestic and exterior lighting comes with the benefits of reducing demand on energy and the associated contribution to carbon emissions. As is often the case, the Yin and Yan of benefits bring hazards that are still the subjects of research. In this case, the problems concern the photobiological safety of lamps and lamp systems. The concerns are based on the blue radiation frequencies emitted by LEDs that can cause retinal stress and in some instances behavioural issues in both humans and animals. Shang et al. (2014) propose that care is needed in the use of white LEDs that are rich in blue light frequencies which their research shows that chronic (long-term) exposure is likely to cause damage to the retina. Chronic exposure is a danger as LEDs are increasingly being introduced in domestic lighting applications. LEDs used in street lighting are likely to pose less of a risk,

except where street lights are situated directly outside residential properties.

As Feki et al. (2013) reasonably conjecture, IoT is likely to be the next disruptive technology after the World Wide Web, enabling as it does the means of interacting and controlling the environment through the embedded physical devices and the data that can be harvested. IoT could be considered to be a natural extension of advances in computing, the Internet and Information Technology forming a chain of innovation dependencies without which IoT technology would not be possible. The role of standards is notable as an important form of governance, developed from collaboration and voluntarily adhered to in product implementation.

One of the claims made in street lighting PFI business cases is that improved street lighting can and does reduce road accidents. Indeed this has been a feature of lighting the way for travellers for more than two hundred and fifty years. Contributing to these assertions is research from a number of sources, notably photometry.

From an innovation perspective, the adoption of PFI is expected and intended to achieve Value for Money through effective service delivery, change management capabilities and stronger community engagement HM Government (2012); HM Government (2011); Audit Commission (2007).

In terms of product innovation, the Central Management System (CMS) is the biggest single innovation that is applied to the management and control of the street lighting system, besides the adoption of PFI by the lighting authorities.

### **Chapter 3 Public-Private Partnerships and the Private Finance Initiative**

Following the product and service innovation literatures, attention turns to the innovation that is PFI. This is interpreted as an innovation, not because of the public-private relationship in the provision of public services for that is not new, but it is the policy to encourage and promote private finance in the provision of public services for that is new and as will be seen a new funding source for the lighting authorities.

In “A new approach to public private partnerships”, the capabilities of the private sector are seen as more efficient compared to their contemporary public service organisations and are not just restricted to technical and knowledge-based fields but project and risk management skills and the competitiveness necessary to survive in the marketplace (HM Treasury (2012b)). Furthermore, if the private sector’s ability to finance, or arrange finance, is harnessed together with asset ownership, then the prospect of off-balance sheet accounting arrangements becomes hard to resist.

Before looking at the UK PFI programme, Public-Private Partnerships are considered by opening with the assumption that Public-Private Partnerships are a relationship between a government and a private company, governed and defined by contractual and legal arrangements, with the purpose of delivering public services such as infrastructure, housing, health, education, transport, energy and defence.

The capabilities of the private sector are not just restricted to technical and knowledge-based fields but include project and risk management skills and the competitiveness necessary to survive in the marketplace. As HM Treasury stated it “Successful Public Private Partnerships (PPP) enable the public sector to access the discipline, skills and expertise of the private sector” HM Treasury (2012b). Further the public sector is seeking to access private sector management and expertise to drive value for money HM Treasury (2008)

Furthermore, if the private sector's ability to finance, or arrange finance, could be harnessed together with asset ownership, then the prospect of off-balance sheet accounting would be hard to resist.

Risk management was seen as one of the ways to determine value for money if shared between the public and private partners, but as will be seen in the next section, Private Finance Initiative, the distribution or transfer of risk is not a trivial matter and has attracted considerable criticism.

A definition of Public Private Partnerships, is stated by The World Bank in their "*Public-Private Partnerships Reference Guide*", and can be used to compare it with the assumption presented above,

*"A long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance"* World Bank (2014).

The differences between the assumption above and World Bank definitions are that the formal statement includes risk, responsibility for management and payment dependent on performance as the burden shifted to the private sector. The World Bank definition might leave an impression that the private sector is the dominant partner, however, the public sector still should lead a collaborative and monitoring role.

The World Bank guide has three main parts. The first deals with the basics for readers who need to know more about PPPs, how they can be used and the benefits and risks. The second covers developing a PPP framework for PPPs by developing policy to the financial management and is therefore aimed to inform government and finance officials. The third part covers the implementation of PPPs. Throughout the guide a useful parametric form is used to describe PPPs. The broad parameters cover

the type of asset or service involved, what functions the private organisation has responsibility for and how the organisation is paid for the work or services they provide.

### **The Private Finance Initiative.**

The Private Finance Initiative in the UK is a variation of PPP. Wall and Connolly (2009) admit that their statement to capture the essentials of PFI is simplistic, but it is helpful to gain a broad view of the approach:

*“In simple terms, PFI involves defining the service(s) required; allocating the risk to the party most able to bear it; complying with a process; demonstrating VFM and relating payment to performance”* Wall and Connolly (2009, p, 709).

An important point in this statement deals with the allocation of risk that does not mean that the private partner takes on the risk burden for every aspect. There are certain risks that the private partner should not be expected to bear such as changes to the PFI that arise from changes in regulations, and central government legislation that could not have been reasonably anticipated during risk management.

Wall and Connolly accept that PFI is now very well established since its launch in the UK in 1992 and remains operational with new projects still being approved. They therefore conclude that there is value in further study, suggesting four research themes such as the various stakeholders, changes to PFI, other areas and asking is PFI the only option for infrastructure projects? The “other areas” theme potentially covers a broad range of topics including for example, to determine whether cash or accruals-based accounting systems result in different decisions or have an impact on the PFI attractiveness of PFI. It is curious that PPP / PFI is exploited in some regions and not others, what causes these differences and what are the differences between countries, what effect has the “credit

crunch” had on PFI uptake and what is the view of PFI from the perspective of the various stakeholders? Note that governance and innovation are not included although economic issues and changes to PFI are clearly matters for governance consideration. In relation to procurement for infrastructure replacement, renewal or new additions, PFI is only one of the procurement options available to public organisations and is not mandated by central government.

Wall and Connolly show simply that as PPP / PFI in the UK has matured, a new research agenda needs to be considered and the subject of this research would fit under that umbrella.

PFI was justified on the basis of offering value for money, but Wall and Connolly observe that if risk transferred to the private sector is not managed effectively, there will be an additional premium paid to cover the additional costs the risk may incur.

If innovation is expected to contribute to PFI products and services, then it is essential to have an appreciation of factors that encourage or inhibit innovation. For example, Eaton et al. (2006) describe a critical evaluation of innovation stimulants and impediments in the published literature of the construction industry and opens with a statement that organisations achieve their competitive advantage from their economies of scale and access to capital, but ask if this is sufficient to survive in an increasingly competitive marketplace? Survival is increasingly seen to depend upon creativity and innovation as an essential capability. The paper notes that,

*“A critical factor claimed for PFI is the ability to bring innovation into project delivery”* Eaton et al. (2006, p. 64).

At the time of the publication of the paper, there had been little research that could confirm or refute the claim that innovation for the PFI process was or was not achieved. There was evidence from Eaton et al. that

management behaviour patterns had not changed despite the different procurement approach under PFI.

Albury (2005) discusses the issue of what innovation means in the context of public services and acknowledges that there is a plethora of varying definitions. Albury takes as a working definition:

*“Successful innovation is the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes, efficiency, effectiveness or quality”*  
Albury (2005, p. 51).

Albury also proposes that the low level of research in innovation in public services might be due to the apparent low level of innovation in public services. The majority of innovations are not radical or systemic, but are just as important as incremental changes and adaptations to existing services or processes.

Eight impediments to innovation are identified by Albury from McCormick et al. (2003) and all but two map onto the list of twenty-two identified by Eaton et al. (2006). The exceptions noted by Albury are an over-reliance on high performers to be the sources of innovation and a reluctance to close down programmes or organisations that are failing. However, some care is needed in making this comparison since Eaton et al. were studying the pre-contract phase and Albury may have considered a wider view that is not clear from the article.

Albury asks *“Are there innovation advantages from greater scale and scope of a number of organisations operating within a common management and governance structure?”* Albury (2005, p.56).

Albury states that one size fits all services are not suited to an increasingly diverse and heterogeneous society whose expectations also seem to be increasing. It could be argued that street lighting is a one size fits all

service and in previous generations of lighting systems this was certainly the case, but can this be assumed for this new generation of lighting systems?

Impediments to innovation or the 'stifling' effect of PFI itself on innovation are amply illustrated from the results of a series of case studies by Barlow & Köberle-Gaiser (2009), drawn from the construction industry, of work in the NHS. Barlow & Köberle-Gaiser focus on the implication of PFI on innovation in the NHS infrastructure programme that parallels the NHS reform. Again PFI is seen as a means of increasing innovation into hospital infrastructure delivery in the UK. From the study of six cases it was argued that the introduction of PFI has only served to increase the complexity between the delivery of the hospital and its operational functions, with a consequence that innovation outcomes are impeded. Furthermore, PFI did not necessarily offer improvement in efficiency. It was suggested that a delivery model that included incentives for the private partners might be a means of exploiting the innovative capacities of the private sector, although no indication of what form these incentive mechanisms might take is offered in the paper.

De Zoysa et al. (2006) present a more optimistic view in their research in showing that innovation in PPP projects may be achieved by replacing the more 'traditional' design-bid-build (DBB) type of procurement by an innovative procurement mode. A transportation project is reviewed in detail revealing four types of innovations covering product, process, organisation-contractual and financial-revenue innovations which the authors use to assist in their analysis. These authors note that in addition to the debt plus equity cost of the private sector capital used to contribute to PPP/PFI projects, there are additional costs needed by the public sector who make use of legal, technical and commercial advisors. These contributing costs from other specialist sources are also observed by Ball et al. (2000) who note that the unitary charge covers the capital, revenue and financing costs of the PFI. In addition, the cost of the bidding process

may be such that local authorities are encouraged to bundle like projects together. An implication of this is that PFI may only be applicable for large capital projects. There is an expectation however, that the costs of financing and bidding may be offset by benefits such as the potential for innovation in construction and operational processes leading to further value for money benefits. Critically, De Zoysa et al. (2006) observe that opportunities for economic savings are not significantly different between "traditional" contracting and PFI/PPP contracts as the marketplace actors i.e., private firms are mainly the same companies. What would encourage these companies to innovate?

De Zoysa et al. present a few of the more prominent definitions of 'innovation', but note that such definitions invariably relate to individual firms or organisations. However, PPP/ PFI contracts are more likely to have consortiums as the private partner. As will be seen from the empirical study data, both public and private sector actors employed advisors.

Froud (2003) presents a simple and effective exposition of the logic of PFI. PFI at its simplest is a contractual approach that provides public services, keeps the assets involved off the public balance sheet while allocating risk to those better able to bear it and offering value for money. As shall be seen, at least one of the authorities studied in this research, retains the assets throughout life of the contract. The essential point is that the private sector provider or shareholders will require a profit from the finance they break and the service they provide. Value for money can only be achieved if these additional costs are offset and exceeded by any savings brought by the innovation marketplace competitive efficiency and risk transfer to the provider. In the paper, Froud is concerned with understanding how the policy of risk transference in PFI secures better management and lower costs than "traditional" contracting arrangements.

Included in Froud's paper is a section discussing the usages and concepts of risk and uncertainty, an essay essential to the development of her

analysis of risk in PFI. Uncertainty however, cannot easily be assigned a probability, and therefore a full contract covering every eventuality cannot be established. This is an argument made previously by Keynes (1973, p. 213-214).

The paper notes that the risks that can be quantified, that is, assigned a probability. Realisation and mitigation costs may be calculated and serve to increase the cost of the public sector comparator as it is a cost that would have to be accounted for in the comparator if the risk was not transferred out to the private sector with the result of reducing the benefit of the PFI.

The ideas underpinning PFI are to develop contracts whose purpose is to apportion and allocate risk, promote and achieve value for money and to keep assets off the public sector balance sheet by transferring risk from the public sector to the private sector thus providing better management and lower cost services. Froud also notes the emphasis made by the Treasury on how important projects and contracts should not be over-specified if costs are to be reduced by allowing the private sector opportunities to innovate Treasury (1997, p. 23); Treasury Taskforce (1997, p. 9); Froud (2003). Not all risk in a project need be transferred but that which the private sector is the best able to manage Treasury Taskforce (1997, p. 10). This requires a technical assessment leading to the quantification of identified risks. For example, one of the risks could be that of project financing by the private partner, the value of which is used to justify the PFI, resulting in a circular argument to justify adopting the PFI which is based upon the ex ante justification and the ex post facts dealing with the same event risk value Froud (2003) and Freedland (1998). Froud quotes Freedland who argues that the justification for adopting PFI is supported upon a set of ideas rather than a distinct set of rules of operation (Freedland 1998, p. 289).

Froud summarises by saying the logic of PFI as contractualised risk transfer thus raises a series of questions, not only about the technician problem of measuring risk, but also about what is counted as risk and

whether risk transfer can and does genuinely take place. In effect, can the contract really protect the public interest via a risk transfer mechanism and what are the implications of ignoring uncertainty Froud (2003, p. 578)?

One approach to risk mitigation is to employ standard types and documentation for PFI projects. The UK PFI model admits of a variety PFI types such as

Design, Finance, Build, and Operate (DFBO),  
Design and build (DB),  
Facilities Management (FM),  
Operation and Maintenance Contract (O&M),  
Lease Develop Operate (LDO),  
Build Own Operate Transfer (BOOT), and  
Build Own Operate (BOO).

These types are found in use wherever the PFI model is adopted. The most common PFI model found is the Design, Finance, Build and Operate (DFBO) type. The street lighting PFI uses DFBO model which means that the private supplier designs the new and replacement lighting systems, arranges for them to be built (manufactured), installed and commissioned, brings finance into the service and operates the service for the duration of the contract. At the end of the contract, responsibility for the assets is handed back to the commissioning authority unless they enter into another contractual arrangement.

In the turn between the first and second decades of UK PFI projects, interest, and concerns were emerging from all quarters, academia being no exception, regarding value for money. Ball et al. (2000) in their paper and in this context inquire if PFI was an advantage to public finances or was it going to be a burden for many years to come.

The paper has a detailed discussion of additionality, value for money and risk transfer. Additionality, is a term that appears frequently in the

documentation of that time is understood from a question posed by Ball et al., that is

*does the use of the PFI allow a higher level of capital investment, ie is it additional to the level of traditional infrastructure procurement?* Ball et al. (2000, p, 97)

For completeness, the other questions Ball et al. ask are querying the use of PFI in terms of allowing better value for money to deliver more with the available level of finance than might otherwise have been possible and if risk be effectively transferred to the private sector given that this is a critical VfM test, and if it can - how?

Achieving value-for-money requires performance monitoring to demonstrate that the service delivered is aligned and consistent with the output specification. There is no simple or single view of the contributing factors to value for money as Robinson & Scott (2009) show in the literature they review that ranges from risk transfer considerations to the high bidding costs of PFI to no standardised methods to identify and estimate the value of risks. The point these authors make about examining service delivery is obvious in that the only way service delivery can be effectively explored is during the operational phase of the PFI, but until the publication of this paper, service delivery and performance monitoring had not been addressed in the literature.

Robinson and Scott describe the function of performance evaluation in terms of the Kunz and Pfaff (2002) definition which is (1) to control discretionary behaviour aligned to incentives, and (2) to evaluate contribution to the output and (3) determine compensation based on performance Robinson & Scott (2009) and Kunz and Pfaff (2002). Robinson and Scott found that the public clients felt that PFI was not flexible and that any changes needed would cause additional costs. Additional costs are incurred by the public sector for performance monitoring. For minor contract variations, performance deductions were waived by the public client in the spirit of partnership. It was clear from

Carrillo et al. (2006) hat both public and private sectors underwent a learning process and there was knowledge sharing. Carrillo et al. present a knowledge transfer framework which has three stages. The first stage assesses the opportunity for PFI participation and the for knowledge transfer. The second stage is concerned with taking the results of the assessment to develop a knowledge map and the capabilities for knowledge transfer. The third and final stage is concerned with learning by implementing a strategy for knowledge transfer and learning.

However, given the inability to quantify risk transfer, it is surprising PFI became established, for, assuming the private sector placed a bid under these circumstances, it is unlikely that the bid would have been lower in value than the public sector comparator. For our street lighting examples, the technical risks associated with the new lighting technologies and systems could be identified and quantified enabling ready acceptance of the associated risks. Identifying other “risks” associated with central government policy changes fall into the uncertain category where quantification has no foundation. The reform of the PFI model does take government policy changes out of the transfer on the basis that such changes are beyond the control of the private sector and should not be transferred as noted earlier by Wall and Connolly (2009). The technician approach still prevails in this revision by assuming that these risks can be quantified, but the likelihood is that the public sector will just have to bear the cost or “do without” in the event of policy change.

In the early days of PFI, the Treasury Taskforce offered outlines of groups of risks under such headings as design and construction, commissioning and operating, demand, alternatively volume or usage, residual value, technology and obsolescence, regulation which also included taxation and any required planning permission, and project planning Treasury Taskforce (1997, p. 11). For example, considering the residual value, technology and obsolescence group in the context of the street lighting PFIs, there is clearly a risk with respect to the technology given the rate of

change in physical and software components such as those in the CMS and IoT. The Treasury Taskforce (1997, p. 11-12) viewed “technological risk, associated with obsolescence of both the service and the function of the assets themselves, is not usually significant outside IT-based projects”.

Concurring with Robinson & Scott for the need to monitor, Nisar (2013) presents an argument that PPP projects need to account for three essential aspects of a PPP project design. Using transaction cost to offer a theoretical justification to use the private sector in PPP projects, Nisar notes that the basis of the relationship is one of communication and collaboration and is therefore not hierarchical. This would be a critical success factor and should be looked for in the empirical domain. The developed framework has three main attribute areas, project design, partnership management and performance measurement, and 28 topics to consider. Elements of this could be useful input to the empirical data analysis in this research, selected from Nisar's framework by a filter developed from the other literature in this review. Nisar did not use all the factors in the framework when assessing the data from the three case studies used in his research, instead concentrating on risk transfer, the whole life approach, and managing partnerships.

An important factor found by Nisar is that all three cases in the research had adopted a whole life approach. The outcome of this is the contractors' obligation to maintain the buildings (in the cases) to agreed standards for the life of the project. Failure to meet the standards would cause penalties to be placed on the contractors thus incentivising them to include design feature and their facilities management capabilities into the construction phase.

All three of the contractors in the cases exhibited reduced levels of management systems together with formalised relationships through boards. One of the cases Nisar reports had included in their governance system, "extensive monitoring and control systems" with broadly similar

controls in the other two cases. However, two of the cases had not implemented effective reporting systems. Nisar does not seem to make a strong distinction between governance and project management. It is acknowledged, however, that a PPP project's "strategic framework must also promote the best value through the management of whole-life costing, involving service improvements and innovation". As a suggestion for completeness it could be added that a strategic framework is a governance instrument providing overarching direction and guidance for the project.

In terms of risk transfer, HM Treasury ratifies risk transfer of PFIs in England from audits conducted by external auditors. For example, an audit study report prepared for the Treasury estimated average savings of 17% in a series of PFIs. Ball et al. (2000) found nearly half of the PFIs they studied did not include any risk transfer valuation in the Final Business Cases and thereby introducing an error margin into risk transfer valuations. Consequently, they urge a more cautious approach, recommending longitudinal or retrospective studies to evaluate the effectiveness of risk transfer realisation in the PFI projects studied previously. The research used economic modelling to obtain a view of the medium to long-term outcome to the UK economy of PFI. The conclusion of the additionality element did not find strong indication that PFI brings significant additional investment.

VfM was also indeterminate as the case studies in the research lacked innovation leaving further uncertainty of any gains to be had over the life of the contracts. Risk transfer with its attendant impact on value for money also left uncertainties given risk valuation inaccuracies. These researchers were unable to say if PFI represented a "*good deal*" as they put it, and were open to the likelihood that it may be a drain on future taxpayers.

A survey by Carrillo et al. (2008), of the state of UK PFI programmes in construction projects experienced problems ranging from lengthy bidding period resulting in higher bidding costs, low levels of PFI expertise in the public sector, little knowledge transfer between projects and a public who remained to be convinced that the private sector could achieve value for money. These and other problems were addressed in the 2012 re-launch of PFI as PF2 and following 20 years of experience and learning.

In terms of innovation, Carrillo et al. found that there was little conviction that both client and private organisations thought PFI delivered anticipated benefits. For example PFI was expected to achieve increased innovation. Carrillo et al. refer to the findings of De Lemos et al. (2003) who concluded that innovation in designs were achievable only if the contractor had higher control, but with less control only modest innovation was possible. A benefit of PFI was expected higher levels of innovation as a result of the consortia that was created during the bid phases. However, it is not unreasonable to expect that the private partner may exploit the tension between accepting more risk or taking a more cautious approach to the design, especially if they are to be the operator during the operational phase of the project, thereby making their task easier.

Demirag et al. (2004) observe that in the 10 years preceding the publication of their paper Public Private Partnerships had accelerated in use and noted that in the UK amid much contention, a PPP variant of the Private Finance Initiative saw increasing deployment.

Demirag et al. have included in their paper a framework or system to assist in UK PFI project decision-making, by evaluating the implications of accountability and value for money. They take as their definition of accountability its wider sense of "*the management of expectations of various stakeholders.*" They also take value for money decisions to be a stand-in for performance in PFI projects and thus link to or are a component of accountability. The purpose of the framework is to assist improved or better understanding of interactions between accountability

and value for money during the various stages of the PFI processes. Demirag et al. observe that while the PFI literature has studied and reported on accountability and value for money issues, this has been somewhat opportunist and ad hoc with few examining the PFI processes over the long term.

Value for money considerations by successive UK governments to use PFI to increase investment in infrastructure and to reduce public debt or at least to delay capital outlay has shaped the way VfM is viewed and has impacted the way the PFI projects have been driven and in turn this has had an impact on accountability according to Demirag et al. Accountability has a variety of types and purposes such as communal, contractual, managerial and parliamentary as Demirag and colleagues list and describe. In terms of VfM, it is not clear what the Treasury meant by VfM and importantly for whom it is to be delivered. Demirag et al. list seven publications studying PFI accountability, five of which were case studies and of the five two were case studies and interviews.

Demirag et al. depict the PFI stages, forms of accountability and the VFM drivers as a Table, reproduced here

<b><i>PFI Stage</i></b>	<b><i>Description of Stage</i></b>	<b><i>Forms of Accountability</i></b>	<b><i>Value-for-money (VFM) Drivers</i></b>
<i>1. Initiation</i>	<i>Treasury guidance steps 1-3 (see Appendix E)</i>	<i>Contractual</i>	<i>Consensus that PFI is cheaper than the PSC</i>
<i>2. Set-up</i>	<i>Treasury guidance steps 4-13 (see Appendix E)</i>	<i>Contractual</i>	<i>Fulfilment</i>
<i>3. Implementation</i>	<i>Treasury guidance step 14 (see Appendix E)</i>	<i>Managerial</i>	<i>Efficiency and effectiveness</i>
<i>4. Internal Monitoring</i>	<i>Progress of PFI contracts is monitored through operational review meetings with public sector project managers, private sector facilities managers and uses of the service.</i>	<i>Managerial</i>	<i>Efficiency and effectiveness</i>
<i>5. External Monitoring</i>	<i>NAO and Audit Commission assess PFI contracts for VFM. Findings are reported to parliament, representing public interest.</i>	<i>Parliamentary</i>	<i>Policy goal achievement</i>

Table 4.1: Accountability, VfM and the PFI Processes Demirag et al. (2004, p. 10).

Accountability is an important aspect of governance therefore the accountability identified in the PFI stages is a useful contribution to the governance system. Equally, standard or model documentation for PFI should also be a useful resource.

Experience of PFI from the construction industry and the NHS and construction innovation in the NHS reviewed earlier in this chapter, shows evidence from a series of case studies by Barlow & Köberle-Gaiser (2009), with a focus on the implication of PFI on innovation in the NHS infrastructure programme that parallels the NHS reform. Impediments to innovation or the inhibiting effect of PFI itself on innovation is amply illustrated in these case studies (Barlow & Köberle-Gaiser, 2009).

In 2011 a fundamental review and reassessment of the PFI model was undertaken. Included in this assessment were issues raised by interested parties from the public and private sectors, academia, the “third sector” and others in a call made by the Treasury in December 2011. The report “*A new approach to Public Private Partnerships*”, acknowledges the key criticisms of waste, inflexibility and lack of transparency in the UK’s PFI programmes HM Treasury (2011).

### **Reform of the UK PFI Model**

Following the 2011 review, changes to PFI were introduced in 2012. These changes do not apply to the target PFI project the subject of this study, but it has relevance to new PFI projects approved under the refreshed PFI model, now called PF2. The Rt. Hon George Osborne (2011) in his Written Ministerial Statement and the Treasury reform call, HM Treasury (2011) both stated that the existing PFI model should be reformed. In particular, and relevant to this study, the following statements were made that a future variant and improved PFI should be

*“...Less expensive and uses private sector innovation to deliver services more cost effectively”, and*

*“...has greater flexibility to accommodate changing public service needs over time. H M Treasury (2011)”.*

The first point is clearly a call for innovation, but is the private sector encouraged to innovate? If it is, how is this innovation encouraged? Secondly there is the realisation that change is inevitable. PFI contracts are typically let for a period of 20 to 30 years. It would be surprising therefore, if no change occurred during that time that changed or amended the original requirements. For example, changes to environmental regulations requiring further reductions in carbon footprint would likely cause re-assessment of street lighting with attendant implications for operational issues and the application of new technology.

In the 2012 “Autumn Statement” from the Chancellor, under the heading of “accelerating delivery and investment”, the publication of a new approach to public private partnerships was announced. This new approach is called PF2.

The revised PFI model has been designed to address issues identified from the public consultation of 2011, interested private and third sector companies and organisations, NAO reports, Select Committees and media reporting. Some key issues are summarised next.

The first issue concerns the delivery and investment in public infrastructure and services by continuing to invite private finance and expertise into the PFI marketplace. Next, the global and UK prevailing financial and economic situation requires measures to allow, account and manage these conditions. Prior to the review, there could be a period of four or five years from inception to achieving a full contract resulting in

additional costs and a reduction in value for money. The intention in the revised PFI model is to achieve a contract in eighteen months.

Lack of transparency concerns in PFI is to be addressed by publishing accounts and progress together with access for public scrutiny.

A weakness of PFI was perceived to be lack of experience or skills in the public organisations when procuring major infrastructure projects. To remedy this centralised procurement is to be adopted. The first programme to be dealt centrally in PF2 will be for the Priority Schools Building Programme. This will be handled by the Education Funding Agency, which is a central unit in the Department of Education.

Greater flexibility in contracts will be achieved by excluding certain services, for example, cleaning and catering services will be excluded from the PF2 contracts, but let on short-term contracts to permit flexibility. It will also contribute to managing performance in those service suppliers.

The Government will become a shareholder in future programmes with the intention of ensuring a collaborative approach to programme performance improvement and the management of risk. However, it is intended that the public sector will take on risk that protects the contractors from changes to the law and other provisions. The Government will take a share of the financial rewards of PF2 programmes as well as the private sector shareholders, which is a move toward gainshare.

Poor relationships between the public and private organisations has inhibited effective contract management, therefore a turn to relationship and collaboration management will be expected.

Further loss of effective contract management stems from restrictions to the contract that prevent alterations to the requirements during the operational phase of the project. A feature of PFI and the street lighting projects was a standard document in the street lighting projects procurement pack model documentation called "Schedule 18." Critically this document describes the terms of reference for a network board and

partnering facilitator. In clause 3.2 (d) of the Schedule, the board's accountability is stated formally as

*“3.2 (d) considering all issues related to innovation and agreeing recommendations regarding the implementation and monitoring of any innovation” (Schedule 18).*

An approach taken to augment the changes proposed to the PFI model is an intervention called Operational PFI Saving Programme or Operational Savings review (OSP / OSR). This programme applied to the existing PFI projects claims to have a total of £2.5 bn in saving and committed efficiencies. A sidebar in the report lists lessons from operational efficiency reviews. One of these quotes a review undertaken by a local authority and its PFI service provider which showed that investing to save in a CMS and LED lamps for its street lighting would deliver a significant reduction in energy usage H M Treasury (2012, Box 4.F, p. 53).

Augmenting the saving review is a voluntary code of conduct that public and private sector organisations sign up to thereby expressing their commitment to agree to identify and make savings in their operational PFI project (Infrastructure and Projects Authority, 2013). The public sector is expected to provide a single coordinating point of contact for the savings and encourages collaboration between the partners.

In *“A New approach to Public Private Partnerships”*, HM Treasury (2012), more detail is presented on the thinking behind the revision of the model. The basic theory is re-emphasised which is that there is a belief that the private market sector causes companies to be as efficient as they can be, and must always strive toward business opportunities when these are presented.

The reforms of the Private Finance Initiative model, now called Private Finance 2, should not be considered in isolation. Published in 2011, the Open Public Services White Paper is an expression of the prevailing

Coalition Government's intentions to reform public services in the UK HM Government (2011). The White Paper states that the Private Finance Initiative is seen as early progress in public service reforms, dealing with finance and brings many lessons to be learned from the 700 programmes undertaken to date. The White Paper says much about decentralisation and devolved powers, and mentions such enabling functions as the Localism Bill (2010). The reforms to public service are concentrated in three main categories of public service, namely, Individual Services, Neighbourhood Services and Commissioned Services. Individual services include education, skills training, adult social care, childcare, housing support and individual healthcare. Neighbourhood services covers maintenance of "the local public realm", leisure and recreational facilities, and community safety. Commissioned services include national and local services that cannot be devolved to individuals or communities, for instance, tax collection, prisons and emergency healthcare.

At the time of this review it was not yet clear how PF2 will contribute to the financing of new and existing programmes that emerge post the Localism Act, except to notice that it is with commissioned services that PFI/PF2 is likely to continue to be among the options available to support these programmes. The government continues to express a commitment to achieving private sector financial support to provide new and maintained infrastructure programmes. This is emphasised in this research, because it lends further impetus to researching sustaining innovation in the PFI life cycle.

The Standardisation of Contracts (for PF2) makes a claim that transparency will be improved if the public sector participates in project governance. It is not yet clear how this will operate in practice. Inputs from the call for evidence issued by the Treasury in December 2011 included a number of conflicting proposals. Some were supportive for public sector involvement in project governance. Others saw this need

only if public sector equity were involved. It was also considered that a liaison committee would be able to help with project governance.

A point to note is that in PFI, the organisation that managed the investment, designed the infrastructure or service, operated the service until the end of the contract is called the Special Purpose Vehicle (SPV). In PF2 SPV is used but more frequently called 'project vehicle', 'project', and 'project company'.

To summarise the PFI reform, the main points being addressed included

- A call for innovation,
- Delivery and investment in public infrastructure and services from private finance and expertise,
- Lack of transparency,
- Flexibility in what is contracted for,
- Invest to Save, and
- The private market sector causes companies to be as efficient as they can be.

HM Government (2012), HM Government (2011).

Leiringer and Schweber (2010) present the various arguments that expose the heavily contested arena of the benefits taxpayers gain from PFI. From this section of their article, this research notes the issue of shorter 'construction' times, widespread use of innovative solutions and the opportunities for the providers to adjust their organisational strategies and structures to benefit themselves from the opportunities presented by the PFI market and quote Saxon (2005) as '*The Private Finance Initiative (PFI), and its corporate counterparts, are opening up new business models for life-cycle value creation*'.

Leiringer and Schweber draw on neo-institutional and strategic change theories to assist their analysis of PFI firms. They note that "the extension of PFI logics to all projects, be they private, public or mixed" is called for by the PFI ideology, which calls for integration of the two environments.

This author agrees with Leiringer and Schweber in their discussion that this has yet to happen and shares their doubts that it will happen at all.

The case study used in Leiringer and Schweber's article is that of an anonymised PFI firm and was analysed from the viewpoints of asking if the business unit is semi-autonomous. The degree of structural integration and reputation were studied together with the nature of collaborative working arrangements. How the firm mobilised for service delivery and their long-term commitment to PFI undertaking or business were also scrutinised.

Further research is suggested in this article because it is not clear how the construction sector has changed as a result of PFI. There is a need to explore practices such as 'collaboration' and 'service delivery' rather than pursue a line of research and analysis based on a theoretical model that takes two viewpoints of fragmentation versus complete integration.

A conclusion of this article is to argue for more empirical case studies designed to capture PFI practices, to expose and provide understanding of

- How particular mechanisms vary across cases,
- The range of different forms that practice has taken, and
- The effect of environmental constraints on the practices.

The advantage of this approach the authors contend is to be more applicable to PPP projects in general.

However, perhaps a shortcoming of the approach taken by Leiringer and Schweber is the concentration on the private organisations involved - the PFI firms - and raises the question would it not be better to look at the PFI as a whole, i.e., both public and private partners that would facilitate the generalisation noted previously?

To summarise this chapter, the financial burden of maintaining renewing infrastructure coupled with government reforms leading to leaner and more efficient governing arrangements, it follows that new ways to engage and encourage the private sector would be found and exploited. One such

approach is public-private partnerships and the variant called the private finance initiative launched in the UK. A valuable exposition of the practice of the UK PFI model is found in Wall and Connolly (2009). A key issue in the UK PFI is to ask if PFI offers better value for money than a public only project implementation. Following twenty years of PFI experience, a revised model, PF2, was introduced in 2012, addressing the shortcomings of the original model. A framework to assist in the UK PFI project decision-making process is presented by Demirag et al. (2004) and still seems relevant for the new PS2 model.

### **Some Challenges and Opportunities Presented by PFI and PPPs.**

The introduction of PFI into the UK as an option for infrastructure procurement was not without challenges for both the public and private sectors.

Research in PFI / PPP projects showed that finance could be problematic. This was especially true following the global financial crisis and its aftermath from 2008. For example, institutional investors, authorities and those trying to raise debt finances for projects faced considerable challenges National Audit Office (2018); World Bank (2014).

A challenge for UK authorities of how to estimate affordability over the long-term nature of PFI and PF2 in how to estimate prices particularly when the Treasury only provided budget certainty to 5 years in advance. The banks and insurance industry also face challenges from holding more capital against risk-weighted assets National Audit Office (2018).

The identification and implementation of methods to improve the management of innovation in the construction industry became a challenge particularly in bidding for PFI projects De Zoysa et al. (2006), Eaton et al. (2006).

The unitary model of firms working in uniform environments is challenged by PFI which brought one of the main challenges facing large construction firms active in the PFI market is how to adapt their internal organisational structure to meet the demands of multiple markets, each with distinct institutional logics.

PFI challenges this model by calling for empirical and theoretical inquiry into the challenge of internally complex firms in multiple markets Leiringer & Schweber (2010).

As reported by Saxon (2005) evidence has shown that construction firms were found to be moving towards integrated systems. This is a major culture change and challenges the need for strong leadership and coaching skills and to see customer value and integrate their suppliers to meet it.

Project boards, established to control and manage projects, essentially challenge and support the project team. Working with the existing strategic partnerships within each of the partner organisations is inevitably complex and challenging Nisar (2013).

Market competition and survival can stimulate innovation and its diffusion in the private sector, bringing the challenge to create similar mechanisms in the public sector although not necessarily the market element. A challenge for the public sector is to bring those private sector mechanisms that stimulate innovation into their realm Albury (2005).

Other challenges in the UK are illustrated by the provision of an adaptable healthcare infrastructure. Core challenges here are found in planning, design and managing complex systems while coping with the changing patterns of demands Barlow & Köberle-Gaiser (2009).

The challenges, also brought opportunities, although some were limited. For example, in the healthcare study it was found that the PFI bidding

process stifled innovation. The thought was that since design and tendering were conducted concurrently and risk allocation fixed early in the bid process, opportunities for innovation were very limited. Architects had fewer opportunities to talk directly with clinical staff Barlow & Köberle-Gasiser (2009).

To increase the flexibility of the maintenance elements of PFIs / PF2, the reformed model will permit the procuring authority an opportunity to amend the specific requirements. An opportunity to save, achieved through more efficient use of assets, reviewing financing and management costs with savings retained by the procuring authority HM Treasury (2012b). Opportunities for innovation from the private sector are by specifying output in the contracts rather than inputs. Refinancing may provide the project company an opportunity reduce the financing costs World Bank (2014).

Opportunities for research arise from the role of PFI to support the modernising of UK public services, and this still may be present with the demise of PFI, but the intention to continue with PPP type projects Wall & Connolly (2009). Public service managers and professionals will still need the skills and opportunity with motivation to innovate Albury (2005). PFI is also repeatedly presented as providing opportunity and incentive for construction firms to reorientate their organisational strategies and structures but as seen earlier in this chapter significant challenges were created in making the necessary changes Saxon (2005).

Winch (2012) identifies four eight-year phases of the United Kingdom PFI experience. One of the problems that was observed was that smaller projects worth less than £20 million had high transaction costs resulting from economies of scale issues. The higher costs were incurred because of the care and detail need in the output specifications, tendering and contract negotiation considerations. There was little evidence that the PFI procurement route stimulated innovation although innovation rates were

found to be higher where the whole service is outsourced as in DFBO projects. Winch refers to a National Audit Office report National Audit Office (2008) that identified PFI procurement was more expensive than traditional or conventional procurement because of the additional costs if flexibility was considered. To mitigate the higher costs, saving must be found elsewhere if value for money is to be achieved with a major approach being risk transfer. Risk is found in three areas, in the business case for the investment (is this right project?); effective management against the business (is the project being implemented correctly?) and the availability of the service through the life of the project.

This chapter was concerned with the HM Treasury (2012b) issues of Value for Money (VfM), risk transfer as main issues. Innovation stimulants and inhibitors were presented by Eaton et al. (2006) in the bidding pre-contract phase of PFI. Accountability, VfM, risk management and project delivery are the province of project boards, seen to be established early in the projects Demirag et al. (2004). Project boards are a common feature of PPP organisations Nisar (2013).

## Chapter 4 Governance

The innovation and Public-Private Partnership literatures have presented some of what is known about the new technology available in external lighting applications and how PFI has launched and re-launched in the UK encouraged by the central government for infrastructure projects. This chapter now turns to what literature records about the role of governance accountabilities which influence the management and control of innovation. To achieve this an approach following the development and evolution of government to governance and to discover the scope of governance systems and to what extent innovation is included to appreciate the role of governance in creating or encouraging the conditions for innovation and hence value for money during the life of the chosen street lighting PFI project.

There is an extensive body of knowledge and literature dealing with governance. Here we are concerned more with arrangements that are made at a local or regional level and even more so with the management and control of major programmes or projects of public works. The influence of central government on these programmes stems from a variety of drivers that have emerged over a period of thirty or forty years and can be observed operating on a global scale in both developed and developing countries. Of these influencing drivers, two or three are key to the current trends and particularly the evolving trend from 'large' to 'small' government, regionalisation and greater powers for local government Osborne (2010), Osborne and Brown (2010). This might in part arise from a conviction that private companies can do the jobs of infrastructure and service provision better than a large bureaucratic central organisation. This coupled with ever-increasing demands on central and local government to provide more and more services, but that the growth of the "collective fund" from taxation and government bonds or equities and other revenue sources, is unable to match the demand.

Following the development and evolution of government to governance and to discover the scope of governance systems and to what extent innovation is included may help to appreciate the role of governance in creating or encouraging the conditions for innovation and hence value for money during the life of the chosen street lighting PFI project.

Widespread use of the word 'governance' has, according to Hughes (2010), diminished its meaning however, Hughes concedes that governance does exist although its meaning has become highly contested Hughes (2010, p. 87). Before expanding on this, it is advantageous to understand the difference between government and governance, if a frame of reference for governance in the context of PFI programmes is to be found, and in particular for the street lighting programmes in focus. Hughes clarifies by making the distinction simply as

*“Government is the institution itself, and Governance is a broader concept, forms of governing which are not necessarily in the hands of formal government”* Hughes (2003, p. 76).

Hughes continues by identifying as an example of the broader governance concept with corporate governance from the private sector. An important point made by Hughes is that the form of governance or the form taken by governance is shaped by

*“... the policy being implemented and the context in which the policy is applied.”* Hughes (2003, p. 76).

What are the attributes of a governance system? What attributes are present in the street lighting PFI governance system? Is there a single overarching governance system or do the public and private partners use their own systems? To set a boundary for a study of the development of

governance arrangements, an entry point is taken when there was a growing consciousness to 'scientifically' develop administrative science.

Private sources again increasingly find their place in these social developments, not just from the capacity to do work and efficiently manage complex programmes, but they are also the source of private funds that if leveraged into the public domain can assist beleaguered governments in public infrastructure and service provision.

The emergence of Public-Private Partnerships (PPP) in its variety of forms has been a recent trend internationally in helping to alleviate some of these national infrastructure programmes. The United Kingdom has been a leader in the use of this type of partnership with the early policies introduced in the late 1980s to the full introduction of the Private Finance Initiative (PFI) in 1992 and the recent re-launch in December 2012 of Private Finance 2 (PF2).

It should be noted, however, that engaging private agents are not as new as it may seem. In Britain, there is much evidence over the past three hundred years or more, of the use of private means to achieve public ends, such as "letters of marque" authorising private vessels to assist the Royal Navy in fleet protection. Other examples of private companies illustrating private enterprise for public good, include the hire of private contractors to light and extinguish lamps in London when street lighting was introduced *Gazetteer and London Daily Advertiser* (1762), and the management and provision of prison services and lighting Sturgess (2011), English and Baxter (2010).

Sturgess (2011) notes

*"..... from the late 17<sup>th</sup> century, street lighting was introduced into London under a series of 21 year leases"* Sturgess (2011, p. 53).

Importantly, Sturgess records that a progressive change took place from the late 18<sup>th</sup> century from a relational contracting approach to transactional contracting as a response to concerns about political corruption with long-term, in some cases, lifetime contracts being replaced by short-term leases to facilitate reviewing the terms and conditions of the contracts.

In the mid-1800s, Britain had approximately 16, 000 civil servants. This number rose to around 5 million by the late 1940s and the notions of too much too big began to emerge effectively heralding a period of change and reform, building on reforms that were seen to be necessary from the late 1800s Burnes (1996, p. 44). However, from the late 1970s and 1980s onward, a reduction in the UK public sector has slowly taken place, largely inspired through political debate and policy development that challenged the purpose and size of the civil service Flynn (1993), Osborne and Gaebler (1992). Among other factors facing governments is the growing demand for public services. However, limits to taxation and other forms of revenue building also limits the ability to fund demands either for new services or to replace existing ones when necessary. These issues are examined in more detail in the next section. But what of government and increasing use of 'governance' in leading and directing how public service can be effectively delivered?

Wilson (1887) made a case for the development of an American administrative science that would be essentially different from that which prevailed in Europe. He noted, however, that Britain had not embraced the European way, and that the United States shared Britain's approach that had avoided revolution to achieve a somewhat less bureaucratic administration.

Perhaps the foundations of the movement towards 'governance' are to be found in these early thoughts of ensuring a 'lesser' bureaucracy than the European way. While White (1933 p. 3) offers an account of the US Administration system, similar changes were appearing across the world

that was fast becoming industrialised and with a greater need for regulation and increasing pressures to provide services from health to education Bertelli and Lynn (2006).

From the 1850s to the 1920s, the US administrative system as just noted was increasing with new administrative organisations that in turn brought a commensurate rise in problems to study and contribute to their resolution. But as Lynn Jr (2008) notes, quoting Gaus et al. (1936 p. vii-viii) scholars of the burgeoning public administration agencies were soon overwhelmed by the growing diversity and complexity of public administration topics .

It may be interesting to speculate that New Public Management, and New Public Governance, are really just the next stages in the evolution of Public Administration, rather than entirely new approaches. Stephen Osborne, Osborne (2010) and Osborne and Brown (2010) hold some reservations about the emergence of “new public ‘governance’”, as evidenced by the use of a ‘?’ in the titles of his and his associates work. Bevir et al. (2003) noted that,

*“No universal process of globalization is driving public sector reform.”*  
Bevir et al. (2003, p. 203).

This would partially help to explain the many and various forms of (new) governance. However, the need for reforms, new or amended policies is, on a global scale, unlikely to be needed for all countries in the same time frames.

What are these reforms and changes intended to achieve? As a simple summary, it could be said that market competition and outsourcing tactics to achieve the required efficiencies is now replacing the authority and rule-based bureaucratic approaches of early administrations. Utility and potential benefit can be gained from the practice of re-using known governance structures to develop a governance system for a project, or

projects, or to assist in assessing a public-private project governance system.

In the next section, the changes in government and governance driven by the need to reduce a burgeoning civil service, the pressure to renew and build infrastructure against financial limits and the public-private arrangements are reviewed.

### **Paradigm Changes in Governance**

Kettl's ongoing research, Kettl (2005) shows the global extent of changes to what he calls public management by governments striving to improve and increase the efficiency of their respective administrative functions and processes. Kettl shows that this worldwide trend has six core attributes, namely, productivity, marketization, service orientation, decentralization, policy, and accountability. In essence, the drive to improve public administrative functions leads to the reform of public administration. In addition to the arguments made by Kettl, the increasing size of public administration and its associated costs also brings challenges resulting in pressures to reform. The reforms emerging from the early 1970s addressed four main topics from reducing the growth of government and administration, increasing the use of the private sector involvement in public services provision. The other trends were to consider cooperation between governments' and for the adoption of IT solutions to model policy and automate access to services. Hood (1991) discusses these trends and doctrines collectively called 'new public management' (NPM).

Emerging from NPM research is the view that "small" government is better than the previously expanding government as evidenced by the increasing size of the civil service, smaller and costing less to run with an assumption of efficiency and effectiveness. The adoption of markets and competition within the NPM framework has also exhibited two problems. Competition is not as competitive as desired and the cost of transactions has increased

the cost of solutions as reported by Entwistle and Martin (2005), O'Flynn and Alford (2005), Minogue (2000).

## **Public Value**

When a public service need is identified, the rest, from the specification to the design, build and entry into service is handled just like any other commercial business. There is little or no public involvement once the project is in implementation but in contrast, public involvement during the project development stages is welcomed to ensure that value is demonstrated, that is public value.

Accountable politicians and public service managers are also included in the consultation as the potentially wide range of inputs will need moderation, and hence will need the new capabilities that Stoker (2006) has identified. The role of politicians and public service managers becomes one of influence and creating the structure and environment for cooperation in the network. It is less clear how this emerging public administration paradigm addresses the issues of efficiency and effectiveness, which will continue to be of importance in the management of public funds. Stoker poses this question too and suggests that it may have to be considered in the wider context of public value and its achievement.

Another approach to address engagement with the public is to practice deliberative governance, described by Coats and Passmore (2008), as

*“... to use the instruments of deliberative governance to ensure that public organisations are responsive to the refined preferences of citizens”*, Coats and Passmore (2008, p. 4).

Public service managers, using deliberative governance, can demonstrate public value by engaging the public to assist in answering three questions, namely, what is this organisation for; who are the service managers accountable to and what signifies success? Coats and Passmore describe this succinctly as

*“...to use public value is a practical framework for thinking about the purpose of public services that challenges the power of technocrats, the tyranny of the majority and the pitfalls of rule by focus group”* Coats and Passmore (2008, p. 57).

Public consultation may be appropriate in many cases, however, the wide range, variety of responses and technical knowledge that is needed can lead to indecision rather than decision-making.

O'Flynn (2007, 2005) presents a view of this emergent public value paradigm as simply the challenge to bring value to public services and offers a tentative definition as

*"A multi-dimensional construct - a reflection of collectively expressed, politically mediated preferences consumed by the citizenry - created not just through 'outcomes' but also through processes which may generate trust or fairness"* O'Flynn (2007 p. 358, originally from O'Flynn (2005).

O'Flynn's statement holds the implication for politicians and public service managers who continue to have the need to deliver results, but moves more towards managing the relationships in public value O'Flynn (2007).

Alternatively, Kelly et al. (2002) offer a more rounded definition of public value as

*"the value created by government through services, laws, regulation and other actions."* Kelly et al. (2002, p. 4).

The other actions, for example, have turned attention on outcomes such as reductions in recidivism, successes in job placements and reductions in social exclusion. However, this might lead to concern as to what constitutes the “other actions” as noted earlier. Stoker (2006) describes rather than defines public value as

*“Public value is more than a summation of the individual preferences of the users or producers of public services. The judgment of what is public value is collectively built through deliberation involving elected and appointed government officials and key stakeholders.”* Stoker (2006, p. 42).

Consistent with public value it would be hoped that among the key stakeholders were the public who are expected to use the services. Stoker's view, agreeing with O'Flynn, is that public value represents a new paradigm in public administration, the implications are that significant change is inevitable if more consultation and collaboration is expected from the public who are among the stakeholders. Stoker observes that conventional types of governance are under scrutiny, as new forms of governance appear, for example, governance systems associated with networks.

Stoker quotes Kettl (2002) who writes

*“Public managers need to rely on interpersonal and inter-organisational processes as compliments to - and sometimes as substitutes for - authority”* Kettl (2002, p.168).

Stoker concurs with Kettl and builds on the view to elucidate the nature of management needed to achieve public value. Stoker calls for *“An adaptable and learning-based approach to the challenge of public service delivery is required”* and that

*"Managers have an active role in making the system work by recognising that it will not work unless it is adjusted on a continuous basis"* Stoker (2006, p. 9).

However, this might be seen to be close collaboration at best and at worst it could be taken as micro-management reinforcing the need for a wider range of skills as indicated earlier in Stoker's article.

The UK Government stated in the "Modernising Government" white paper, that it wanted public services that "listen to people's concerns and involve them in decisions about how services should be provided." Interestingly there was recognition stated in the white paper that some government departments, in the course of their work, did not come into daily contact with the public, but that these too, need to become sensitive to their customers.

O'Flynn (2007) draws attention to Minogue's argument that the large volume of literature on the tendency toward privatisation, marketisation and the exploitation of contracting, shows little or no evidence that there has been any real gains in efficiency but that accountability of central government, particularly in the UK, has to an extent declined O'Flynn (2005), Minogue (2000). Direct comparisons between PFI implementations in the UK and Australia require care, as these researchers were predominantly writing about their work in Australia where the context showed a strong inclination to change administrative organisations.

Given the problems of NPM, which may have introduced too much efficiency that ignores the need for public and social services, to bring social value to the fore, which is what services bring if they are to be a service.

As illustrated by Potts (2009), (reviewed in more detail in Chapter 3) there is an issue of innovation, or lack of it, in public services. The need for efficiency in the expenditure of the public purse and the central government encouragement to innovate in the provision of infrastructure services in the PFI projects leads to a contradiction between efficiency and cost management leading to risk aversion and innovation implying risk-taking through risk management. Add to this the central setting of targets and an apparent disenchantment of the public with the services, fuelled possibly by an eager media anxious to show their value by exposing inefficiency and waste in public services, and further evolution in service provision seems necessary if not inevitable.

It might seem that the tide of the excesses of dis-aggregating administrative and governance systems is changing in favour of a return to bureaucratic approaches. Olsen (2006), for instance, asks if

*“... is it time to rediscover bureaucracy?”* Olsen (2006, paper title).

The paper recognises that the paradigm shift or shifts, analysed and described in the NPM literature might present change that is irreversible, Olsen nevertheless, makes a plea which is that far from re-aggregating administrative and governance systems, we should have a repertoire of approaches, including bureaucracy, but also use network and market-led systems where appropriate. Olsen quotes a definition by Weimer (1995), of institutions as stable sets of commonly recognised formal and informal rules that coordinate or constrain Weimer (1995, p. 2-3).

Coats and Passmore (2008) describe public value as

*“...a practical framework for thinking about the purpose of public services that challenges the power of technocrats, the tyranny of the majority and the pitfalls of rule by focus group”* Coats and Passmore (2008, p. 57).

Coats and Passmore elaborate on public value practice as “*The aim is to use the instruments of deliberative governance to ensure that public organisations are responsive to the refined preferences of citizens*”, Coats & Passmore (2008, p. 4).

Through deliberative governance, public service managers by engaging the public are challenged to demonstrate public value by working to answer three simple questions: What is this organisation for? To whom are we accountable? How do we know if we have been successful?

Public consultation may be appropriate in many cases, however, the wide range, variety of responses and technical knowledge that is needed can lead to indecision rather than decision-making.

Coats and Passmore offer a number of remedies for the issues faced by public service managers briefly mentioned above. Under deliberative governance, it is necessarily a consultative process between the service providers and the public who will use the service, however, consultation should be targeted to particular services where specific public needs must be addressed. Consultation for every service is not advocated and not necessary. All services should declare what they provide and who is accountable for ensuring the provision is made. In keeping with this, managers will require the appropriate and necessary training if new skills are needed to manage service provision. Inevitably, over time, the culture of the public service will change. Coats and Passmore suggest that there should be incentives for public service managers but this seems difficult to achieve although it could be linked to training and the potential for promotion by increasing the responsibilities taken, therefore ‘soft’ rather than ‘hard’ incentives, however, financial reward requires care and judgement to avoid public concern and controversy.

O’Flynn (2007) points out that the public value paradigm shift has implications for politicians and public service managers for the need to

deliver results and to manage the relationships necessary to achieve public value. Stoker (2006) concurs with this view in his article, which he uses to elucidate the nature of management needed in public value management. Both Stoker and Kettl acknowledge that managers in the public sector have to depend on interpersonal and inter-organisational processes that compliment authority and there are occasions when these processes are substituted for authority.

Stoker (2006) proposes that public service managers need primarily to

*"manage through networks, be open to learning in different ways, and draw on resources from a range of sources,"* Stoker (2006, p. 41).

He contends that these alone will not suffice, and calls for a more general theory of public administration for networked governance.

Theories of public administration are clearly important, but what assurance is there that the governance system is achieving the required results and providing the necessary leadership and direction? This leads to consideration of what is known about the performance of governance.

### **Performance of Governance**

An OECD (2007) study noted that, particularly in the developing world, there had been much interest expressed in the quality and performance of governance systems. Major governance indicators and their properties and limitations are reviewed by Buduru and Pal (2010) who suggest the prediction of the death of NPM made by Dunleavy et al. (2005) is perhaps premature. The literature on assessing and measuring governance opens an extensive and varied body of scholarship spanning state and corporate governance systems.

In an international review of the performance of PPPs, Hodge and Greve, (2007) reveal contradictions in the reported results of evaluations of the effectiveness of the programmes in the study which identifies five “governance families” the first of which considered cooperation between institutions dealing with topics from joint production to risk sharing. The problems of evaluation range from inaccurate risk transfer estimates, lack of independent evaluators and an inability to question government policy. The evaluations also had claims such as transparency and accountability that have a positive impact on business, and contribute to investor confidence, but the evidence for these claims had been not widely researched prior to the publication of the performance review paper.

The second family views long-term legal contracts in which tight specification of outputs are made in the contract. Other families of governance included are public policy networks in which loose stakeholder relationships are emphasised and civil society and community development which partnerships symbolism is adopted for cultural change. A fifth family studies of urban renewal by Hodge and Greve (2007) covers downtown economic development.

The UK PFI is an LTIC and resides in the second family type identified by Hodge and Greve (2009) and (2007). These authors concluded that governance, value-for-money, and innovation together, are subjects worthy of investigation. The research into families of Long Term Infrastructure Contracts (LTICs) has revealed major concerns with governance and value-for-money issues. Further to the five governance families Hodge and Greve (2007), PPPs can also be viewed as two widely differing viewpoints. The first and more readily appreciated is the notion that PPPs are in effect a set of governance tools and the second a set of language games that avoids the use of concepts such as “outsourcing” and “privatisation” Hodge and Greve (2009).

The second viewpoint is that PPPs are “language games” with politicians and governments avoiding the use of words like “privatisation” in order to allay public and media fears over job losses and reductions in services. These viewpoints are further developed in a later paper but which extends beyond the scope of this work Hodge and Greve (2010).

A case study of a major PPP infrastructure project in Sydney, New South Wales by Hodge and Greve (2009) and (2007), illustrates serious shortcomings with the governance system. Their findings show that the project risk assessment failed to identify events and actions that contributed to the failure of the project a year following its operational opening. Note that under a second managing consortium, the project failed a second time in 2013. It could be argued that the failure is more a result of the governance system failing to ensure that the project level had a sufficiently robust risk management system.

Johnston and Gudergan (2007) develop an analytic concept or framework which is instructive. They consider three contexts when examining governance issues. Risk is perceived as an overarching governance concern and has two dimensions. The first is the technical-rational context, and this context includes the legal contract. It is here that risk may fail to identify critical contingencies, as it is not possible to predict all events affecting the project according to Sadran (2004), who notes that for PPPs, the contract is usually incomplete for reasons of bounded rationality. The second risk dimension concerns the social context of the partnership. Based on the case Johnston and Gudergan use in their paper, they propose that a top-down PPP governance oversight that included behavioural rules of conduct for the partners could be effective if the rules included sanctions if a partner broke a rule. An alternative top-down approach might be to have an independent “PPP authority”, however, it is difficult to understand how this authority would be funded without adding further cost to the project.

The OECD (2007) rationale for studying how government activities are measured arises from the view that government and the governance stemming from it contributes significantly to growth and social welfare in the first paper in their “Government at a Glance” project. However, Buduru and Pal (2010) observe that there has been an “explosion” of governance indicators that have been developed whose purpose is to measure and track the quality of governance.

There has been a demonstrable growth in governance indicators. A categorisation of these divides NPM indicators into four classes as

*“1) steering systems for subordinate agencies (e.g. evaluation, performance measurement); 2) culturally oriented management tools (e.g. ethical guidelines); 3) changes in the forms of affiliation for subordinate agencies (e.g. public- private partnerships); and, 4) marketization (e.g. benchmarking ... “ Buduru & Pal (2010, p. 513).*

Buduru and Pal present an argument that such a range of measures links to the NPM movement by demonstrating the continuing reform of government through the use of measures demonstrating change. In their paper, Buduru and Pal review the major governance indicators and list their properties and limitations. However, a search of this paper revealed nothing to inform this research with respect to innovation enabled by governance. The OECD (2007) paper recognises innovation as an objective that relies on effective regulatory policies.

A summary of the literature from the transition of Government to governance reducing reliance on central government or administration to a devolved approach relying upon public service delivery organisations, Rhodes (1996) and Stoker (1998), to the scholarly study of the emergence of ‘new public management’ Hood (1991), until more recently, what some call ‘new public governance’ comes to the fore in Denhardt and Denhardt (2000), Stoker (2006), and Osborne (2006).

Less well researched is that such administrative reforms have developed in an attempt to improve public services and improve the efficiency of service delivery. Ashworth and Entwistle also note that rarely have implemented policies been supported

*“...by a clear causal logic or a body of supportive empirical results”*,  
Ashworth and Entwistle (2010, p. 2).

The concerns of the UK Government can be seen by considering the chapter titles of the "Modernising Government" document, ranging from policy making, responsive public services, quality public services, information age government and public service HMG (1999). However, a clearer interpretation is to engage practitioners from outside government, from commerce or industry, to bring in new legal, commercial and managerial capabilities.

The process of reform was seen as a long-term programme with a package of reforms being announced in the paper. These were not without some contradictions. For example, an intention was stated that, in Whitehall at least, "more people would be brought in from the outside" that conflicts with the drive for "small government."

The paper states "Distinctions between services delivered by the public and the private sector are breaking down in many areas, opening the way for new ideas, partnerships and opportunities for devising and delivering what the public wants" and is likely to be a policy that contributed to the expansion of the Private Finance Initiative programmes of the 2000s. The paper also states that local government has a responsibility for services including education, social services, police, housing and public transport, that represents a quarter of public expenditure at the time the "Modernising Government" document was published. In preparing the Modernising Government report, ministers reflected on the bureaucracy

that stifled innovation and measures that could be taken to increase the involvement of front-line staff who it was considered were a rich source of innovative ideas. An example in the report describes an approach taken in the National Health Service that introduced a National Taskforce on Staff Involvement, which is a cross-section of roles from the service with the task to recommend actions for staff involvement.

Enabling public service to innovate required public service to be free, although "free" was not explained, and there was an acknowledgement that the White paper did not have all the answers.

An initiative that was proposed in the White paper was a budget called "Invest to Save" and over a three-year period funded projects that two or more public bodies worked together to deliver services. This joint working approach piloted joint working with the expectation of wider use in the public sector. Was this the learning experience that resulted in the South Coast Street Lighting PFI programme?

Encouraging innovation and ways of effective modern forms of service delivery at both local and central government levels were to be achieved by working with the Public Audit Forum to find pathways to achieve this end. The responsibility of auditors is to ensure that the organisations are getting value for money, but the paper expressed the need for auditors to *"support innovation and risk-taking when it was well thought through."* Rather than taking a more relaxed approach, auditors are expected to be more open-minded about innovation and risk-taking by public organisations provided the process was thoroughly examined and risk evaluated. Equally, auditors are expected to observe and report on missed opportunities. In the auditors' role, provision should be made to offer advice and share good practice from examples where value for money has been achieved. The paper also stated an intention to use the best supplier for a programme from public, private or voluntary sectors and

"to encourage innovation and continuous improvement, and PFI for capital projects."

"Best Value" was introduced to replace compulsory competitive tendering in local government programmes.

A decade of projects later from "Modernising Government", Value for Money (VfM) has not been demonstrated in many PPPs as noted by Appuhami et al. (2011), who quote Edwards and Shaoul (2003), Greve (2003), Pollitt (2002), and Hall (1998) as also making this conclusion.

Appuhami et al. (2011) identify risk management as a factor that contributes to the loss of VfM. The authors claim, however, that risk in these projects arises due to the differences between the Partners' goals. This leads to individual partners pursuing their own interests thus effectively detracting from the PPP's goals. A Management Control System (MCS) that considers the behaviour of the Partners could, on detecting goal incongruence, re-direct those behaviours contributing to VfM. Merchant et al. (2003) note that because of the complexity of a long-term project, different controls may need to be employed, varying in nature to meet the demands of the different phases of the project and with a focus on the risks arising in those phases. Merchant et al. contend that the introduction of a management control system (MCS) would remedy loss of VfM. The implication that there is no management control is rather worrying.

Appuhami et al. develop their framework based on the transaction cost economics (TCE) theory of Williamson (1985), (1991), (1996) and organisational theory based on the work of Ouchi (1979), and (1980). Appuhami et al. offer as their rationale for using two theories in the development of their framework that a single theoretical viewpoint will limit what can be learned from the subject of a research project. This approach builds upon that of Chiles and McMackin (1996) who widened the scope of TCE by including the neglected behavioural assumption of risk neutrality in

their study to overcome the shortcoming of previous research. Smith et al. (1995) in the research agenda on issues of cooperation and their study of cooperative relationships are fundamental to management success also concluded that “*scholars need to open up to theories from other disciplines*” Smith et al. (1995).

Appuhami and colleagues develop a framework in their paper whose purpose is to enable the analysis of MCS in PPPs. The framework includes factors that potentially affect VFM achievement.

The authors propose a framework to support the systematic analysis of the use of Management Control Systems. The framework is designed to examine management controls in PPPs from the public partner’s perspective, mainly because the public partner often bears the ultimate ownership and risk of the PPP.

The framework also assists the assessment of the management control system from the public viewpoint and as such is very valuable to the client to support monitoring of the contract. It is still necessary to have a joint governance system to assess and promote potential innovation adoption. The database that SSE developed and shares with the authorities during the core investment period, eliminates the threat of opportunism identified by Appuhami et al. as it shares in real-time the progress of the core investment programme. It would be very difficult to create a separate ‘providers-side’ database that recorded the actual progress if that was different from the real progress. The client would be able to see differences from their own visual inspections, so hiding the reality is difficult.

The public partner in the PFI should adopt different but appropriate governance and management approaches and controls, achieved by learning what the different phases require and adopting the requisite strategy and controls for each phase as proposed by Appuhami et al.

Appuhami et al. showed that value for money had not been convincingly demonstrated in many PPPs. Edwards and Shaoul (2003) observe that as any kind of project can fail, turn their attention to whether partnerships reduce or amplify the effects of failure and particularly to investigate how risk transfer works in practice and how it contributes to value for money.

A critical finding is that in the partner selection process, selection of a very competitive bid may result in choosing the 'wrong' or inappropriate partner. That partner, working to an agenda, might use their proposed solution to develop capabilities to be exploited in other similar projects, i.e., their proposal is effectively a "loss-leader" to attract the business. Other problematic issues identified included a lack of formal and systematic mechanisms for ex-post facto evaluation. The authors also recommend non-financial audit in addition to the usual financial audits.

Another point made by the authors is their claim to "international relevance" of their paper by an extension of the UK government's "export" of privatisation to the export of "partnerships."

Value for Money is an ambiguous concept according to Edwards and Shaoul (2003) being associated with economy, efficiency, and effectiveness. But in contrast, Potts (2009) shows that striving for efficiency and effectiveness may be misleading and reduce innovation opportunities.

Edwards and Shaoul summarize a number of NAO reports of PFIs that had failed. The NAO reports examined what had led to the failures and what lessons could be taken to apply to future PFI projects. Edwards and Shaoul are critical of these reports in that there was no focus on value for money considerations, however, the nature of the failures and the media and public interest could have skewed the focus of the reports to investigating what went wrong as more important.

In their findings, Edwards and Shaoul question the problem of how VfM can be assured if annual audits are confined to financial accounts. Their remedy was to recommend non-financial audit in addition to the financial audit to check the veracity of performance measures together with validity and independent evaluation. This recommendation echoes the advice and recommendations of the Sharman Committee's Report (2001) that examined the degree of accountability and audit that is appropriate in the management of public money. The report contributed using a case study approach to explore *ex-post facto* public procurement processes .

Previously, NAO investigations have been concerned with establishing what went wrong and what lessons need to be learned in public project procurement. Few investigations have examined risk transfer and value for money in the available options and were addressed in the Sharman Report. A key point made by the authors is their observation that "commercial confidentiality" limits the quantity and availability of publicly available data of PFI programs in general, thereby adding to the difficulty of research in these areas.

Within academic studies, there is debate whether New Public Governance (NPG) is indeed a new paradigm as described in Lynn Jr (2010), and Osborne (2010). As Lynn Jr observes, making a comparison with NPG, arguably still a work-in-progress, and the completed concept is "problematic". Lynn suggests that re-framing the question, thus

*"Might the story of new (public) governance have the same ending as the story of new (public) administration? That is, might the qualifier "new" eventually be dropped and "public governance" replaces "public administration as the general term that encompasses all forms of state-society interactions that we study and practice?"* Lynn Jr (2010, p. 118 in Osborne (2010).

Lynn Jr discusses the question of which lasts longer, public governance or the life cycle of reforms. He stresses that the terms used and the meanings attached to them are important in trying to answer this question.

From the foregoing, it becomes apparent that there are different governance types.

### **Governance Types**

Stoker (1998) shows that there has been a blurring of governing between public and private sectors, generally agreed as governance and broadly is more a focus on managing mechanisms that do not necessarily need government to authorise. In this paper, five propositions are discussed, however, some care is needed. For example, the first proposition states

*“Governance refers to a set of institutions and actors that are drawn from but also beyond government,”* Proposition 1, Stoker (1998, p.18).

This proposition implies a system that can lack simplicity because of the potential complexity between the institutions involved.

Traditionally 'governance' is used synonymously for government. Although not expressed directly Stoker observes Rhodes' view that the (increasing) use of governance heralds "...a change in the meaning of government, referring to a new process of governing; or a changed condition of ordered rule; or the new method which society is governed" Stoker (1998) and Rhodes (1996, pp. 652-3).

Stoker holds that governance is about making the context for rule, regulation, and actions to be taken. The important development is that governance is essentially about creating governing arrangements that do not need to refer up to the authority of (central) government. Stoker proposes that the value of taking a governance viewpoint lies in that it

offers an "organising framework" that helps us to understand how the processes of governing are changing by enabling us to ask essential questions. However, as Stoker warns us, regrettably, it doesn't necessarily offer answers.

The second proposition may give rise to profound problems of who is responsible in the unhappy event that the endeavour "goes wrong." This leads on to an appreciation that the governance relationships between the collective organisations involved in an endeavour will find that none can command, but one can dominate the rest which is the concern expressed in the third proposition. If a power dependency is established, the danger is that the outcomes are likely to be different from what was originally intended. The fourth proposition concerns the development of networks that self-govern.

The public and private organisations involved in the project will be expected to self-govern for the remainder of the contract once the project has passed the pre-bid phases and resulting approval from the higher authority of central government is given. Finally, proposition five recognises the need to challenge the past way of working and to lead and coordinate. Stoker concludes that government and governance are changing and that the changes are worth studying through taking a governance viewpoint takes a simpler view of reality that has the potential for great complexity.

The plethora of uses of governance should not surprise or confuse. Governance stemming from political purposes is a key and essential element of this research; however, it is by no means the only aspect. With private organisations becoming involved in public programs, there is value in reviewing corporate governance with a view to understanding where such governance systems contribute or are aligned with the public purpose.

A valuable and revealing paper van Buuren et al. (2012) shows complexity in an airport governance system as an example of the complexity found in real-world systems. The complexity arises because of the 'system of system' nature of the organisations involved, their relationships and their respective governance arrangements. A difficulty with researching (and managing) complex systems is to appreciate that the development path can lead to an understanding of what might happen in the future, but also reduces or prevents learning from external sources. Van Buuren et al. note the volume of literature collaborative problem-solving has received, however, they consider the literature has paid scant attention to the role of governance when the need to collaborate arises. This literature does offer hope from the use of consensus building and dispute resolution processes as practical approaches to solving the challenges of collaborative problem-solving. The paper identifies six attributes of complex systems that governance systems need to have a response. The first attribute requiring governance attention is fragmentation and connectedness resulting from the subsystems that are independent, possibly with their own governance system but are nevertheless connected in the context of a project. The next attribute considers the non-linear dynamics of a governance system that are those asymmetries, activities and unexpected events that often cause outcomes to be different from what was originally planned. A property of complex systems to adjust in a way to accommodate changes although there are no external or internal agencies 'controlling' the organisation is the attribute of self-organisation. Two further attributes are coevolution and instability. Instability is the characteristic of complex systems fated to remain in constant change and adjustment and coevolution and arises from the systems within system nature of complex systems suggesting that the subsystems coevolve because of their interrelations from their learning that may re-enforce and encourage behaviours or have the opposite effect. Coevolution clearly contributes to instability.

The sixth attribute is path dependency the evolution of the complex system, how it came together and developed can essentially 'trap' the system into certain directions in the future. However, van Buuren et al. acknowledge that interacting actors are the basis of governance systems and they have self-governing capabilities. Van Buuren et al. adopt the definition of governance from Koppenjan and Klijn (2004) as follows,

*" the coordination of activities around collective problems by mutually dependent actors"* Koppenjan and Klijn (2004).

Another type of governance is achieved by the implementation of policy and services in IT systems. Dunleavy et al. (2006) state that twenty years on from the mid-1980s, the 'new' approaches to public management and governance "have essentially died in the water." However, they did concede that at the time their paper was published, some approaches were still being developed, others completely institutionalised and the remainder stalled or abandoned. They make an important point in noting that previous public management practices were still in use, indicating path dependency.

Dunleavy and his colleagues herald an age of "Digital-Era Governance" (DEG) through the use of IT systems. It was noted, however, that the United Kingdom Treasury, banned the use of the Private Finance Initiative for the development and management of Government IT programs, due to concerns regarding the 'traditional' problems of software development, such as late deliveries, escalating costs and failed systems. Dunleavy et al. show that changes to information systems (IS), coupled with government IT and governmental organisational changes are the main ways in which adjustments to policy and the resulting outcomes will be achieved. Three main themes are used to consider the effect of digital-era governance practices "Reintegration" - means the re-integration of the services that were disaggregated as a result of NPM, will depend upon IT as the means of bringing in the improvements needed to achieve a

"joined-up government" effect; "Needs-based holism" - simplifying and changing the relationship between agents (service providers) and the clients; "Digitization changes" - deep changes by moving to completely digital operations Dunleavy et al. (2006).

As an example, the UKGov website can be used to report faults with street lighting. This requires entering the postal code of the locality of the light. The user is then directed to the appropriate lighting authority. Perhaps street lighting is a more trivial example compared with tax return forms, motor vehicle licencing and tax, passport applications but illustrates the growing range of public services available on-line.

### **Corporate to Project Governance**

Corporate governance has a wide range of components, related topics, and applications. It also exhibits a broad variety of evolutionary paths. Universities, schools, Non-Governmental Organisations and not-for-profit organisations are a small example of groups that have governance systems besides private sector companies.

The Cadbury Report (1992) published in the UK was an instrument to address issues such as investor loss of confidence in the honesty and accountability of Stock Exchange listed companies. A concise definition is taken from the Cadbury report that reads

*"Corporate governance is the system by which companies are directed and controlled"* Cadbury Report (1992, Para 2.5).

The OECD (2004) definition of corporate governance is more comprehensive compared with the Cadbury report, stating

*“ A set of relationships between a company’s management, its board, its shareholders and other shareholders. Corporate governance also provides the structure through which the objectives of the company are set and the means of attaining these objectives and monitoring performance are determined,”* OECD (2004, p. 11).

The OECD “Principles of Corporate Governance” states that governance structures have six purposes. These are ensuring the organisation receives a maximum return on investment and directing and controlling its operations and strategic activities. Importantly there are responses to the legitimate rights, expectations, and desires of its stakeholders. This is achieved by evaluating performance before permitting a project to progress and monitoring the delivery of benefits through, progress reports and audits and reviews at various phases in the project's lifecycle. Finally, there is a need to formalise organisational learning OECD (2004).

A feature of the OECD governance structure is the assumed “projectisation” in corporate company operations. Essential governance for projects should include “stage gate” approaches to evaluate the readiness and risk before continuing to the next stage or phase and to continue throughout the life of the project with auditing and progress reporting.

Evidence that the UK public sector is encouraged to use projects to deliver infrastructure and services can be found in examples such as the HM Treasury publication “New Approach to Public Private Partnerships” which uses the word ‘project’ in 288 instances HM Treasury (2012b). The use is consistent with the recognition that the private sector has achieved much from an effective project and programme management. The NAO report “Performance of PFI Construction” states that their 2003 report found that 75% of PFI projects delivered to the contracted timetable and price. Between 2003 and 2008 this performance largely continued although prices had increased due to a variety of reasons. For the NAO 2008

survey of non-PFI projects, 63% delivered to timetable and 54% to the contracted price. 66% of those delivering late incurred price increases NAO (2009) and (2003). The UK Government launched a number of initiatives as part of that growing interest and appreciation of the private sectors' capabilities in project management and a realization that skills in project management needed to be improved within the government. The Office of Government Commerce (OGC), now subsumed into the Cabinet Office, published a number of guides in project management, notable among which is "Managing successful programmes" Office of Government Commerce (2007).

At the project level, a sound definition of governance is offered by the OGC

*"Governance – the functions, responsibilities, processes and procedures that define how the programme is set up managed and controlled."* – OGC (2007).

The overseeing body is usually the 'project board' whose role is to ensure that the interests of the shareholders or in a public project, the taxpayers' assets are protected. Shareholders in a private organisation can reasonably expect a return on their investment, but the chapter does not make it clear the nature of the return to the public shareholders. HM Treasury published a guide for project management governance – "Project Governance: a guidance note for public sector projects", and is a component of UK meso level supporting documentation. This guide can be considered as the connecting piece between the meso national level government structures and the macro project level, is included in this review to make the connection between them HM Treasury (2007). The guide lists the main activities of project governance as they relate to program direction, project ownership, and sponsorship, ensuring the effectiveness of project management functions, and reporting and disclosure (including consultation with stakeholders.) The guide usefully defines the "project" as covering

“... the whole life cycle: from and including initial studies, feasibility assessments, the production of outline and full business cases, the procurement process and transition through to, service delivery and *disposal or exit*.” (Project Governance: a guidance note for public sector projects, HM Treasury (2007, p. 5).

It is emphasised that governance arrangements are likely to change as the phases of the project change, so too should the terms of reference (ToRs) for key staff in the phase change to match the roles in the phase.

The roles themselves should cover decision-making, communication, and stakeholder management. A board or system of boards is advised as an effective way of governing the project. Included in the guide are four annexes listing a series of questions that can be used to check, review or used to assist in establishing the effectiveness of the proposed or current project governance arrangements. The use of these is outside the scope of this research, as the questions contribute to more of an audit style of assessment. It is noted that the guide does not mention ‘innovation’ in the text. The guide does reflect the key attributes of governance systems, but it is a guide, normative but not mandatory. It does not list the OECD (2004) definition and guidance among its references.

The Project Management Institute standard is consistent with the OECD guide stating that program or project management is collectively the process of developing, communicating, implementing, monitoring and assuring the policies, procedures, organisation structures, and practices associated with a given program with oversight and control meeting the requirements of the governance system Project Management Institute (2013).

In studying project governance, Miller and Hobbs (2005) consider that

*“...project governance regimes could be analysed not with the goal of identifying the single best structure to put in place, but for the rich mix of*

*governance regimes to be put in place to manage different issues and different stages of the project life cycle and the variation in their usage as the projects and its context evolve,” Miller and Hobbs (2005, p. 47).*

According to Miller and Hobbs, three governance literature streams are reviewed when designing or analysing a project governance structure; corporate governance, institutional governance, and project governance. Megaprojects by their nature are not regular occurrences for public and private sector organisations. Megaprojects are complex because they carry greater risk and therefore need a governance system that addresses the differences between the “routine” projects that occur at higher frequencies.

The authors’ research agenda is to avoid designing a specific governance system for megaprojects, preferring instead to identify design criteria that decision makers responsible for the design of a project governance system, can consider and used to review the applicability to their situation.

Direction and control of private organisations have seen the evolution of corporate governance systems. Within organisations exploiting project structures to deliver their business, a corresponding development of project governance is found. Implicit in these organisations and projects is the need to work with other organisations and public sector agencies particularly in partnerships that leads naturally on to a study of collaborative governance.

### **Collaborative and Network Governance**

The growth of partnerships has seen a corresponding growth in the study of collaboration. The interest in this next review is with collaborative and network governance.

Turning to collaboration first to consider a working definition of collaborative governance is found in Ansell & Gash (2008)

*“Collaborative governance is defined as a governing arrangement where public agencies engage with non-state stakeholders with the aim of making or implementing public policy or managing public assets.”* Ansell and Gash (2008, p. 544).

An alternative viewpoint in Williamson (2008) is,

*“... The means to which to infuse order, thereby to mitigate conflict and realise mutual gain”* Williamson (2008, p. 43).

Mitigating conflict in Williamson’s definition would be a valuable addition to the Ansell and Gash (2008) definition that appears to assume no conflict arises between the partners in collaboration.

The definition of collaborative governance that Williamson (2008, p. 43) use in their paper was deliberately restricted by them to create a comparatively level playing field, thereby increasing the comparability of the 130 or so case studies in their data set. Rather than calling their model ‘collaborative governance,’ they choose to call it the ‘governance of public affairs.’ From their definition they identify six criteria, namely (1) *The forum is initiated by public agencies or institutions;* (2) *Participants in the forum include non-state actors;* (3) *Participants engage directly in decision-making and are not merely “consulted” by public agencies;* (4) *The forum is formally organised and meets collectively;* (5) *The forum aims to make decision by consensus (even if consensus is not achieved in practice), and* (6) *The focus of collaboration is in public policy or public management.*

In addition to the six criteria, they identify six factors from their study plus critical variables that are, *“crucial within the collaboration process itself.”* The critical variables are face-to-face dialogue, trust building, development of commitment and shared understanding.

The authors note that collaborative governance and public-private partnerships can also sometimes refer to the same phenomenon. Although the role here might just be to coordinate rather than make decisions, in the street lighting PFI, examples, decisions did have to be taken particularly in the core procurement phase. Ansell and Gash, however, see decision-making as secondary to the definition of PPP, but collective decision-making is a process central to the definition of collaborative governance with leadership critical to establishing the public and private organisation together and to guide them through difficulties that require decisions. Following the brief description of Schedule 18 in Chapter 3, it can be seen that the Network Boards were potentially a pathway to collaborative governance of the PFIs with both private and public members participating in their proceedings.

An illustrative case by Mah & Hills (2012) may help to show the nature of the relationship. The example from Mah & Hills (2012) is of two provinces in China where wind resource assessment is being used to explore wind energy potential of these regions and thereby contribute to the enactment of China's renewable energy law that was passed in 2005. A key aspect of the study is to use the theoretical concept of collaborative governance and empirical development in Wind Resource Assessment (WRA) work and study the connections between the theory and the empirical. A feature of work on the Wind Resource Assessments (WRA) project is the wide range of disparate agencies potentially involved in addition to the national and local governments. Mah and Hills declared that collaborative governance was a “relevant conceptual framework” to help them study WRA, and because of a large number of actors and the complexity of interactions, linear cause-effect models were unlikely to be effective tools for analysis. It is not clear how Mah and Hills analysed the data gathered in the field, but it might reasonably be assumed that they accepted Ansell and Gash’s criteria developed from their definition.

The issue that leadership is critical in establishing the partnership raised by Ansell and Gash continues in two of the seven ‘perspectives’ presented by Huxham and Vangen (2005), in their book, who deal with the issues of leadership in collaborations, primarily that leadership sometimes is not within the membership of the collaboration, that is, an external agency and that the leader’s work will be accompanied by difficulties and dilemmas. Huxham and Vangen take the view that partnerships between organisations, public and private, deal with social issues that are often overlooked. Such partnerships offer what they call ‘collaborative advantage.’ However, they state that evidence shows that collaborations can also make progress slow or end without ever achieving their aims. This state is called ‘collaborative inertia.’ The book concentrates on developing the principles of the theory of collaborative advantage, as a themes-based theory of collaboration useful to scholars and practitioners, but is careful to include the problems leading to inertia. Another of the authors’ aims is to demonstrate to practitioners in both public and private organisations the value to be had from scholarly research and to influence management practice.

Their theoretical insights were produced inductively from the data arising from an action research approach they used as a research tool in the field. The theoretical framework derived, views collaborative organisation through seven perspectives *Common aims, Sharing power, Trust, Partnership fatigue, Constant change, External leadership, and Leadership dilemmas and difficulties*. Huxam and Vangen suggest that the simple analytical tool which is published in their book and reproduced here, may prove useful for collaborating researchers to present findings from their research:

	<i>Explicit</i>	<i>Assumed</i>	<i>Hidden</i>
<i>Collaboration aims</i>			
<i>Organisation</i>			

<i>aims</i>			
<i>Individual aims</i>			

(Huxham and Vangen Ch. 4 “Action Researching Collaboration,” 2005).

The difficulties experienced by those attempting to work collaboratively as described by Huxham and Vangen in their book led Johnston et al. (2010) to agree that for collaborations to be successful, conditions for success need to be created and managed. These authors adopt the “contingency model” developed by Ansell and Gash, and employ multi-agent modelling to run simulations to test the two main practices from the empirical data that lead to successful collaborations, namely a deliberative planning process to aid building trust and commitment, and thoughtful inclusion of new members during group formation.

The multi-agent model has the merit of adding to the understanding of the interdependencies that had been omitted or simplified in the Ansell and Gash model.

An essential difference between the cases used by Johnston et al., study a state sponsored public health programme whose participants come from non-profit, private organisations and community representatives on a purely voluntary basis. By contrast street lighting PFI is a contract, and therefore the Johnston et al. study may be of limited value.

The literature viewed so far is concerned with community collaboration while the street lighting PFI pre-contract collaboration of networks and post-contract team collaboration and therefore it is necessary to consider network governance look elsewhere in the literature.

Emerson et al. (2012) offer a significant paper introducing a Collaborative Governance Regime (CGR) that in their words is a

*“... a system in which cross-boundary collaboration represents the predominate mode for conduct, decision-making and activity”* Emerson et al. (2012, p. 10).

The CGR framework has two influencing elements. “Collaborative dynamics”, the essential drivers that bring the organisations together, and “principled engagement” through which the organisations are able to overcome their respective differences and work together, make decisions and solve problems.

The purpose of the CGR framework is to facilitate the organisations to achieve the objective, hence the framework element "capacity for joint action" and its properties. They conceptualise this capacity of " four necessary elements:" (1) procedural, (2) leadership (3) knowledge and (4) resources.

Emerson and colleagues believe that the framework can be used to help researchers evaluate projects, taking the whole framework or just particular elements of it. For example in the street lighting PFIs it might be used to look at the capacity for joint action and leadership.

CGR is not a phenomenon that is consciously started by one or a dyadic of actors, but that it emerges and develops once two or more organisations agree to work together. The framework has the merit of opening up a range of future research opportunities. The authors do acknowledge that some aspects of the framework are speculative and that future research is needed to confirm or amend these as necessary.

In the street lighting examples, there is a hierarchy, but the collaborative nature of the relationship during the core investment period overcame the tendency to glacially slow behaviour. This is perhaps explained by the "dual-governance" nature of the relationship, and the exigencies of the work in that phase indicating that other ways of looking at governance may be needed.

Stephenson (2008) acknowledges the public sector trend of increased customer focus, delivering what customers, i.e., citizens, need. Note that

Stephenson writes “need” which still suggests that it is what the public sector decides to deliver. However, the issue does come to a consideration of how much variation in the service can be tolerated by the service provider before costs act as a limiter. An important point reported by Stephenson is that under the “NPM movement” private sector efficiency approaches are used to establish the value of public goods to achieve cost-effective public services.

The key point made in this section is that leadership is critical in collaborative arrangements. It should be noted that sometimes that leadership comes from outside the partnership. A disadvantage is that the benefits of collaboration may be reduced as a result of collaborative inertia, and the effect that inhibits the progress of the project.

In the review of collaboration literature, network concepts have arisen naturally in the discourse. For example Stoker’s description of public value networks in which politicians and public managers have the role in creating and nurturing the structure and environment for cooperation in the network formed from the public being served, including the politicians and public managers and other relevant parties Stoker (2006). This is consistent with the aspects of the meta-governance of networks proposed by Sorensen and Torfing (2009). Stoker in his 4<sup>th</sup> proposition made a call for the development of networks that self-govern Stoker (1998). However, in his later work suggests that public service managers – manage through networks and calls for a more general theory of public administration for network governance Stoker (2006). Stoker proposes that political leadership and lean non-hierarchical autonomous organisations steered by tight central leadership that facilitates rather than commanding is the basis for inter-organisational arrangements.

Sorensen and Torfing acknowledge the increasing fragmentation of social and political life. It is argued that the reforms brought about by NPM have contributed to that fragmentation. They observe that the response to this is

a growth in governance networks. The concern expressed in the paper is how to ensure that such network governance systems are effective and democratic. They propose that meta-governance tools may help to remedy deficiencies in network governance systems. Public managers have special responsibility for unleashing the potential of governance networks. Nevertheless, it is Sorensen and Torfing,'s view that the political dimension is needed in PFI and PPPs.

Sorensen and Torfing cover a wide range of network governance in their paper from policy-making to public-private co-governance. The context very much determines the type of network and its purposes. Given this range and potential complexity of relations and purpose, defining a framework for assessing the effectiveness of a network would seem to be an almost insurmountable task.

In the bureaucracy of the public administration or management, there is an ongoing tension between the need for cost efficiency and operational effectiveness. This presents a loose-tight dichotomy on the one hand administratively requiring tight control and discipline and the other to experiment operationally requiring more relaxed approaches to control and discipline. Roberts however, suggests that collaboration through networks may help to resolve this dichotomy Roberts (2000, p. 228).

Sorensen and Torfing propose a meta-governance system to assess the effectiveness of governance networks. This, in essence, is the governance of governance and consists of network design, network framing, network management and network participation. The design sets the scope and composition of the network while framing defines the political aspects financial and legal limits of the network. Network management is concerned with the operation of the network from leadership to conflict resolution and network participation maintains the policy agenda and sustains cooperation.

## **Sustainability Governance**

Sustainability has come to the fore from concerns from the limits of resources to global warming and is about trying not to damage or risk the welfare of the future by taking care of how we live in the present. Energy, its production, and use are two of many aspects of sustainability that involve individuals and organisations. The UK Government recognises the influence local authorities can play in and the wider role they can potentially have to contribute to the development of energy policy. These issues are discussed in a series of publications as the "Low Carbon Transition Plan" DECC (2009), the 2011 UK Carbon Plan HM Government (2011), and the Community Energy Strategy (2014) and (2015).

Local authorities have two roles to play. The first role is to encourage energy consumption reductions in the area they service, by engaging with the public on measures that they might take and the second role is to implement actions that the local authority can take itself. For the latter actions, the Committee on Climate Change report "How Local Authorities Can Reduce Emissions and Manage Climate Change" CCC (2012) with emphasis on the need to have a step change in the tempo of reductions in emissions and hence carbon reduction CCC (2012).

The report also shows that local authorities have a significant role to play by establishing carbon plans for emissions that are under their control, this in turn identifies the crucial role local authorities have in contributing to national carbon emission budgets. A concern raised in the report was to ask if local authorities were sufficiently incentivised to take action on climate change. Ten key messages directed at local authorities identify the actions that can be taken at their level. Of relevance to this research are the messages dealing with, low-carbon plans and "own estate." Own estate includes council or authority owned buildings, transport including street lighting, and procurement.

By acting on opportunities presented in these areas the authorities can demonstrate leadership and control. The report includes the measures that local authorities may take with respect to street lighting, namely reducing emissions through a number of options including dimming lights at night, switching off during certain hours and the use of low energy lighting, for example, Light Emitting Diodes (LEDs). In preparing the report, the authors considered setting a carbon budget for the local authorities, however, given the number and variety of drivers of emissions and the partial influence authorities have over some drivers, the approach was abandoned.

The Local Government Association introduced an initiative in 2010, called Climate Local. This initiative was launched in 2012 with the purpose of supporting councils in their actions to reduce carbon emissions and to increase resilience to the changing climate. Climate Local presents a framework to assist local authorities with local priorities and opportunities for action. The framework consists of a Climate Local Commitment – a suite of commitments and actions for councils to voluntarily choose and sign up to in order to demonstrate their commitment to addressing climate change and challenge them to build on their existing achievements. In addition to this there is a Council Framework on Climate Change – step-by-step guide on reducing emissions and adapting to climate change, including indicators local authorities can use to prioritise their programmes and monitor progress. Additional resources and support are also available such as a web-based resource, an online community, and opportunities for peer learning. Bringing together councils and national partners to help shape and drive the ongoing development of Climate Local is a Climate Local Steering Group and Network.

The number of initiatives that may be taken, funding difficulties and lack of statutory measures presents a complex field for local authorities to navigate and may explain weak performance in this area. Cost is particularly dominant in achieving low-carbon programmes. Local

authorities in the UK can access a range of funding at the European, National, regional and local levels. Despite these sources, the prevailing financial situation and lack of statutory obligations to act are not encouraging local authorities to act.

Fudge et al. (2016) propose that bottom-up policy agendas from social to economic specifics are more likely to be more effective than traditional top-down policies when it comes to contributing to and achieving more sustainable levels of energy consumption. Local authorities can be influential in the following ways according to Fudge et al. Firstly to exploit a “Window of political opportunity,” where the role of local government has been able to exert greater influence over energy, within the context of evolving national and international policy frameworks and has consequently become more influential in decision-making on energy and environmental issues. A second approach engages with the community and considering the ways in which local government are able to engage or incorporate the public into their strategies for sustainable energy policy through behavioural niches. Thirdly, by exploiting technology and technological innovation, the ways in which local authorities have been able to evolve as ‘niches’ around technologically driven pathway solutions in relation to sustainable energy management. The local authority can, through technology adoption and infrastructure projects exploit new forms of political engagement with the public and the businesses in their locality.

Findings from the interviews conducted by Fudge and his colleagues show that among the wider range of views given by the interviewees, was a recognisable chance for them to take a leading role at most or at least influence energy concerns at local levels. The paper presents a view that following WWII, local authorities were less involved in policy making such as energy, which became more a matter for central government and a process of centralisation. Following the market-led approach only served to reinforce the post-war centralism. However, the empirical work conducted by Fudge et al. shows signs of increasing local authority

involvement in energy policy issues. For example, fuel poverty, transport, and planning, matters which local authorities are increasingly involved, implies that they have once more, as a result of that involvement, input to policies regarding energy strategy. In practical terms of their own leadership, and setting examples of energy sustainability policy enacted at the local level, authorities are addressing infrastructure renewal and energy reductions through the diffusion of technology, as was shown in Chapter 2 Innovation. It was also seen by some interviewees that issues of energy management were offering opportunities for local authorities to influence policy direction, but that they were not necessarily taking the lead for energy supply and demand for the whole country.

Under the heading of "community engagement", Fudge et al. identify two broad-based themes are taken from their empirical data. The first deals with "particular initiatives developed by the local authority where the involvement of the community has played a central role" and the second theme covers

"... broader strategic aims of local government in combining democratic and institutional renewal towards a more sustainable future" Fudge et al. (2016, p. 10).

As will be seen from the empirical work, the street lighting projects in the cases researched did not fall into either of these two categories. Technology and technological innovation offer opportunities to local authorities to contribute to and take actions for change and to find sustainability pathways which they can take directly or influence communities and local partnerships with, for example, local enterprises.

Before concluding this chapter, another form of governance is briefly considered. This takes the form of standards and guides developed and promoted by professional bodies. The first of these is "The Road Lighting Maintenance Code of Good Practice", originally published in 1999, was

intended to provide a foundation upon which local authority elected members and lighting industry professionals could use to generate effective road lighting policies.

As will be seen from the cases, the Road Lighting Infrastructure has been in a state of decay primarily due to underfunding and 'reactive' maintenance rather than preventative maintenance, the guide's purpose is to offer "good practice" approaches to making the transition from reactive to preventative maintenance Well-Lit Highways (2004). Its twenty-eight recommendations are not mandatory and assume that the authority has a policy for road lighting maintenance.

Notable in the guidance are policy inputs regarding, training operators, management of cyclical maintenance regimes, monitoring the operational status of the lighting equipment, fault reporting systems for public use, risk assessment strategies and competitive tendering for electrical supplies. Some of this guidance would seem to be obvious. For example, competitive tendering for electrical supply could be considered an activity that authorities engage in as a priority given the pressure on budgets and the need to find savings from the expenditure. The guide, contradicting its own non-mandatory approach, does list some mandatory policies, for example, a European Directive for energy using Products (2005/32/EC) is part of UK law, having been incorporated by Statutory Instrument SI 2007 No: 2037. Clearly, this guide is a valuable source for the post PFI operations and for management of all road and street lighting assets.

The Institution of Lighting Professionals provides a rich source of material for this subject with news, literature ranging from relevant legislation, road safety, crime, a series of technical publications, and there is also a directory of Local Authority Street Lighting Managers. The directory can only be accessed following registration with the Institute. An example of the documentation is "Guidance on current and forthcoming legislation

within the lighting sector”, The Institution of Lighting Professionals (2011), found at <https://www.theilp.org.uk/resources/free-resources/>

The reading of governance literature shows the use of private organisations noted as a phenomenon with a few hundred years of historical practice and a brief appreciation of the evolution of government to governance with the purpose to find if one or more governance systems are may be found in the street lighting projects to be studied. Thoughts of deriving a definition for governance were soon abandoned given the plethora of definitions in the literature. The range of governance systems covered span the broad governance stream, from New Public Management, corporate, project, and collaborative and sustainability systems.

Two aids are noted to enable assessment and analysis of governance systems. The first of these is the OECD “principles of good governance” offer a framework to assess effectiveness of a governance system OECD (2004) and the second, a tool to present results of fieldwork may be of value in analysing and presenting the data from the empirical work in governance research Huxham and Vangen (2005).

The nature of Private Finance Initiatives suggests the collaborative and network governance may have much to offer to assess the relationships between the public and private partners.

Modernising Government” included a stated need to listen to peoples’ concerns, to be consultative and inclusive and thereby achieve public value HM Government (1999). Hodge and Greve (2007) identified five governance families, the second dealing with long-term legal contracts with tight output specifications, for example PFI. A key document in the street lighting context is presented in the form of Schedule 18 calling for the establishment of a network board to oversee the management and control of the projects.

The conclusion from this reading of the literature is that governance is about the processes of social organisation, coordination, oversight, management and control through the rule of law, accountability, financial and risk management. This also sees a shift from hierarchy to markets and networks with increasing inclusion of private and non-profit-making organisations leaving governments as political institutions and establishing policy.

### **Informal governance**

Weimer (1995), in the introduction to “Institutional Design” indicates that research regards institutions as moderately stable sets of formal and informal rules. Weimer states that institutions gradually evolve but others are the result of purposeful design and both exhibit formal and informal rules.

As with formal governance, a definition of informal governance may help, for example from van Tatenhove et al. (2006, p. 14) who,

*“ ... define informal practices as those non-codified settings of day-to-day interaction concerning policy issues, in which the participation of actors, the formation of coalitions, the processes of agenda setting, (preliminary) decision-making and implementation are not structured by pre-given sets of rules or formal institutions.”* . van Tatenhove et al.(2006, p. 14).

Some caution is needed with this definition because the paper records the findings of a study of formal and informal politics in the European Union and takes account of the unique complexity of governing the union’s multi-levels.

van Tatenhove et al. propose that there are four strategies leading to informal practices. Two strategies are co-operative, trying to help or experiment but two strategies are either critical, avoiding or subversive.

To reveal and understand the interactions and interplay of formal and informal behaviours, Goffman's front stage and backstage analogy is used (Goffman (1959)). Another example of this dramaturgical approach is found in Friedman (1995) in his study of negotiations between companies and trade unions. We can think of front stage actors as elected politicians who are in the public eye. The backstage actors are the employed civil servants. All four strategies can be found operating in the front and backstages.

Piattoni (2006) explores the different ways in which informal governance may variously compliment, correct or undermine the formal procedures surrounding Structural Funds management as the object of the study. These ways can be recognised as the strategies that van Tatenhove et al. identified in their paper.

Piattoni's studies show that formal procedures or governance alone do not manage to achieve the co-ordination needed to implement developmental policies. Informal governance arrangements compliment, lubricate, allow experimentation and can act as early warning systems if formal procedures are not operating or used satisfactorily.

In a study by Ayres (2017), the role played by 'informal governance' in shaping political innovation is examined and defined as a means of decision-making that is un-codified, non-institutional and where social relationships play crucial roles (Ayres (2017) and also Horsh (2013), p.481). Managers interviewed used the informality to navigate their working environment and although the study is set in a political context, it can be appreciated that similar mechanisms as reported by van Tatenhove et al. and Piattoni are present in PFI / PPP project environments. Ayres builds on the framework adopted by Van Tatenhove et al. who identify the arenas where informal governance takes place. Using the "staging" analogy, Ayres agrees with van Tatenhove et al. and notes that backstage actors remain hidden from the public. Backstage informal governance may thrive and the flexibility can encourage

innovation but that may have limitations because the contract will need certain things to be delivered to meet the Key Performance Indicators (KPIs) thereby becoming constraints. Wynen et al. (2014, p. 46) found that an innovative-oriented culture encompasses both the intention to be innovative and the creation of a supportive climate for innovation.

Wynen et al. used NPM reforms and related characteristics to explain innovation-oriented culture within public sector organisations and studies to what extent managerial autonomy combined with result control does affect the development of an organizational culture conducive to innovation. The results support the assumption that granting a high level of managerial autonomy is likely to bring about a more innovation-oriented culture, which could be seen as a support for managerialist theories, arguments related to specialization, organizational legitimacy or identity building. Verhoest et al. (2007) found that managerial autonomy allows for more flexibility in the use of staff and finances potentially releasing resources for innovation and experimenting.

Ayres states that networks appear as a form of governance and formally sanction collaboration noting that front stage actors, being visible, need to remain in role, but working backstage may permit relaxation of formal rules to enable complex negotiations. As Piattoni explains, in the European Union, governance increasingly works through networks of interested actors from both public and private domains. Network governance is reviewed in the section “Collaborative and Network Governance” in this chapter.

### **Key Governance Topics**

The following summarises key topics in governance that are of note for the study of these projects.

- a definition of governance, Hughes (2003, p. 76) (thesis Chapter 4 Governance p. 95).

- Public Value (thesis Chapter 4 Governance p.100 et seq.)
- Stoker (1998) "... governance is about making the context for rule, regulation, and actions to be taken: and creating governing arrangements that do not need to refer up to the authority of (central) government" (thesis Chapter 4 Governance p.116).
- An expectation of a trend to project management - OECD (2004); A feature of the OECD governance structure is the assumed "projectisation" in corporate company operations. (thesis p.121) and HM Treasury publication "New Approach to Public Private Partnerships" which uses the word 'project' in 288 instances HM Treasury (2012b) (thesis Chapter 4 Governance p.121).
- Collaborative and network governance (thesis Chapter 4 Governance p.121).
- Sustainability: the UK Government recognises the influence local authorities can play in and the wider role they can potentially have to contribute to the development of energy policy. These issues are discussed in a series of publications as the "Low Carbon Transition Plan" DECC (2009), the 2011 UK Carbon Plan HM Government (2011), and the Community Energy Strategy (2014) and (2015) (thesis Chapter 4 Governance p.132).
- Informal governance (thesis Chapter 4 Governance p.138).

### **Research Questions**

A series of Associated Questions were developed from the literature reviews leading to answering the Central Question. The literature was identified using ATLAS.ti to find the articles that had two or three of the keywords governance, innovation and Private Finance Initiative/ Public Private Partnership present in their text, were placed according to the frequency of occurrences of the keyword in order to inform the innovation, PFI, governance questions.

To assist in understanding the prevailing innovation in the street lighting PFIs, the following associated questions will be addressed derived from the literature Belmans et al. (2004); Greengard (2015); Kortuem et al. (2009)

AQ 1: What lighting innovations have been developed and applied in those projects?

Leiringer & Schweber (2010); Leiringer (2006); Winch (2012); Robinson & Scott (2009); Carrillo et al. (2006).

AQ 2: What is the impact of innovation on the organisations involved in the PFI projects?

P3 / PFI Associated Research Questions derived from the literature ; Caldwell, Roehrich, Davies (2009); HMT Delivering Long Term Value (2008); Infrastructure Standardisation of Contracts (051212); Leiringer & Schweber (2010); Nisar (2013); Well Maintained Highways (2013); Robinson & Scott (2009).

AQ 3: How did the PFI satisfy the requirements of the three different authorities?

Johnston and Gudergan (2007); Nisar (2013).

AQ 4: The PFI was the first undertaken by the three authorities, was it treated like a traditional contract or did it caused the authorities to adapt their governance or management arrangements?

Governance Associated Research Questions derived from the literature Hartley (2005); Johnston & Gudergan (2007); Winch (2012); Robinson and Scott (2009); OECD (2004); Demirag et al. (2004). van Tatenhove et al. (2006)

AQ 5: What form does the street lighting PFI governance system take?

Wynen et al. (2014, p. 46).

AQ 6: How does the governance system promote and encourage innovation in the project?

The literature review has helped to develop the Associated questions leading to the following:

**Central Research Question:**

CQ: What is the scope of innovation encouraged by the governance system in the street lighting Private Finance Initiatives (PFIs)?

## **Chapter 5 Methodology and Method**

### **Introduction**

Having examined sets of literature in the key fields spanning the research subject in the preceding chapters. This chapter considers the methodology and method employed in the research to cover these topics and in addition instrumentation, the N-C-T cycle, qualitative data analysis, researcher bias and ethical considerations. Firstly, the context and philosophical considerations in this type of research will be discussed to support a qualitative approach.

### **Context and Philosophical Considerations**

The issue that the street lighting systems in the counties of Hampshire and West Sussex and the City of Southampton were reaching their end-of-life stage and were in urgent need of replacement provides the wider context for this research. This situation also prevailed in Surrey, the subject of the Pilot study, where the project heralded an innovative approach. All the councils involved, following an investment appraisal process, opted to seek PFI funding to provide the inward investment necessary to support the replacement projects. The managers and informants of both the Pilot and Target studies were the lead project and commercial managers to their respective PFIs and also sat on the executive (Network) boards formed to govern the projects. The sub-contractors to the Special Purpose Vehicle was also part of the network boards with their risk and commercial project manager contributing as informants. The Pilot and South Coast Street Lighting PFI were awarded to different contracting companies.

The words in the above context description are consistent with those used within the communities of practice of governance and project management that enable effective communication with peers and the community in

general reflecting their ontology, the real world experience that has informed and developed from their body-of-knowledge.

Although the informants and the investigator share this common currency of meaning they are likely to interpret what is communicated, because despite their shared body-of-knowledge, they have had different experiences stemming from their individual practice. Making sense of the investigator's questions and in turn making sense of the informants' responses in an attempt to construct mutual and self-understanding of the PFI project is in essence an interpretivist approach. This approach required the methodology and methods adopted in this research.

The words used by actors and respondents in the cases act as labels, derived or developed to give subjective meanings of experiences that enable the researcher and informants to have a dialogue from which sense can be made of the experience (Creswell (2014); Mertens (2010); Crotty (1998); Lincoln and Guba (1985); Berger and Luckmann (1967)). A worldview emerging from the underlying philosophy and expressed as 'first-person knowledge' by Isaacs (1999), who believes such knowledge is "highly relevant" and by containing the whole experience, has an interpretive element.

The main concept in focus for the research is "governance," and the meanings used to direct attention towards socially constructed and agreed sets of rules or structures to oversee the management and control of the replacement and ongoing maintenance of lighting infrastructure covered by the cases. taking place in the cases.

The original question motivating this research suggested three literature streams or domains that would support understanding the context, developing associated research questions and the interview questions: namely governance, Public Private Partnership and Private Finance Initiatives (PPP/PFI) and innovation. PPP was included because PFI is a

type of PPP. Innovation presents the contributing and applied technologies that may be found in modern street lighting solutions. PPP/PFI takes the particular path of reform in the UK public sector to understand how PFI has developed in the UK and how from twenty years of experience has now been reformed based on that experience.

Weber (2004) raises valid points regarding the positivism versus interpretivism rhetoric with a call to develop a new rhetoric. The differences should not divide researchers, but we should realise that as researchers, we are trying to understand a shared experience of a phenomenon. However, to be able to repeat our own study or to enable others to conduct the same research, we must be sure to state which philosophical, theoretical, methodology and methods we have used. For example, repeating this study from an ethnographic standpoint would surely result in differences in the findings from this research, but hopefully valuable insights. It is therefore essential to declare the approaches taken.

## **Methodology**

The origins of positivism that emerged in the late nineteenth century embracing both natural and social sciences with the methods that were objective and researcher neutral summarised in Bell and Thorpe (2013) who state positivism is the dominant paradigm in management research. The purpose of this research paradigm is to find causal explanations for behaviour in managerial situations.

The changes in appreciation of the philosophical landscape explicated by Kuhn, to concerns about the nature of knowledge and the means of its acquisition expressed by Morgan and Smircich suggests a growing awareness that positivist approaches might not be appropriate in the broader social science and in particular, business management research (Morgan and Smircich (1980); Kuhn (1970)). Prasad and Prasad (2002)

illustrate the growing number of methodologies in qualitative research in their introductory paper concurring with Burrell and Morgan (1979) who earlier had stated that there was no single paradigm in management research.

In our research practice we may use reflexivity and social construction, however, we should heed the cautionary note made by Weick (2002) in his paper, advising us, in essence, not to overindulge in reflexivity to the extent that we detract from the subject or the informants, by concentrating on ourselves. However, reflection on issues that may cause misunderstanding of the field being studied is necessary, for example, researcher bias, and is discussed later in this chapter.

Newman and Benz (1998) dispel the argument about quantitative and qualitative methodologies, rejecting the arguments that one is “superior” to the other and that they are mutually exclusive by declaring that they are parts of a continuum whose basis relies on scientific philosophy. A value of this declaration is that it admits the validity of mixed methods, but it does not exclude the need for the researcher to provide a rationale and assumptions for the choices used in their research.

Crotty’s work encourages a framework with which to help the development of a research proposal. Importantly this framework shows the interdependency of the processes in designing research.

Creswell (2003) used Crotty’s framework to ask three questions key to the design of research, (1) what knowledge claims are being made by the researcher (including a theoretical perspective); (2) what strategies of inquiry will inform the procedures and (3) what methods of data collection and analysis will be used?

The theoretical perspectives underpinning this research are drawn from the large corpus of literature presenting:  
the emerging concept and development of governance;

the literature describing the developments in Information Technology and Systems (IT / IS); the various sources of Private Finance Initiative literature ranging from governmental guidance and policy to academic research.

This study tries to understand how innovation is achieved, if it is achieved in the chosen PFI and is qualitative research employing case study. The approach taken to initiate the inquiry was to determine who were appropriate to invite to participate in the research, contact them explaining what the research was trying to achieve and what their participation would involve. The instruments for this are described later in the chapter. Documentation that could be found that described the target PFI projects was also to be used.

Online searches, county council and UK government websites were the main sources where project specific and PFI documentation could be collected. Interviews with the managers who agreed to participate in the research were to be recorded with their permission. Transcription and analysis of the interviews was to be made in the QDAS tool ATLAS.ti.

Yin states that there are several ways of conducting social science each with advantages and disadvantages in their adopted strategies. Each strategy depends upon three conditions: (1) the type of research question, (2) the control an investigator has over actual behavioural events, and (3) the focus on contemporary as opposed to historical phenomena Yin (2003, p. 1).

The nature of case study is expressed by Yin in an abbreviated form as *An empirical inquiry about a contemporary phenomenon (e.g., a “case”), set within its real-world context—especially when the boundaries between phenomenon and context are not clearly evident* Yin (2009, p. 18).

To determine if case study is appropriate for this research project, the conditions and the definition must be considered.

Firstly, although the research question asks “what”, the “how” or “why” , of the governance system to encourage innovation, may (or may not) follow. The researcher has absolutely no control over the PFI project being neither employed nor associated with any of the organisations involved and therefore meets the second condition. The third condition is also fully met, as the project combines evidence from both public and private sources including documentation developed by the public clients, situated in a live PFI project of duration 2010 to 2035, to replace obsolete infrastructure in which it is not obvious whose policies or agency led to innovation or continuing value for money.

Having considered thus, a case study was adopted with the type of case both exploratory and descriptive; the exploratory part coming from the respondents' interviews and the descriptive element combining the interviews and the project documentation together to create a broader and deeper presentation.

## **Methods**

At present, there are 31 PFIs in England for street lighting infrastructure projects. The subject of this research is the “South Coast Street Lighting PFI” which is the largest project of its kind in the United Kingdom. At the initial stages of the research it was planned to treat the “South Coast PFI” as a single case study. However, it was discovered that following the award of the contract, the project was treated as three separate projects one for each county council and one for the city council and together with the Pilot study, the contract/sub-contractor and the certifier offered the opportunity for six case studies. “South Coast” is also the subject of a case, but this is based only on the available documentation.

The units of analysis are the PFI Project Managers in the respective organisations, Governance Boards, and Auditing Team, i.e., the

Independent Certifier. A series of semi-structured interviews and the PFI project documentation were used to develop a six-case qualitative research methodology approach. Researcher comments and insights were omitted to avoid researcher bias. This appears a reasonable set size given the street lighting PFI population size of 31 projects.

The approach taken for the analysis follows that described by Seidel (1998), a process of Noticing, Collecting and Thinking about Things from the empirical data and informed by the literature review, see Figure 5.1 Seidel.

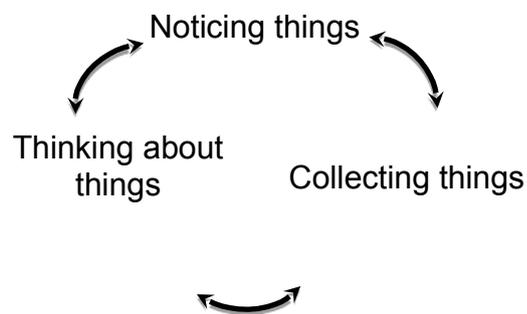


Figure 5.1: The N-C-T Cycle (adapted from Seidel (1998))

### **Rationale for the Chosen PFIs**

Surrey Street Lighting was chosen as the pilot study as the researcher is a resident in that county and access was enabled through the office of the local councillor, who is also the chairman of the Council Transport Committee, a sub-group of which is responsible for the street lighting PFI.

## **The Pilot Study**

The pilot study was important to establish and confirm the protocol, testing out the experience of interviewing, data collection and analysis on a small scale. The findings from the Pilot are included in the findings from the main study.

An interview scheme was established and trialled in the Pilot with the purpose of confirming or amending as necessary and to refresh interviewing skills for use in the target projects. At the heart of the interview is the deep intention to explore and develop understanding of the experiences and knowledge of the managers in the PFI projects following the views of Seidman (2013), Cohen and Manion (2000). As interview style in the form of a dialogue was adopted and as Arksey and Knight (1999) proposed, allows for the clarification of points and improvisation necessary if that depth of understanding is to be achieved. Roulston (2010) states that the researchers philosophical position should be linked to the type of interview used and describes “Romantic” that includes establishing a rapport with the informants and “Constructionist” in which both interviewer and interviewee work together in making sense of the topic being studied. To an extent both of these types were used in the case study interviews.

The semi-structured style employed in this research did have a series of questions used as a guide during the interviews to ensure that the issues identified from the literature were covered, but had the flexibility to improvise if the discussion was dealing with a relevant but useful additional knowledge input as described by Wengraf (2001), and Arksey and Knight (1999).

In terms of reliability, Miles et al. (2013, p. 312) state that the foundation to achieving reliability is to ensure that the process is consistent and stable over time Yin (2009) states

*“The protocol is a major way of increasing the reliability of the case study research”* Yin (2009, p. 79). Reliability is achieved by using the protocol to guide each stage of the data gathering process and then the analysis of the data.

As the researcher was the primary instrument for data collection, the protocol and its application was a valuable aid to achieving consistency. The use of a QDAS tool also offered the means, as described by Sinkovics and Alfoldi (2012, p. 827) of *“ a systematic, comprehensive and exhaustive audit-trail of their analysis of corpus-data (that) provides greater transparency and credibility otherwise called “trustworthiness ...”* . However, it must not be assumed that using QDAS automatically assures quality, reliability and trustworthiness to the qualitative research process, it is the researcher who is conducting the analysis, not the software Sinkovics and Alfoldi (2012 ); Seror (2005); Gilbert (2002, p. 220). Copies of the questions and transcripts were sent to all the respondents to review and offer any corrections; none were forthcoming.

For the pilot study, the Commercial and Project Manager in Surrey County Council agreed to be interviewed and his opposite, the Project Director in the Special Purpose Vehicle for Surrey Street Lighting Ltd was invited, but declined.

South Coast Lighting was considered a valuable target study, as it is the largest PFI of its kind in the UK, and at the business case stage Hampshire and West Sussex County Councils and Southampton City Council joined forces to achieve a singular economy of scale and with the expectation of achieving the best value for money for their constituents. This event allowed for three studies.

### **Data: Sources and Management**

The data was collected from the main sources of interviews and archived documents prepared by the authorities. Those participating in the

interviews were from the senior management teams of the public and private organisations involved in the street lighting Private Finance Initiatives.

The participants' experiences with the street lighting PFI, will help to elicit what innovation had been introduced to the project and how that affected the organisations involved; how PFI satisfied the requirements for renewal of the lighting system; what changes adopting PFI had on the governance and management arrangements; and finally what form the governance system took and did it promote and encourage innovation.

A number of publicly available documents are also included for analysis in the primary data set. These are openly available on the respective Council websites and include, for example, the Final Business Case for South Coast Street Lighting (2009) and the Department for Transport Survey (2003). This documentation is taken as primary data as it has been prepared and approved by the officers and executive responsible for the projects in the councils and HM Treasury.

Publicly available documentation that supported the study is presented in the following list:

- Hampshire County Council (2013) Hampshire County Council Street Lighting PFI Project Guide.
- Hampshire County Council (2009) South Coast Street Lighting PFI Final Business Case Hampshire County Council, 6 Nov 2009.
- "Improving your street lighting" (2010), Southampton, Southampton City Council with SSE Contracting.
- Police Road Death Investigation Manual (PRDIM) (2007).
- South Coast Street Lighting Final Business Case (Redacted Version) (2009).
- South Down National Park (2013), Short Term Plan 2013.
- UK Department of Energy & Climate Change (DECC) (2014). Community Energy Strategy: Full Report, (January), 1–108.
- UK Department of Energy & Climate Change (DECC) (2015). Community Energy Strategy Update, 43.

- “Well-Lit Highways: Code of Practice for Highway Lighting Management” (2004), 13 August 2013.
- Well-maintained Highways: Code of Practice for Highway Maintenance Management (2013) 2005 Edition Updated Sept 2013, London: The Stationery Office.

It is important to note that only the documents are referenced in the case study chapters. This is because the case texts are developed from the interviews or dialogues with the respective managers.

It may be the case that other respondents would have given a different picture, but none were forthcoming or wished to participate at a level above and below the group who did participate.

The equivalent documentation in the private sector is not freely available. However, their websites are generally helpful in terms of the services offered and their own case studies. They also have technical information on the technology and products used which are employed in the case study projects. Media sources may also be used where appropriate together with company press releases where these are directly applicable.

Access was, in essence, a series of ‘cold calling’ episodes, because the researcher had no prior contacts in the organisations involved in the target project and as the primary instrument, it was a key role and responsibility. This generated an official or manager who responded and who was prepared to participate. One important criteria for the choice of any interviewee was that the executives and senior managers in both public and private sectors who agreed to participate in the study were directly involved in the project.

The primary sources of data therefore came from the participant interviews and relevant formal project documentation, further data contribution is included from the visited sites. It was difficult to avoid noticing artefacts of organisational culture on entry to these offices, conference rooms, and the

depot. However, for completeness, observations made from these are included in the Study findings chapter. Schein teaches us in “Organisational Culture and Leadership” in the “Levels of Culture” diagram, that while what is seen can be hard to decipher, what is seen are the first level “Artefacts” the visible organisational structure and processes, in other words what you see when you enter an organisation Schein (2004, Figure 2.1, p. 26).

Documents prepared by the lighting authorities during the pre-contract bidding phase, for example, the Final Business Case, were available from archive on the Internet in .pdf format.

The interviews were all recorded, permission having been sought earlier and awarded in due course. The researcher conducted the interviews and subsequent transcriptions that helped to keep the researcher close to the “raw” data.

An interview protocol based on Remenyi (2012) was developed to ensure repeatability and reproducibility during the data gathering from the interviews. A document “Information for Participants” prepared as part of the protocol and was sent to the interviewees a working week prior to the interview meeting together with a “Letter of Informed Consent” provided to record for agreement to participation. Examples of these documents are presented in Appendices B, C, and D respectively. An “Interview Question Guide” was generated from the literature and experience in governance and is presented in Appendix A.

The purpose of this was to ensure that the interviews were consistent in their coverage and enabled a return to the questions if an arising topic led to a wider discussion.

The case studies, interviews, transcripts and audio files together with the primary documentation from the councils and SPVs were imported into a computer aided qualitative data analysis software (CAQDAS or QDAS)

programme. The addition of the literature from the literature reviews completed the corpus of material supporting the research. The interview transcripts were logged into the CAQDAS software for transcription, which is a function offered by the tool. Transcription of the interviews helped to recall the interviews, maintained familiarity with the data and continued the process of “noticing things” leading to consider how to analyse the data. This process creates a file that can either, be analysed directly in the tool or exported to be read by a word processor. The process of collecting candidate material to include in the corpus is a dynamic one and continued throughout the research life cycle.

### **Data Analysis**

The QDAS software used to support the analysis of the data was ATLAS.ti, using an analysis cycle based on Friese (2012). The first aspect of noticing things was framed by continuing to use the heuristic of the three keywords governance, innovation, and PFI used in the interviews to guide a series of questions about, for example, innovation. The responses could then be taken as a quotation and coded as “innovation.” As material from the corpus was read, if a phrase, sentence or a paragraph is of interest, it is “collected” by selection as a quotation. In some instances, the code assigned or mapped to the quotation was obvious, for example, in an interview if the thread of discussion was dealing with innovation, the responses would then be selected as a quotation and coded as “innovation.” Thus, ‘noticing’ was moving into a more formal stage of interpretation and linking quotations with relevant codes. In the process of coding and analysis, codes were mapped to corresponding research question memos. When the frequency of coding reduces, i.e., when the number of quotations being coded reduces, signals the point when further analysis will bring little more detail, a report output can then be made of the research question memos and a consolidation summary of the quotations made that are, in effect, responses to the questions. Use of the

QDAS tool provided a support framework for consistent application coding during cycles and facilitated transparency of the analysis.

QDAS tools are able to read inputs in a variety of formats and do not inhibit the coding process. Text can be highlighted and notes or memos made describing the relevance or connection the text has to the research together with thoughts about potential codes. If it is obvious to code, an assignment can be made at this point.

The process used in this research is shown in Figure 5.2. In the first cycle of coding, portions of interview text that had something to say about the domains of interest were selected as quotations. Codes are assigned to the quotations and during this process; memos are created continuing a process started in the literature review when developing the research questions.

The process of identifying quotations and assigning codes is continued and when identified from the codes, a further assignment is made to the relevant research question memo.

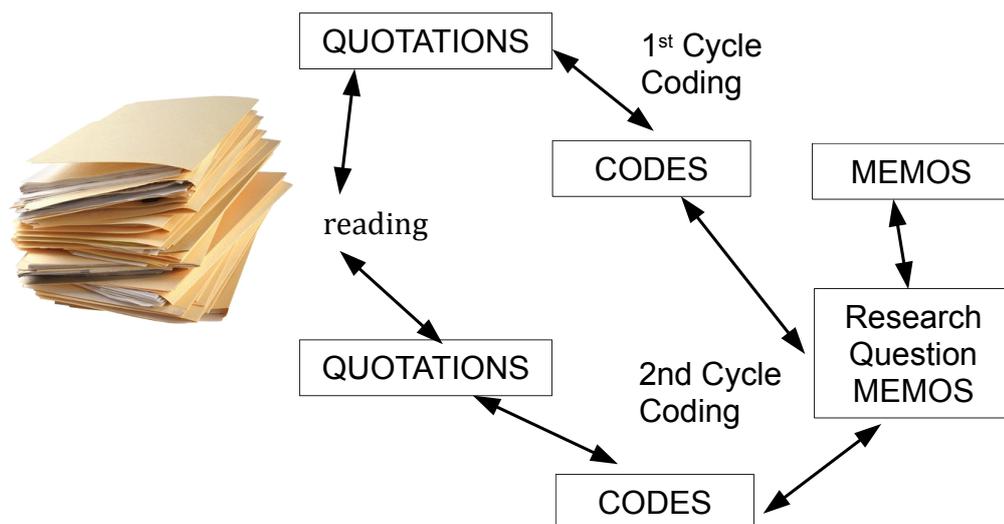


Figure 5.2: Coding Cycles and Assignments

## **Coding**

As declared elsewhere, the empirical work is exploratory in that there is no claim to prior knowledge of the prevailing governance system in the pilot or target street lighting projects. When considering the analysis of the empirical data, it seemed logical, certainly consistent, to use the three keywords as provisional codes in the first cycle of the analysis and coding in what could be called an “exploratory coding method”.

Codes used and arising in the analysis are described in Appendix F in an amended form presented in “*The coding manual for qualitative researchers*” Saldana (2015).

## **Researcher Bias**

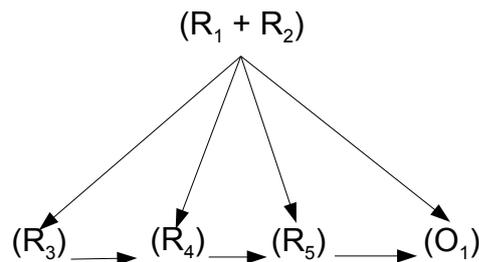
Two potential sources of bias are considered. The first is the effect the researcher has on the case. The duration spent with the authorities and the participants either at their offices or at the depot where they were co-located was limited to no more than half a day with each one. Certainly, this was not long enough to become “one of the team” and therefore insufficient for reciprocal influence.

The second consideration is the effect the cases have on the researcher. Again the short duration of the encounters reduced the likelihood that the culture and practices of the organisations would result in lasting influences.

The managers who participated were the PFI Project Managers and were directly involved in the day-to-day management and control of the PFI and were also Network Board Members, who understood the strategy, decisions and guidance at the board level and had the responsibility to carry it into the project.

In deciding whom I should interview in the other authorities, I asked the current interviewee who would be appropriate candidates to invite to participate. Their responses were used to make contact and in all but one case this proved very successful.

Having achieved access to one of the councils in the South Coast Street Lighting PFI, the opportunity was taken to exploit that access by asking the respondents if they could reveal their counterparts in the other councils and the contractor / sub-contractor's organisation. Miles et al. (2014) call this "opportunistic" or "snowball" sampling and although a seemingly informal approach, that uses and relies on what was a natural peer network during the pre-contract phase of the PFI Miles et al. (2014, p. 32). A stronger definition of snowball sampling can be found in Atkinson and Flint (2001) who reference Vogt (1999). Noy (2007) shows how to illustrate a network derived from snowball sampling. Figure 5.3 illustrates the sequence of contacts for the PFI manager network.



Where:

R = respondent;

O = organisation

Figure 5.3: The Snowball Sample Stemma

The advantage to this study was that in one request the network was revealed and although this did not necessarily guarantee that the identified managers would agree to participate, there was the certainty that their roles and accountabilities were the same in each case.

## **Ethical Considerations**

The project does involve human participants to the extent that they participate in interviews to relate their understanding and experience of the phenomenon under study and have given their permission to respond.

Their agreement was requested and given, following a written explanation of the research and its purpose thus affecting their informed consent. The instruments to achieve this, described previously, are presented in Appendices B to D.

To the best endeavour this complies with the university's Tier 1 ethical process, which was conducted at the Business School level.

Ethical considerations continued to be important during the study and data analysis. My own bounded rationality, meant that ethical issues unknown and unforeseen by me could occur throughout the research and until its conclusion. As any such issues came about, I made every effort to take an honest and reflective approach to find an ethical resolution. Writing reflective memos, respecting the participants and the primary data in the analysis are among the key precautions that are suggested by Miles, Huberman and Saldana (2014, Ch. 3) also Bell and Thorpe (2013, p.108).

The following six chapters present the case studies and begin with the Pilot Case.

## Chapter 6 Pilot Case Study: Surrey Street Lighting PFI

Surrey, one of the Home Counties, covers approximately 642 square miles (1,663 km<sup>2</sup>) and at the 2006 Census, a population of 1.085 million. In terms of the street lighting estate, Surrey has 70,000 lights, 19,000 lights to be refurbished and fitted with energy saving bulbs and 17,000 illuminated signs and bollards.

Surrey County Council achieved approval of the Final Business Case in September 2009.

The Special Purpose Vehicle (SPV) for the PFI was formed by Skanska-Laing, with Skanska as the contractor.

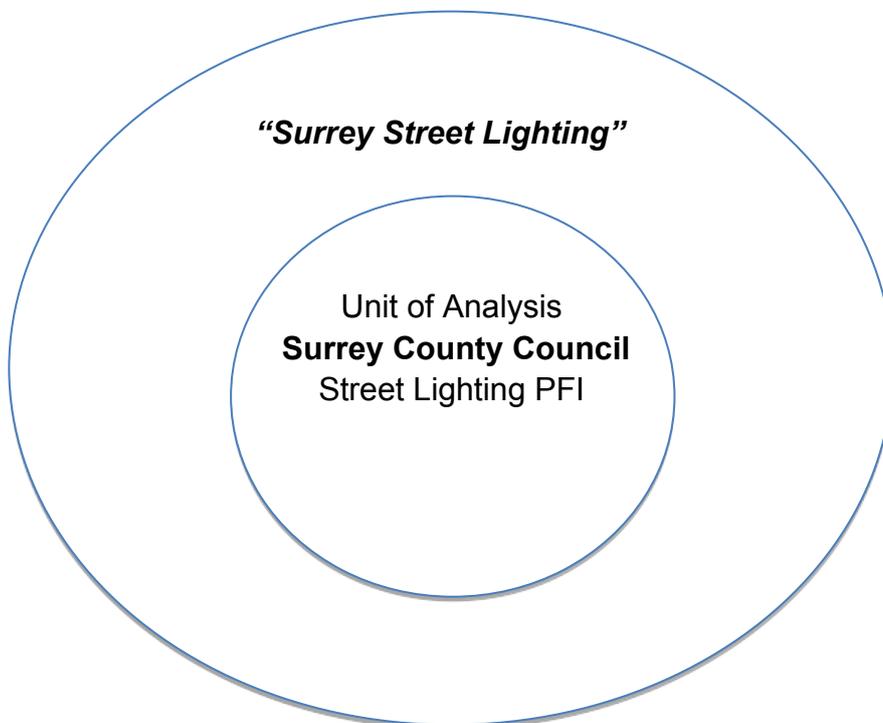


Figure 6.1: Pilot Case – "Surrey Street Lighting"

The case study draws its narrative from a dialogue with the Commercial and Performance Manager (CPM) employed by the client authority.

The street lighting stock in Surrey needed replacement following a long period in which there had been little investment and low maintenance practice. The requirement for replacement was therefore not in dispute and there was a growing urgency from an increased risk of safety liability issues to the public and therefore to the council. The council's recourse to a PFI was viewed as an innovative procurement approach and enabled addressing these issues directly.

The authority intended that a 20-day notice of commencement of work would be sent to assigned localities prior to the commencement of work, advising residents what was to happen and who to contact for queries if necessary. The contractor, more used to starting a project immediately from the launch, had to be restrained by the authority to allow for the required 20 days' notice.

### **Governance**

Two levels of governance were noted for the PFI in addition to the overarching council governance system. At the board level of the project, called the 'network board group level', comprised of members from the Council and the Partners Skanska-Laing, and taking the strategic long-term view and decisions. A lower level governance 'board' working within the project, at a 'contract' and operating level and is, in essence, the project management for the PFI project. This lower level board also had council and partner members.

At the operating level, the prevailing governance system has two loops of checks for feedback,

- (1) Random testing of the means of information capture and reporting; and
- (2) Checking that this information capture and reporting capabilities are fit for purpose.

This is described as the 'performance monitoring system.'

A set of performance standards were derived prior to the PFI contract let are used to decide if full or partial payment is made depending upon the nature of the progress made by the SPV.

The authority considered that the conditions for good governance and management are based on well-defined and designed requirements specifications together with a corresponding schedule of work. Taken together these conditions enabled good control over the project.

The schedule specifies which lights will be replaced, in which streets and between which dates. The requirements specifications and the schedule are what are referred to as the 'performance standards.' In the event that work has not been fully completed in a given time period, then it is straightforward to assess what payment can be held back and escalation input can be simply defined. The incentive for the contracting arm of the SPV is, however, to work closely with the authority to achieve the full payment.

The progress data is captured in real-time and a monthly report is made available to both the public and private partners. The authority described this as an "open book" working approach. From the performance monitoring process and the checks on its data capture and reporting, both parties gained confidence in the quality and veracity of the data. Both parties can see when the project is on track or when some remedial action is needed. There is an indication that the public and private organisations are prepared to work together to overcome a problem or issue with the contracted work. It also indicates a more informal approach is taken in this early stage of problem identification while the matter is resolved. However, if the problem is not resolved at this level, an escalation process is initiated which may lead to a portion of the current stage payment to be held back while the matter is referred to the higher network board level for adjudication and decision.

The authority's project manager was able to make a comparison between "other contracts" and PFI contracts in terms of the speed at which escalation takes place. PFI seems to be much faster to escalate to achieve arbitration. This is as a result of the reporting system that reveals the nature and extent of discrepancies against the standard. That early notice and joint actions taken are the reason the process seems and is faster.

The interviewee was not sure that the governance system or governance model actually drove innovation. It may be surmised from this, however, that it was governance at the working level that did not drive innovation. The operating level had been established to manage the programme of work and report to the network group. It is interesting that no opportunities for innovation were even considered as part of this process.

The view of the public project manager was that "governance" as such was not driving innovation, but if there was innovation then it came from incremental changes.

It was thought however that innovation would come from the higher level of governance, at what is called the "network board group level." This group meets quarterly and includes senior management from the SPV, contractor and the client although it was not obvious how the board would promote innovation.

It was clear that the governance system would change following the completion of the first five years part of the PFI contract. It was difficult to predict what these changes might be at this early stage of the project.

A schedule of the meetings is published annually that includes the quarterly network board for high-level strategic review and direction decisions, a monthly review, formally called the Monthly Monitoring Review and monthly working level meetings. It was admitted that there were problems in adhering to this schedule despite being available well in advance to aid planning. The result of this is that there is little time to prepare in the interval between a late meeting and the next meeting in the

scheduled sequence particularly if the next meeting is held according to the schedule.

## **Innovation**

The phrase "innovation with a small 'i'..." appears quite often in the dialogue with the project manager and it was really thought of as process improvement rather than innovation. It was the participant's view that innovation was "*quite hard to do unless you've got an R&D budget.*"

Throughout the dialogue, it was considered that PFI itself was the innovation. The applied technology was considered to be an improvement. Thereafter, it was the limited use, where necessary, of lighting systems like LEDs, but these were not considered innovations as such, but just taking a measured risk to reduce carbon footprint and costs.

No mention was made of the Final Business Case (FBC) that had proposed the use of "Innovation Zones." Within Surrey, the zones are designated localities where new services, new infrastructure and so on can be trialled with a wide variety of partners with whom the Council has established for these purposes. The FBC expresses the intention to include such an arrangement for street lighting, and it is likely that it will be in such a zone that the LED technology will be trialled.

An example of process improvement was that in order to achieve the network synchronisation of the lights in a locality within the network on the central control system, it was operationally necessary to leave the lights on for typically a week while that synchronisation process took place. This resulted in a large volume of inquiries from members of the public asking if this was "normal" and equally complaining that the lights were left on and wasting electricity!

The remedy here was to add a statement to the "20-day notice" regarding the street lighting replacement programme, explaining that for technical

reasons and to enable the network control system, the lights would remain on for approximately a week and possibly a few more days beyond that if there were technical difficulties to overcome. This all but eliminated these inquiries.

It was interesting that the participant thought that it was 'possibly' difficult to know if the PFI would be more expensive in the long term. Although not stated, it is assumed that this remark is comparing PFI with the conventional term or traditional contracts.

At the time the interview was held, the project had reached a stage where the contractor had achieved nearly a years' advance on the planned work. While presenting some problems of how that situation could be managed such that expertise on the contractor's side was not lost if the work slowed to half pace or stopped altogether. An opportunity did, however present itself in that the next cycle of work could be considered in advance. This was to consider the use of LED lighting technology for street lighting.

Surrey County Council started their street lighting PFI competitive tendering exercise in the first round of PFI credits but did not complete until the second round. This delay enabled a re-examination of the technology and permitted the introduction of a central control and monitoring system for the lights. Surrey was one of the early adopters of this with the benefit of enabling greater and more precise control of the street lighting. Rather than using timers, lights can be controlled individually, dimmed or have alternate lights switched off and so on.

The technical and output specification are based on a variety of factors such as knowledge of the available and emerging technology, the highway topology that needs to be illuminated, the budget that is available and so on. There will be issues that were not appreciated during development of the specification. For example, many changes that have taken place since the street lights were previously installed some 20 - 30 years previously,

such as underground cabling and pipework for gas and water utilities have not normally been added to the civic design and planning documents. This results in unknowns that are encountered when a street light lamppost is re-positioned to meet the new design standard. To overcome problems arising from this the authority and the contractor has worked closely and collaboratively to resolve the issues of bounded rationality inevitable in complex projects. The collaboration has greatly assisted the authority who has to approve any fixes or alternative solutions to resolve the problems. If a problem arose, then both the public and private sector actors involved would work together to achieve a way forward and it is emphasised, thereby avoiding escalation as described in the governance section.

Staffing levels are dictated by the allocated budget and in Surrey the funding was such that allowed a small team of three. A fourth team member would have been valuable but was not possible due to these funding constraints, in that it was hard to justify the expense of a fourth staff member.

Surrey County Council, unlike most other street lighting PFIs have not included illuminated road signs and bollards in the first five years' replacement programme. The problem is that replacing the lights with LED technology is not just a matter of replacing the lights, but the signs have to be replaced as well because the light fittings electrical requirements are not compatible with LEDs. The cost of replacing the signs and bollards is such that on the major cost reductions achieved by the reduction in electricity consumption would take nearly ten years to pay back. This is unlike the street lighting case where the payback is faster and the figures are so large as to make the change acceptable to the budget holder. However, it might be observed that the Department of Transport Highways Agency was providing a credit for the replacement street lighting stock, and would not have been a cost to the Council.

While there is the main emphasis on streetlights — the lights or luminaires themselves, there are other changes taking place. For example, some lampposts are now being manufactured in carbon fibre. This type of technological change plus LEDs can be used to benefit certain critical areas, and therefore there is no need to replace the whole lighting inventory at once.

### **Personnel, Learning and Knowledge Management**

In the two months preceding the commencement of the contract, the team that was charged with staffing the project into the first stage implementation stage spent time learning about PFI and the contract. No formal programme of training for PFI was arranged for the team. The contract and commercial and technical details were well-defined from the work of the bid team, which was an advantage to the incoming team.

The team, therefore, took the responsibility of acquiring the knowledge capability that they needed without any formal process being promoted from HR. The skills are more related to the team function and it was noted that the skills change over time by virtue of the work and the team's engagement with it. For this organisation, and while the participant noted that there were changes being made to "staff development", it was always going to be a difficult challenge for a small organisation that had a growing number of contracts to manage. The organisation was becoming more like a procurement organisation rather than having the appropriate or necessary knowledge base to work with the various contracts.

A learning event to "compare notes" with two other authorities who were using the same contractor was arranged between the authorities. This was called 'knowledge management' and 'peer review', and may loosely be the former but it was not peer review in the strictest sense. Difficulties encountered in the event were to do with the different communities of practice that attending the meeting. On one side, mainly engineers who

were running their contracts and on the other commercial and procurement specialists neither speaking the same "language" although they were all engaged in the same type of project.

In the opinion of the project manager, there was a weakness resulting from the loss of the people who had developed the contract and who were no longer working on the project following contract let.

The result of this was to lose the continuity between the two phases of the project and particularly the loss of rationale behind the decision-making or the decisions that were taken. However, it was acknowledged that the different phases of the project required different knowledge and skills. There is a need to ensure that new personnel are suitably inducted and have sufficient knowledge about the state of the project and contract.

The participant said that the interview or discussion was useful and that when the next stage of work was reached that he would want to be in the approval loop for the governance documentation. It can be claimed then that even this brief 'intervention' has been a benefit to the future of the project.

## **Chapter 7 South Coast Street Lighting**

In January 2006, Hampshire County Council initiated their Expression of Interest (EoI) to the Department of Transport (DfT) for Private Finance Initiative funding to replace the County's' street lighting stock. The Hampshire authority had established that significant investment was needed to improve lighting standards and reduce a growing backlog of maintenance and repair issues that could not be managed within the available budget.

In July 2006 the Minister for Transport requested the authority to submit an Outline Business Case (OBC) to support the authority's funding proposal. Towards the close of 2007, the Department for Transport Minister expressed concerns regarding the affordability of the project. The Minister noted that both West Sussex County Council and Southampton City Council had also submitted PFI funding proposals to replace their respective street lighting inventories, and asked the Hampshire authority to explore the opportunities for collaborative working to achieve efficiency savings.

The Department for Transport (DfT) approved the bid for PFI investment in January 2008 as a joint partnering approach between Hampshire County Council, West Sussex County Council and Southampton City Council had been agreed and was called "South Coast Street Lighting," and whose objective was to select a single Service Provider who would have separate contracts with each Council on completion of a successful bid.

Each Council had independently established that their street lighting stock was aging and significant investment would be needed to replace columns, lanterns, and other illuminated equipment. Table 7.1 shows a comparison with national figures of the age of the "South Coast" authorities' lighting assets and Table 7.2 shows the lighting assets of the authorities prior to the commencement of the PFI.

	HCC	SCC	WSCC	National Average
30 years old +	42%	48%	37%	31%

Table 7.1 – Comparison with National figures (Source DfT 2003 survey.)

The DfT detailed analysis assessed the extent of the shortfall in the existing stock showing that the percentage of street lighting apparatus over 30 years old is higher than the national average of 31% (Source DfT, 2003 survey.) The DfT data confirms the authorities own data regarding the age of the lighting assets.

	HCC	SCC	WSCC	TOTAL
Columns and Bracket Mounted Units	129,080	25,359	66,765	221,204
Illuminated Traffic Signs	8,456	2,197	8,478	19,131
Illuminated Bollards	2,500	920	3,339	6,759
TOTAL	140,036	28,476	78,582	247,094

Table 7.2 – Current inventory prior to the PFI

The Authorities identified a number of drivers for change.

Public perception: considered that street lighting is important to community safety and wellbeing for themselves and visitors.

Asset condition: given the contribution street lighting makes to communities, it was recognised that the condition of the lighting assets had not kept pace with modern standards and today's requirements. A detailed analysis assessed the extent of the shortfall in the existing stock

and is presented in Table 7.2. This shows that the percentage of street lighting apparatus over 30 years old is higher than the national average of 31% (Source: DfT 2003 survey.)

Local Transport Plans (LTPs): all three Councils promote safe and reliable public transport. Contributing to this is the provision of improved street lighting and CCTV systems.

Partnerships: the Councils have developed partnerships with their District and Parish Councils, Police Authorities, the DfT and a variety of service providers. Street lighting is again seen as helping to reduce highway accidents and address local crime issues in these other areas within the counties and city.

Each of the Councils in South Coast project have developed their own strategies and objectives to meet the needs of their respective counties and city, but they could agree that the drivers were of common interest.

## **Governance**

The collaboration between Hampshire County Council, West Sussex County Council and Southampton City Council known as the South Coast Street Lighting PFI project received confirmation from the Department for Transport in February 2008 that the project was authorized to enter the procurement stage and having satisfactorily answered two conditions that had been imposed by the Project Review Group (PRG).

The PRG had been concerned with issues regarding a debt funding competition and clarifications of the future contract structure. The latter was to be resolved during the procurement but had to be completed before the Invitation to Submit Detailed Solutions (ISDS) stage.

The credit offer from the government was £225m with the stipulation that the project should be affordable in the offer.

## **Innovation**

The Output Specification included provision for apparatus that enabled dimming, adjusting lighting levels and lighting times. This also provided an opportunity for the authorities to make further savings from reduced energy usage.

Note that this was only partially fulfilled in the West Sussex project agreement.

The contract has a built-in flexibility to account for changes in lighting levels that may occur in the duration of the contract although it is assumed that the defined levels will remain unchanged. For example, if an authority wanted to introduce new technology to meet changes to requirements such changes can be accommodated, but the additional cost will be borne by the authority requiring the changes.

The evaluation of the proposal also considered potential opportunities for innovation in service delivery.

## **Private Finance Initiative**

The Outline Business Case considered a number of options in addition to a Private Finance Initiative.

The option to do nothing except make repairs through a reactive maintenance programme was discounted because this would result in a continuing degradation of the lighting assets. A “do minimum” option required a level of investment that would be used to replace assets that were at the end of working life and must be replaced and as with the do nothing option, would not keep pace with the rate of asset decay. Another option claimed to just replace those installations that are out-of-date, but this would have required substantial investment. A fast track replacement programme to replace the majority of installation was similar to the option of a full replacement programme and given the urgency of finding a

solution to the problem, became the preferred option. Both of these last options would require the highest inward investment.

A review of the inward investment sources was conducted with the conclusion that a Private Finance Initiative was the only way of accessing Government funding for this project. Bidders were also asked to provide alternatives if the financial markets were not offering value for money - especially as the Financial Crisis was breaking during the pre-bid and bid phases.

The Output Specification included an allowance, made by the bidders, for increases in lighting levels but restricted to major traffic routes, town centres, and areas where crime levels are higher than average. However, the overall bid had to offer an energy neutral solution.

The financial flows in the PFI are one of high investment in the first five years, the Core Investment Programme (CIP) and a steady expenditure, from the Unitary Charge, over the remaining 20 years of the project. The contract has defined Performance Standards set throughout the PFI. Failure to meet the standards results in the imposition of financial penalties. Not specified is what happens if force majeure is the only option left.

An Economics Options Appraisal as a subjective analysis considered what contributions would be made to the service delivery objectives. Included in these considerations were the provision of modern lighting levels, a safe and sustainable infrastructure, deliver and sustain high-quality service standards, value for money and best value principles, contribution to corporate aims and objectives and the time-scale for achieving these objectives

Examples of the non-financial benefits taken into account are to improve perception of safety and security in the streets at night by reducing the fear of crime, to increase leisure and commercial activity after dark to improve the vitality of the Councils, to encouraging walking, cycling and to

use public transport as an alternative to the private car, to development safer routes to schools, to create quality environment for the local people, business and tourism, to foster community regeneration. These are closely aligned with the drivers for change indicated above.

A decision was made to use standard documentation included the use of the local partnerships Street Lighting Procurement pack. This contained an Output Specification that was based on a specification written by a London Borough. Some amendments to this were required to account the different requirements of two large counties, Hampshire and West Sussex, both of which have National Parks and significant rural areas within and across their boundaries.

Having decided that a fast track approach was the best solution, option for the necessary inward investment by evaluating procurement options examined

- Traditional financing, the public sector comparator,
- Consortia,
- Design Build Finance Operate (DBFO) PFI, single council case, and
- Design Build Finance Operate (DBFO) PFI, joint council procurement.

The evaluation also considered service delivery options against the following criteria from the ability to attract investment, affordability, time-scale to delivery, vires, procurement costs, and potential for innovation.

The evaluation concluded that procurement of a DBFO PFI would offer the best service delivery option. Risk management was an essential part of the project development and negotiation in the competitive dialogue. At all times the aim was to transfer risks to private sector bidders that have the capabilities and expertise to manage. One risk that the councils retain is that of the fluctuations in the cost of energy. It is a PFI convention that the client retains the risks associated with energy prices or costs.

The conclusion of the analysis was that the ‘fast track replacement’ would give the best benefits, for example, the Net Present Value of the economic benefits stemming from reductions in road traffic accident and crime returned £1,257m with a Benefit Cost Ratio of 6.54.

The private and public organisations involved in the South Coast Street Lighting pre-contract process are shown in Figure 7.1

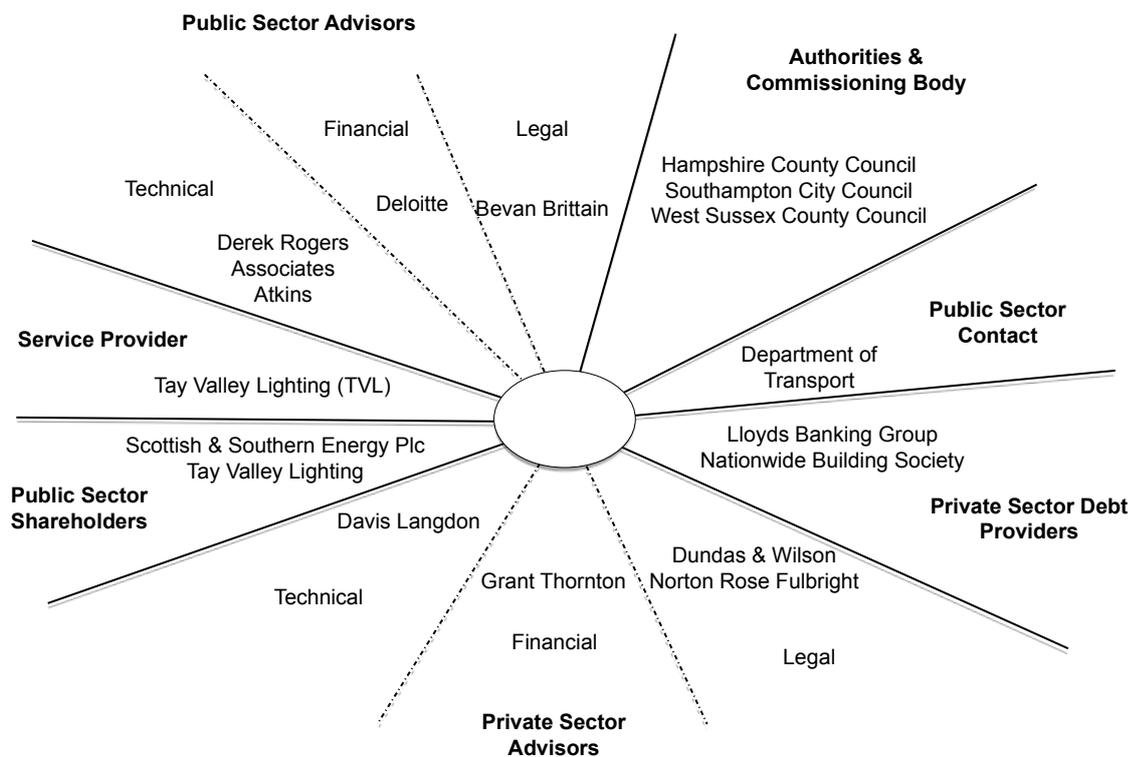


Figure 7.1: The South Coast Lighting Organisations

The public authorities were encouraged by the central government to use external advisors to support them in the bid phase. Each authority took responsibility for specific aspects of the bid and were

- West Sussex County Council – technical responsibility partnered with Atkins as external advisor,
- Southampton City Council – legal responsibility partnered with Bevan Brittan as external advisor, and

- Hampshire County Council – financial responsibility partnered with Deloitte as an external advisor.

Scottish and Southern Energy for the private sector also commissioned external advisors who were

- Technical – Davis Langdon,
- Legal – Dundas and Wilson and Norton Rose Fulbright, and
- Financial – Grant Thornton.

Other advisors were contracted on an as required basis to cover specific topics such as, contract management, pensions, and environmental impact, but are not detailed in the final business case.

## **Chapter 8 Hampshire County Council**

Hampshire is the second largest authority in the UK, covering approximately 1,400 square miles and at the 2011 census the population of Hampshire totalling 1,759,800 in 11 District councils, and 261 parish and town councils. The Council's Gross Budget 20/03/2014 was approximately £1.76 billion.

85% of the county is rural with a third lying in conservation areas such as the South Downs National Park. The county has 5,300 miles (8,600 kilometres) of roads, and 150,000 street lights, illuminated signs and bollards much of which was installed in the 1960s and 1970s.

Despite a maintenance programme of repair and a small level of column replacement, it was no more than "fire-fighting" and not able to keep pace with the end of whole life expectancy of an increasingly large proportion of the inventory.

As Hampshire County Council planned and made their bid to the DfT to fund the replacement programme with a PFI, West Sussex County Council and Southampton City Council were also, separately, making their respective bids.

The Hampshire PFI manager acknowledged that it was the DfT who had suggested to the authorities to join together in a single bid because of the high cost of procuring PFIs. If the bid succeeded, the authorities would then continue as separate projects. The other authorities agreed to the partnership and the combined bid was called South Coast Street Lighting.

The service provider is Tay Valley Lighting with Scottish and Southern Energy contracting Ltd as the operating sub-contractor.

An independent certifier (IC) was appointed as the only authority to issue compliance certificates for the work meeting the specified standards in the

performance targets, monitoring by inspection. This appointment was limited to the duration of the core investment programme (CIP).

### **Governance**

On taking up this appointment, the Hampshire authority's PFI manager, decided that a series of governance levels were necessary to manage and control the project. The first of these is the monthly payment meeting, which looks at the various performance standards. Performance against these standards is monitored and payment is made for work done. Deductions are made for work not achieved according to the output specification for the period in review.

The role descriptions or job profiles of the staff involved in the project are contained in written statements of the governance arrangements for which the role and therefore the jobholder were accountable.

Although there is no written governance framework, there was no indication was given that one was needed, because individuals had roles and responsibilities included in their job descriptions. This does open up the issues of how the roles are coordinated, and how a successor manager maintains this system unless a new approach is introduced.

A Network Board composed of the senior directors and project managers of the authority and the contractor set strategic direction and guidance for the PFI. This board receives the progress reports from the monthly management review and will arbitrate on matters that cannot be resolved the lower levels.

The authority owns the lighting estate, except approximately 9000 lighting points that are owned by local authorities.

The coordination of all the inputs to the replacement programme with the local authorities is, therefore, a straightforward process.

Monitoring quality of service is a continuous process with the output specification listing the details of progress made. The non-conformance with the standards is expressed as faults, and also in the payment report.

In the Core investment programme, Performance Standard 1 is the expression of the required and contracted performance standard. The other performance standards are checked against SSE's own management information held in a database shared with the authority and called the 'FM.'

The Hampshire PFI manager found at the commencement of the contract, that there were few reports to enable him to monitor the progress and performance of the programme. In the absence of a reporting system, he devised a series of reports that were to assist him in his task. Included in the reports were data from sources drawn from the monitoring work of the customer care and customer service teams, data from the maintenance and repair teams and data automatically captured by the CMS system, which provides performance, faults, and usage data.

SSE recognised the value of this comprehensive set of reports and have adopted them for all their contracted street lighting PFI projects. These sources of data are used to determine the status of the contractor's performance against the output specification. That information then feeds into the monthly payment report, which in turn forms the first part of the monthly monitoring report.

This is illustrated in Figure 8.1.

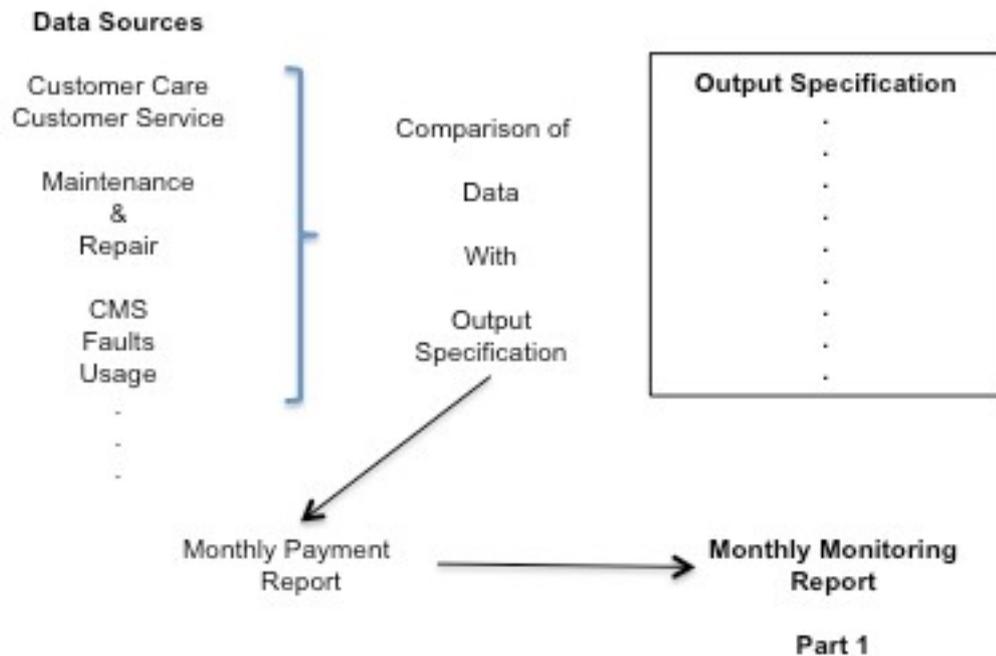


Figure 8.1: Data Sources, Comparisons and Reports

The PFI manager stated, “(that) To a large extent PFIs can be self-governing. “

However, given the size of the funding involved it is necessary for the client to have a competent monitoring process and team to confirm that the monthly payments to the contractor, are a true declaration of the progress and work achievement is as specified in the output specification. If the contractor has succeeded in completing the target work for the month, then they are paid the full unitary charge. Any underperformance results in a deduction made by examining three aspects of the performance.

The first aspect is the core investment contribution, which deals with the replacement of columns and lanterns. The sub-contractor is paid for the work they have done against the monthly target of units installed.

The Independent Certifier establishes conformance to the design standard and confirms the extent of defects found. Should the number of defects rise above a 20% threshold the number of inspections increased (see Chapter 12). This results in the contractor is penalised over loss of performance against the agreed monthly targets

The second aspect at the next level deals with performance monitoring and the commissioning of the central management system. For the CMS, failure to meet the agreed target installations results in reduced payment to the sub-contractor.

Thirdly, performance against the required maintenance standards is monitored and again the penalty is a reduction in payment if the performance targets are not achieved.

The PFI contract expresses the output behaviour as Performance Standards (PS). PS1 states the requirements for the core investment programme. PS9 and PS10 define the requirements for CMS. PS10 is also concerned with response times and reliability.

The Hampshire PFI manager championed collaborative working as the effective way of avoiding escalation of problems. Co-location was a key enabler with both the authority and contractor sharing office space in the contractor's depot. Indeed, the manager was convinced that co-location was essential in running a service contract such as street lighting.

The goal was to resolve issues at this working level and resorting to escalation if agreement and resolution could not be achieved.

In the Core Investment Programme period, the escalation route is to take issues for resolution to the Network Board. If there was ever a need, it would be contained within the contract, but with the working relationships that have been achieved, escalation has been avoided.

The PFI manager explained that he had experienced too many adversarial situations in previous contracts and learned that trust was needed to

create the necessary environment to achieve the collaborative working and encourage problem-solving.

Other essential ingredients are having the will and desire to deal with issues directly, but the relationship is a fair and hardworking commercial arrangement. There is, however, a realisation that the two organisations from the public and private sectors have different viewpoints. The private sector is contracted to deliver the service and also make a profit and the public sector authority needs to recognise that profit objective but needs to find the right balance between achieving the required customer care and service delivery while ensuring that the contractor achieves a fair profit.

The Hampshire authority believes that the street lighting technical solution and proposed forward strategy offers a good level of resilience to future challenges presented by further commitments to reductions in carbon footprint.

The authority has three options to support carbon abatement policies, i) dimming policies implemented through the CMS, ii) partial night switch-offs in rural areas, and iii) the introduction of energy efficient lanterns (LEDs). The authority observed that further significant reductions in energy consumption are eventually limited.

Hampshire conducted a trial to switch some lights off during specified periods during the night. This experiment was heavily criticised in the local press also receiving numerous complaints from the public. Consequently, a full switch off policy was abandoned. Neighbouring Dorset embarked on a similar switch off policy and also attracted a high level of criticism. West Sussex has adopted a partial night policy, which seems to be operating successfully. The Hampshire authority is working with some rural parish councils in the county who wish to have lights switched off to contribute to dark skies policies. The authority is trying to establish a protocol to implement requirements from the parishes that will,

for example, switch off lights after midnight in those parishes preferring dark skies.

## **Innovation**

The PFI manager did not believe that the governance system supported innovation. His view being *“the governance system won't actually support innovation. I think that's the point. The governance system is here to ensure that we are getting what we are paying for.”* In other words, governance is really there to ensure that the county is achieving value for money and a return on its investment.

However, there is a joint Hampshire - SSE innovation working team – *“Well actually it's very much a joint effort”* - whose role is to review new and emerging technologies in the market and recommend what might be compatible with the PFI. If there is a likely prospect a costing will be drawn up including the cost of introducing the item. The belief is that what can be achieved with street lighting has plateaued, and operational procedures are the only avenue remaining for improvements rather than innovation.

*“The key with this is that through innovation what you're really driving at is twofold; 1) energy reduction, that's one of your key drivers with this these days and 2) looking at efficiency driving (with) inside the contractors team as well.”*

The technical solution for Hampshire included a Central Management System because it was affordable within the funding estimate. The Hampshire PFI manager believed that this brought them into the forefront of where *“most lighting authorities would like to be.”* The introduction of this technology is innovative and enables a number of capabilities not previously possible.

The next step is for the authority is to look at further savings of energy by exploiting LED lighting technology.

The service provider has made a small fund available for innovation – the “innovation fund.” The size of this innovation fund depends on the size of the lighting stock and is directed at a) energy reduction measures and b) achieving efficiencies within the contractor’s team.

If the lighting stock was completely 100% reliable then there would be no need for a maintenance team other than those needed for planned maintenance, cleaning, painting and so on – preventative rather than finding and fixing faults.

Discovering what can be achieved in terms of these efficiencies is a collaborative process between the authority and the service provider with the Network Board as the first forum for joint discussions at the next steps of bringing new technology into the PFI.

An issue is that having replaced most of the stock in the five year CIP, the opportunity to introduce new technology is reduced.

The PFI manager noted that some street lighting PFIs had split their core investment period, unlike South Coast Lighting that has a single CIP.

The advantage this brings is that later and more efficient lighting technology may be available and may be introduced when the second investment period commences.

If new technology is to be added post-CIP in the South Coast lighting projects, then the individual authorities will have to find the investment to pay for it.

The danger is that the original PFI is, in essence, a loan for 25 years, paying for more new technology, which requires funding, means that a loan is taken out in addition to the initial one. Care is needed to ensure that the payback period is short to release savings.

The authority believed that a lot had been achieved, however, it was by no means all that could be wished for in terms of energy savings, in that when

the project was started in 2008 LED lighting would have produced a much better solution for energy use reduction. Unfortunately, the capital costs of LED lanterns at that time were so high that made them unaffordable in the design solution.

Seven years later, the cost and the reliability of LED technology has fallen to more affordable levels.

Lantern bodies will still last the same sort of times as the old stock, because they are subject to the same 'wear and tear' from weather exposure.

The LED lights themselves have a much longer life than the older technology. It was speculated that maybe plasma might be a new lighting form in the future.

Operational Savings Reviews formalize the collaborative efficiency drives leading to innovation.

### **Private Finance Initiative (PFI)**

Hampshire County Council decided to make a bid to the DfT for PFI funding to invest in replacing street lighting stock following a financial appraisal.

The primary objectives of the street lighting project was essentially to replace the aging low pressure sodium lighting (SOX) street lighting stock, upgrade to energy efficient lighting, high pressure sodium lighting (SON) street lighting, and white lighting sources, and thereby reducing energy consumption, and to install remote monitoring to enable further energy savings from variable lighting policies such as dimming.

The street lighting PFI funding has two components.

One from the credits provided by the DfT. This source is used to pay for the capital cost incurred in the first five years. However, this cost is

spread over the whole 25 years. The second funding source is from the authority to pay for the difference between the credits, credit value and the unitary charge.

There are a few lighting estates in Hampshire owned by the local authorities, and these were included in the PFI. This ensured that these local authorities were able to benefit from the new technology and maintenance provision. This also ensured consistency of street lighting equipment across a wider area of the county.

The local authorities have a license agreement with the county authority that charges the local authorities for maintenance and energy consumption.

The private networks owned by the local authorities are not included in the PFI as they are not government assets.

The contractor tendered by assessing the resources they needed in terms of human resources, materials, equipment that will be needed in the two main phases of the PFI, namely the Core Investment Programme (CIP) of five years duration and the operational phase of maintenance and repair of twenty years' duration. This produces a calculated cost over the 25 years of the contract. Division of the total gives the Annual Unitary Charge and from that, the monthly charge is calculated. This can be variable depending on the variations in performance. A benefit of the CMS is reductions in the scouting expeditions required to check lighting at night. These are a saving to the contractor, but is a saving that is reflected in the unitary charge.

Both sectors have financial models that they use to over the 25 years of the contract. The biggest concern is the rise in the Retail Price Index but provided inflation remains in control the financial risk remains low.

The DfT conducted a trial on 17 PFIs that had exhibited poor value for money. This was a response to criticisms that PFI was not delivering

value for money. The trial was called an Operational Savings Review (OSR) with the objective of finding cost-cutting measures using innovative approaches where possible. Over the three-year duration of the trial, a saving of £1.5 bn was achieved.

Encouraged by this success, the government has extended the Operations Savings Review (OSR) to all the 700 PFIs. The DfT has developed a Code of Conduct that is a commitment for PFI partners to sign an agreement to collaborate to achieve savings under the OSR. This will, in the main, reduce the unitary charge.

The Hampshire lighting authority and the service provider were in the process of their OSR at the time of the interview. The government has not asked for the resulting savings to be returned, meaning that the authorities will have more funds available to meet their budget demands.

The Hampshire PFI manager expressed the need to avoid changing the base model of the PFI because change incurs costs. These costs could be shared between the three authorities but are really to be avoided. Current work between the three authorities is to find areas where they can find agreement to work together to make cost reductions.

The PFI was considered to bring an innovative technical solution to the project and that what had been achieved was far superior to the lighting that had been replaced.

For example, as the CIP neared its close customer satisfaction surveys were recording 90% satisfaction with the new lights.

The distribution of replacement street lighting is to have white light sources in all residential areas. High-pressure sodium (SON) CosmoPolis lighting is installed on the principal roads.

In the National Parks lights will be full LED installations to assist in meeting the 'Dark Skies' policy. The LED luminaires can be focussed more efficiently to 'place' light where it is needed.

At the commencement of the CIP, 20% of Hampshire's lighting stock was relatively new high-pressure sodium SON lanterns located in residential areas. These were changed because the output specification called for white light. 70% of lighting columns had to be replaced with the remaining 30% compliant with the standard, thereby offering a safe operational life of 25 years. The warranty for the stock is 30 years over which term the service provider carries the risk and has to provide a certificate stating that at the end of the 25 years PFI, the stock will be warranted for a further five years. Post CIP the client monitoring team will switch its attention from the CIP to monitoring the contractor's performance in maintaining the lighting system.



A CMS Node being fitted to a Luminaire (Courtesy: Chess Photography).

## Other Observations

LED life is reportedly achieving 100,000 hours life, which is 25 years of output although there appear to be uncertainties with those figures.

There are still operational problems, for example, the life of the drivers the ballasts and electrical circuitry that condition the electricity supply to the lights have a shorter life therefore they will still need to be replaced within the overall lifecycle.

What prevented the Hampshire authority in adopting a full LED solution was the high cost which would have resulted in a financially non-compliant bid.

It was also acknowledged that LEDs could offer very flexible lighting stemming from their controllability for dimming to changing colour.

As reliability improves and production costs are reducing LEDs are becoming an affordable solution. For Hampshire with its large stock, it would still be a significant investment for the authority to make.

One important element of improving street lighting is to reduce crime and the fear of crime. Anecdotal evidence suggests that this may not be the case, with a police commissioner reportedly commenting that villains don't like the dark because their torches give them away!

From the authority's viewpoint, there was no evidence either way by switching lights off at certain times. Crime is always going to happen during the day and at night and just because there are no streetlights, or they are switched off does not imply that crime will increase.

Improved and brighter lighting in shopping areas and town centres contributes to improved CCTV camera operation from the higher lighting levels that help to increase video definition.

City centres and precincts are places where the lights would not be switched off. Rural areas and low crime areas are where lights can be dimmed or switched off, but if the crime rate is perceived to increase, then

the lights can be switched on again and consider dimming or switching off somewhere else. This is the advantage of the CMS that enables flexible control and policy implementation.

The adoption of the PFI has presented the authority with inevitable challenges. As this was the first PFI Hampshire had undertaken the learning curve was felt to be very steep mainly because PFI is not like any other contract.

Other change challenges are in the realm of customer relations. For example, because the old lights had lenses that diffused and scattered the light, customers might enjoy the benefit of having their garden lit.

However, the more directed and focused lanterns have reduced if not eliminated stray light. But how do you let the customer down gently, who is complaining that they can't see their garden at night? The answer is, of course, that the lighting is there to illuminate the highway and not their garden! But this needs to be done sensitively and politely.

Other challenges included the thought that the sub-contractor would bring experienced staff into the project, but they did not, and they were also on the steep learning curve.

A problem for the authority was that initially there was a difficulty in confirming the figures feeding into the performance report. This was because there were no supporting reports in the shared database to build the evidence.

Another challenge for the authority with the PFI was that their previous contracts have all been conventional client - contractor form in which the client or authority specified and designed the lighting system.

In the PFI this no longer the case and the authority is now a monitor.

Some of the authority team did have difficulty relinquishing their power.

The need for reduced staffing levels has led to some being transferred to the contractor through TUPE. Other authority staff left for opportunities in

the private sector. As the CIP comes to a close the team will reduce in size even further with staff being re-assigned to other roles within the council, leaving the reduced monitoring team for the future maintenance programme.

Hampshire has, like other councils, had to address redundancies resulting from the OSRs. The council is now facing ongoing changes from budget issues but have a structure that they believe can carry the work through to the next OSR.

## **Chapter 9 West Sussex County Council Case Study**

In the 2011 Census, West Sussex was found to have a total usual resident population of 806,900.

In the 2006-2008 period, West Sussex County Council owned a street lighting inventory of 78,582 items; counting 66,765 columns and bracket-mounted units; 8,478 illuminated traffic signs and 3,339 illuminated bollards.

Although the County Council makes a funding allocation to the lighting authority to maintain, repair and replace lighting as required, it had become obvious that the maintenance fund could not keep pace with the rate of decline in the bulk of the inventory particularly as it neared the end of safe working life.

The approaching end-of-life for the street lighting inventory left no doubt that a significant investment would be needed to meet the cost challenge of a replacement programme. A financial review was held to consider the funding options for this replacement programme. The review ranged from what benefits there were to draw from the County Council's "War Chest" and prudential borrowing options one of which was a Private Finance Initiative. Following the review, the decision was taken to bid for a PFI on the basis of the levels of inward investment needed and which would be available from the Department for Transport who would provide 'credits' covering the cost of replacing the lighting systems during the Core Investment Programme (CIP).

### **Governance**

The authority while still in the early planning stage of their bid, was advised by the DfT that joining with the Hampshire and Southampton authorities would be to the advantage of all three authorities. Both of these other authorities were bidding for PFIs for their replacement street lighting

programmes. The DfT also advised the use of external advisors would also improve the chances of a successful bid.

Following the DfT intervention, the procurement phase of this contract became a three-authority process with each authority taking responsibility for the three main procurement areas. West Sussex led the technical area, Hampshire led on financial and Southampton led on legal.

It was noted that none of the original staff involved were now available post contract let.

Fortunately, on the technical process, the original technical lead was available for the first year of the contract and ensured a valuable handover to the following technical manager.

On further DfT advice, external advisors for financial, legal and technical specialisms were employed, again to improve the chances of the bid's success.

The authority recognizing the need for a successful outcome on this project took the DfT's advice and employed Derek Rogers Associates for technical consultancy, Bevan Britain for legal and Price Coopers Waterhouse for financial guidance. The advisors are shown in Figure 7.1 The South Coast Lighting Organisations.

On the subject of staff continuity on the PFI project, the authority noted that the service provider had had a similar experience to theirs, in that they too had a change of personnel from the procurement team to the implementation team. The new team brought ideas and approaches that were different to those of the pre-contract team.

The authority learned from this that the discussions of the procurement should be documented and agreed by both client and service provider to counter the differences between the formal contract and what is intended and understood by the contract terms.

The outcome of the absence of the documented intent of the contract favours the service provider who in the authority's view allows them the freedom to negotiate the outcome of performance milestones.

The authority expressed their view that some operational performance measures did not relate to actual operational characteristics of the lighting system.

Given the authority's disquiet regarding the unrepresentative nature of some operational performance measures, it was reasonable to want to make changes or updates to the standard documentation. To achieve this a process had to be followed, which had to include the leads for the main topic areas of finance or technical, receive their inputs and then submit the changes to the DfT. The time taken to achieve approval was usually four to six weeks and cost of the order of £100k.

The implication for the authority, for it was that the authority had to pay the cost to be sure that the change or changes they wanted, needed to cost or be worth more than £100k. Otherwise, the change proposal was not going to return a value to the contract. The authority then had to develop a cost benefit of each and any changes that it wanted prior to entering the change process. What they wanted was to have performance targets that were measurable, for example, the failure of a light is something that can be measured. Instead of measuring how many lights are not working, the performance target in the contract requires measures of how many telephone calls made by the public reporting light outages. There is no coverage of faults reported which is puzzling as performance is based on this measure.

The authority believes that the measures listed in the contract are aspirational rather than real-world "hard" measures. They feel locked-in to these measures now for the remainder of the contract.

It was revealed that the technical solution for West Sussex did not include a Central Management System (CMS). Such a system would have enabled the authority to monitor light outages as one of the functions that the CMS can perform.

A CMS was offered in the technical solution, but the financial concerns suggested that the bid would not be "financially compliant" if CMS were

included. The authority's executive then decided not to include CMS in the technical bid. When eventually all the costs for the bid had been accounted for, it was evident that CMS could have been included. The authority subsequently asked to cost adding CMS as they now believed it was affordable. Unfortunately, in the intervening months, the price of the system had increased. In the future, any new installations that the authority includes under their own funding arrangements will be fitted with CMS and ensure the installation uses compatible equipment that will not incur additional maintenance costs. This will require engaging with the PFI contract. Compatible standards are to be included in the specification for street lighting in new developments, so the CMS network will slowly extend its coverage.

It was believed that the approach would be achievable because the authority was driving the process rather than the service provider. This investment might come from the Green Investment Bank.

It was emphasized that the county did have limited CMS in critical places. Finding the critical areas was achieved by asking the workmen which places and footpaths they feel unsafe and prefer not to go. Such places have segregated footways that can only be inspected by conducting scouting assignments on foot and at night to check levels and operation. For Health and Safety reasons those were the places where the limited CMS resource has been fitted.

Monitoring the PFI will be achieved in two phases, one for the CIP and the other for the post-CIP, five and twenty years respectively.

Post-CIP will be different by its nature. Discussions about that were underway as the CIP was nearing its conclusion.

Issues to be explored in post-CIP discussions are the priorities of the different authorities. These differences reduce the freedom of the service provider to offer common approaches to delivering post-CIP services. The

discussions examine detailed working to determine where there is a commonality and to optimize the service in those areas.

One problem for West Sussex has been the fact that SSE had their depot and HQ in Southampton. Co-location of offices was then fairly straightforward for both Southampton and Hampshire authorities at the SSE site.

West Sussex already felt that they were remote from their Eastern boundary and moving to Southampton would be to take them out of their own county. Understandably they were reluctant to move their centre of gravity any further west, preferring instead to use the SSE office in Burgess Hill.

The office at Burgess Hill is used by WSCC staff, by the manager, although he is not necessarily there on a weekly basis, to team members who are present much more frequently to work with their opposite SSE colleagues.

During the CIP, governance is achieved through a Network Management Board for directors from the authority and the service provider. It meets on a quarterly cycle.

At the next lower level there are two monthly formal meetings. The first of these discusses operational issues and is followed by the Monthly Monitoring Report that reviews the financial status of the project.

The Network Board has been a rare event as there had been no meeting for approximately two and a half years and this is because of frequent turnover in directors' appointments. The workaround had been to engage a director on an ad hoc basis to make a decision on the resolution of any escalation issues.

However, the Network Board has also been re-established and there is more support for the team. Post-CIP discussions depend heavily on having the Network Board running looking at opportunities for future working between the authorities. It was West Sussex's view that

Hampshire was only looking to have a “thin client” effectively just signing off the monthly payment since it is seen that post-CIP will be largely self-certifying.

One of the organizational changes has been to the monitoring team. This team has been moved from the Highways Team and are now led by the Lighting Team.

West Sussex County Council expected the Independent Certifier to do the coordination between the partner West Sussex councils. In the West Sussex view the IC was not able to do this either from an unwillingness to do the task or an inability. The Council then had to get involved and was consequently under constant pressure, as they had no increase in their team size to be able to do the additional work.

The post-CIP discussions are oriented toward opportunities with Hampshire and the service provider SSE. All three authorities are considering how they could agree to a common maintenance regime. These arrangements must be financially attractive to all parties involved.

There is no single governance document describing the policies and approaches taken for the project. The financial documentation is the most detailed particularly setting out what the monthly report contains and how it is assembled. The technical aspects are less formal.

The outcome is then that the contract formally establishes the monthly report within its conditions, and the technical arrangements are less formal.

*“Working relations cannot be contracted for....”* (WSCC Commercial Manager.)

Trust between opposite numbers is how the West Sussex team is encouraged to work. The West Sussex Team has a flatter organisational structure compared with Hampshire who has a three-layer hierarchical

structure. Regular and frequent meetings are programmed into the working schedule but are not contractual.

Each team member has an area of expertise and meets with their SSE opposite numbers. Anything, news, issues that arise in these 'experts' meetings are briefed to the remainder of the team at their weekly meeting so that they are aware of what is currently working across the project.

This approach has advantages in that actions are taken quickly, but there can be a number of conclusions about the same point stemming from the different viewpoints.

In Hampshire, this last point is rarely seen because the communication comes through one person.

Running these regular team meetings has proved challenging as they tend to take a long time giving each manager the opportunity to 'bring their news.' Keeping interest up was difficult for some specialists, who are only interested in their topic and not sure why they have to listen to all the others.

A list of external regulations that the project needs to recognise in terms of governance input may be more of an issue for the service provider as the implementer.

As noted earlier, it is the financial document that is primary governance defining the performance targets for each of eight milestone areas. The detail takes each area of the MMR and specifies contact references, the actions, and the contact references. This information is held in a spreadsheet and is in essence how the project is financially managed. This document does not say anything about innovation, and it was conceded that this is a valuable topic to have included for reference and guidance in the management line.

The motivation for taking the PFI programme and funding route was principally access to the funding and the large reduction in the risk of catastrophic failure. In the first five years of the project - the CIP - all

lighting columns over 15 years old are to be replaced. Progressively since the early 1990s there have been columns falling from one or two per year, but at an increasing rate and therefore increasing the risk of injury to the public and council workmen.

The PFI manager has a task to take a strategic view of the project as it develops over the next five years in terms of what work will be done and how much money is likely to be available for investment in lighting. A frustration experienced by the manager is that operational matters frequently interrupt this strategic work.

When looking at other PFIs it is clear that this strategic approach has to be taken rather than just making the massive investment and then letting the project drift over the next twenty years.

### **Innovation**

The authority has at least prepared their lighting system for future enhancement by including the 6 pin S6000, a patented device that can permit either a Node or Sub-Master element of the Mayflower control system to be fitted to the lantern so that CMS could be connected when the investment is achieved.

Some relatively new lighting stock fitted two or three years prior to the start of the PFI are now seen to be inefficient in terms of maintenance and energy consumption. This presents a basis for additional investment to replace this stock that in relative terms costing 110 watts per individual lighting unit, with new units that consume 30 watts.

Innovation in service delivery is only encouraged and extended to that which is included in the contract.

*“Only as much as it's included within the contract ... that is the limit ...”*

There is a limited LED fund that is being fully utilized. The South Downs National Park has declared their dark skies policy and has applied for International Dark Sky Reserve status. This is clear from their statement;

*“Over the next few years many streetlights will be changed to modern LED lights. These are much better than the orange lights that currently cause light pollution, as they do not allow any light to ‘spill’ upwards and into the sky. They will also be dimmed and trimmed to further enhance the special dark sky qualities of the park. “* South Downs National Park (2013).

The LED fund is being used to support that policy by replacing streetlights in the park with LEDs lighting and at the same time is experimenting with this type of lighting.

In the remainder of the county, LEDs are being used in illuminated signs and bollards, but have not yet been extended to street lighting.

The authority will continue to experiment while the LED fund permits.

The low uptake of LED and other technologies is still about immaturity, cost, and aesthetics. Some luminaire designs lack aesthetic appeal looking rather functional. LEDs can also produce rather stark lighting levels and manufacturers are addressing this problem by introducing ways of making the light more diffuse while still providing the coverage required by lighting standards.

LED technology option is undoubtedly reducing in cost as design and quantity production costs decline.

The authority considered lighting that covered the road surface only, but this proved inadequate and unsatisfactory as it left vertical surfaces un-lit, and lit vertical surfaces are relied upon to gain visual cues.

## **Private Finance Initiative**

The authority observed that the PFI contract does not assist in initial innovation at the pre-contract or bid phase.

*“And of course the PFI talk about stifling progress innovation, what the PFI contract did not allow you to do was to have options.”* (Commercial Manager).

For example, if the bid process permitted two costed options, in their situation, one including CMS and one without CMS, the decision made by the Council may have in favour of including CMS. The bid process only permits one costing.

The penalty is that the authority has to implement lighting policy, for example for dimming, manually. Crews have to go to each light and implement the policy, however, a CMS system enables the lighting policy to be implemented by one operator from a laptop.

The county would have benefitted from CMS coverage along the coastal strip and up along the eastern boundary where the most of the population of the county is located. As it is scouting parties are still required to monitor and check the status of the streetlights, a task that has to be conducted at night as well as daytime external visual inspections.

It was obvious that this situation has been a source of great frustration to the authority's street lighting team.

Ownership of the street lighting assets remains with the county. The risk lies with the service provider and holds risk for an additional five years following the end of the PFI contract effectively providing a guarantee on the technical solution.



## Replacing the Promenade Lighting – Bognor Regis, West Sussex

### **Further Observations**

The County Council has adopted an open office policy that includes no individually held filing cabinets and “hot-desking” or shared desks. As a result of this much of the pre-contract and early documentation for the project has been destroyed or lost.

Electricity for West Sussex street lighting is supplied by the Designated Network Operator (DNO), UK Power Networks (formerly known as EDF Energy) and is procured in four yearly increments through, the Local Authorities South East Region (LASER) energy buying group. LASER is one of the largest in the UK that buys from future price blocks and whichever energy supplier offers the most favourable price.

West Sussex had also considered the use of council sites to host the street lighting depot, but they no longer had a site that was sufficiently large enough to hold all the equipment, store columns and so on. The highways department had already allocated suitable sites to the highways contractors.

West Sussex County Council see the provision of street lighting as a frontline service with very little interaction with the public when the lights are working and a strong reaction when they are not! The public refers to our street lights” showing a good personal ownership.

West Sussex County Council recognises the importance of street lighting in reducing traffic accidents and crime. The latter has extended to assisting Police inquiries regarding the status of lighting in some accident cases. This action is consistent with the Well-Lit Highways guidance that calls on the Police Road Death Investigation Manual (PRDIM) which specifies the traffic control and lighting systems operational records, standards and condition that should be maintained to assist in inquiries Well-Lit Highways (2004) and Police Road Death Investigation Manual, (PRDIM) (2007).

The DfT primarily based on the theory that contractors would not understand changes did not recommend tailoring of the standard PFI document in the West Sussex Council case. It is more likely that the standard was assumed and insufficient due diligence on the part of bidders is more of a problem. DfT was proved correct in their approach when one subcontractor did not notice the small but significant change of 'may' to 'will.'

A way forward in terms of the future investment may be found in the type of payment mechanism. This may be a way forward following the end of the CIP and could be a better value, as the value will be returned to the authority but not shared with the service provider. Early repayment of the investment will bring early release if the benefits of reduced operating costs. If shared with the service provider, the payback period would inevitably take longer. The dilemma for the authority is to try to do the best thing, or taking an action that is the best financially to secure the long-term safety of the lighting service but which may not appear to be the best thing.

## Chapter 10 Case Study: Southampton City Council

Southampton is a City with a strong maritime and aviation heritage and a population of 236,900 at the 2011 census.

(2011\_census\_southampton\_summary\_factsheet.pdf).

The PFI programme is worth £30m and replaces 28, 000 streetlights, illuminated signs, and bollards.

In 2005 to 2008 period, it was clear that the maintenance and repair programme would not keep pace with the deterioration in the city's street lighting estate. The bulk of the stock needed to be replaced, but this introduced a significant affordability challenge for the City Council, coming as it did at the beginnings of what became a long period of financial restraint. Additional rationale and details can be found in "Improving your street lighting" (2010).

### Governance

Southampton City Council has adopted a three-level governance model for the street lighting PFI contract illustrated in Figure 10.1

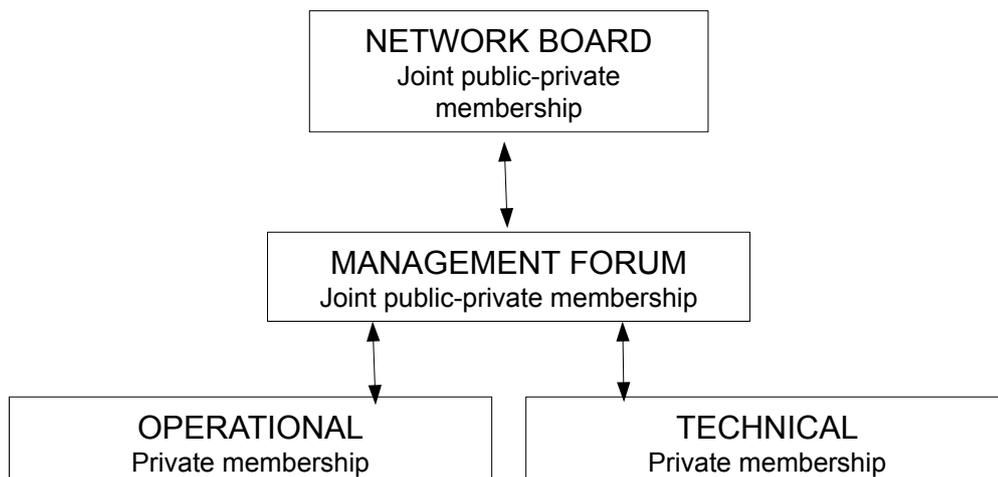


Figure 10.1: SCC Three Level Governance Model

The first of these is the 'Network Board'. Executives and senior managers from both Southampton City Council and SSE Contracting attend this board, the purpose of which is to discuss and resolve strategic issues and to provide leadership and direction. The board meets quarterly and this will change to twice a year and may even be a virtual meeting when the PFI enters the post core investment period. The agenda for the board will require re-affirming to ensure that there is no upward 'drift' of operational minutiae.

Some areas of the city were not included in the original PFI. This was because they were either private lighting networks or parishes that had their own street lighting systems. The city council maintains and repairs these streetlights through sub-contract arrangements to those areas. These streetlights are also nearing the end of their safe operational life and so will need to be replaced. The Network Board had to decide if these lights should be replaced and included in the contract and subsequently that inclusion was made.

The service provider proposed a solution to replace the lights with the same types in use for the rest of the city thus bringing the whole city up to a consistent standard while providing themselves with an additional business opportunity. This is an example of the strategic direction and decision-making that the Network Board considers in their role.

Another issue the Network Board is confronting is the need for SSE to downsize their organisation to match the level of work that will be required in the maintenance and repair period when the core investment period comes to an end. Network Board discussions have started to plan the future post CIP.

At the next level there is a small management forum and again representatives from both organisations are present. Note that the two senior managers for the contract also attend the network board thereby providing continuity between the two governance levels. The purpose of

this second level is to manage the issues arising from the contract and project management.

Beneath this level are two other groups. One dealing with the operational aspects of the contract and the other is a technical group.

The council has established a contracts group (or unit) whose purpose is to manage contracts that are high profile, high value and most important to the council. (Of course, all the council's contracts are important.)

The rationale for the development of this contracts' management group is part of a vision to manage and control the council's strategic and large contracts, rather than have individual contract managers for each contract. A notable outcome of this approach is to develop capabilities in running contracts rather than have specialists running IT, HR, Highways, Street Lighting, and so on.

Prior to restructuring, the governance and control approach was to manage the service providers, but in the new organisation the approach is very much to monitor than manage. The rationale here is that the work has been outsourced, so rather than duplicate the management activities of the service provider, a surveillance or monitoring role would be more effective and productive, by not restricting or otherwise interfering or inhibiting efficiencies that the service provider may wish to introduce. This role change is progressively being adopted in other contracts.

There are technical specialists to draw on to support the contract managers.

As new contracts are considered or existing ones renewed, these will be added to the contract group portfolio.

Within the contract group, there is a contract and governance manager who leads a small team that includes technical staff who are concerned with the street lighting and highways contracts. They are also responsible for a smaller but related contract dealing with the management of CCTV and traffic cameras.

The role of governance for this authority is generic across the contracts in the contract group. This has allowed the development and application of skills in performance management and managing cross-contractual services. This leads to more efficient oversight, better consistency, and standardisation. Some tailoring of the system is necessary to allow for the nature and scope of individual contracts. The governance group has responsibility for monitoring the standard. Within the contract, technical experts contribute to governance activities.

Governance is also treated as a delegated responsibility. The governance manager in the Contracts Group has a responsibility to prepare and promote cross contract governance policies. At lower levels, the responsible manager has a similar role specifically for the policies relating to their particular post. For example, there is a highways' manager responsible for the policies relating to highways and street lighting. These policies include standards and frequency of road repairs, electrical standards for street lighting, painting and repair of lighting columns and so on. For example, if the service provider was having difficulty with certain customer queries because the authority had not published a policy regarding attaching shields to the top of lamp covers, then the Highways Manager would be asked to prepare a policy on this to help the service provider address the queries and take the appropriate actions. This is also viewed as an aid in decision-making. It does ensure that the private partner is not making policy. Policy remains a responsibility of the public sector authority.

The monitoring activity, for the core investment period, reviews the monthly performance, ensuring that the financial claims are correct. This also takes technical inputs by checking the technical performance is as expected, leading to further substantiation of the financial claims. Equally, if there is under-performance, the evidence is checked for availability and accuracy and agreed. Calculations based on the evidence

determine the number of deductions that are made to the service provider's payment.

The task of monitoring is undertaken as desktop views and analysis of the technical data that is made available. Available to the governance team are three technical staff that work across the highways contracts. (There were three highways contracts at the time of the interview.) These technicians go out and inspect the status of work. Information from the desktop analysis is being used to focus these inspections into areas where performance is not as expected. In the areas where the service provider is performing well, the authority will leave the service provider to pursue the work. The approach is to move progressively to targeted inspections.

The contract specifies a range of outputs that form a scheduled series of milestones. Monitoring focuses on the adherence to the schedule and the performance against the milestones. Behaviours are also part of the contract particularly with respect to how customers' queries and complaints are handled.

In addition to the authority's monitoring role, there is an independent check made of the status, condition, and compliance with lighting standards. For the Southampton authority, this independent check is their only technical check. The company contracted to do this is based in Hampshire and, in this role is called the Independent Certifier (IC).

The IC's role ends at the end of the Core Investment Period. It was not clear if SCC was aware of the penalty payments to the IC if they had to escalate the testing in the event of the service provider failing to meet the standards.

The IC has a number of points to check on each installation that they inspect. However, only a percentage of the lighting points installed are inspected. The SCC governance managers' understanding was that the authority could procure increases to both the sample size and frequency of inspections conducted by the IC, but this would be at the authority's expense.

Overlaid on the established organisation of the authority is the elected political organisation, now led by a cabinet of, at the time of this study, eight members, each with specific portfolios who report on the status of their portfolio to the City Council. There are relatively frequent changes to the cabinet composition in terms of the number of members and their portfolio responsibilities. Street lighting falls within the Environment and Transport portfolio.

The customers drive another aspect of governance. Customers in this context are the City's ratepayers who through payment of their annual rates have contributed to the costs of services that the council provides on their behalf.

The authority and the service provider have two extremes of input or contact with the customers. The first is passive contact through a website which customers can post problems or praise. The other extreme is that City Councillors are faced directly by customers complaining about street lights being either too bright or "why has a new light been placed outside my house?"

This is an example of a governance input that is now managed by the service provider. City Council staff would have undertaken this service prior to the PFI contract.

Operational data is needed to enable effective monitoring. Data is available to the authority through a shared IT system. Access to this system allows the authority to see the same management data that the service provider generates in the course of their work. It prevents the service provider "hiding" underperformance and permits the authority to explore specific cases. The openness helps to promote trust and is seen as a strong commercial partnership.

The contract development process generally followed by this authority is to have a core contract and a specification. The responding companies

provide a model as a “method” statement that describes how they meet the obligations of the contract.

The governance system for the project is a jointly held activity at the network board and lower levels. The governance is partly a contractual commitment, and partly from the needs arising from the operational necessities.

The only process by which the governance system appears to be assessed, i.e., that it is working effectively is through a process called ‘benefits realisation.’ In this process, governance is examined to determine if it is undermining or inhibiting the contract thus adversely affecting the benefits of the contract.

### **Innovation**

The Network Board had noted that LED technology was going to be an efficient lighting provision. In the bid phase period, LED technology was still relatively immature and the production costs still high therefore concerns over these issues led to its exclusion from the core investment technical solution.

At a future point, LED technology costs will have reduced to the extent that the cost to the authority of replacing streetlights will become viable, although at an additional investment to the PFI, likely from external funding in some way, for example from the Green Investment Bank. Then additional significant reductions in energy consumption can be made possible. Furthermore, the promise will be to offer the authority and the service provider, the capability for innovation in service delivery and the management of the lighting estate, for example, by adopting new processes based on the technology it would be possible to make savings in operations from reductions in inspection frequency, cleaning, and painting. This was the potential future that the selected solution needed to

be able to accommodate, thereby “future proofing” the new lighting system.

Further improvements are possible by exploiting technology not previously available to support street lighting. This technology enables Central Management Systems or Remote Management Systems (CMS, RMS). The ‘traditional’ maintenance process required visual inspections at night to determine faults (called ‘scouting’), and the delay between this approach of detection and dispatching a repair team. As part of the service, there is a commitment to affecting repairs within certain timescales.

CMS is included technology in the Southampton street lighting solution.

If the future investment can be achieved, knowing the LED supplier and the market developments is an important task. During the core investment period, the service provider has set aside some funds that can be drawn upon through mutual agreement to support the investigation and experiment with emerging street lighting technologies.

An innovation for the authority is to have real-time access to a database that hosts project progress data. Superior to a monthly written report, this access has enabled openness, trust and the opportunity for close collaboration between the authority and the service provider.

Discussions continue to explore future work prospects at the Network Board level. The offer of more potential innovation in post-CIP operations could arise from benefits that may be had from arrangements from contracts held with neighbouring authorities, for example, by sharing depots.

The service provider is to close its main depot in Southampton and move to a new location near Portsmouth. Good road links to Southampton will not hinder the post-CIP operations for Southampton, and there are potential opportunities as noted above from sharing depots.

## **Private Finance Initiative**

It was accepted that the PFI had been a large and valuable learning experience although it was unlikely that the authority would use the approach for future projects. However, the underpinning principles and experience gained are being exploited on other projects.

A major benefit of the PFI was the value for money in that there was a large investment at the beginning of the contract thus enabling large-scale replacement of the street lighting inventory in a short timescale. A potential problem that may arise in the future is the likely critique of the contract that will no longer show the large investment but will seem expensive for what will be a maintenance and repair programme.

An intention of the PFI model was that risk would be transferred from the public to the private sector. For SCC, this seems to be an outcome with risk to renew columns, repair failures now the responsibility of the service provider. The benefit to the authority is the assurance that it will not need to find funding to cover unexpected repairs.

The core investment programme is contracted for the first five years of the life of the project. Part of the organisational restructuring that established the contracts group included a manager responsible for maintenance, and so each new column and lamp installed by the CIP is automatically transferred into the maintenance and repair inventory. The result of this is that there is already working experience of maintenance and repairs with the new stock.

The restructuring also created an investment managers post, but for the street lighting PFI, that role will scale down at the end of the CIP.

## **Further Observations**

Although inter-working between the authorities seems difficult if not impossible, there are potential synergies as they have the same private company suppliers, for example, highways repair and maintenance and IT.

It was noted that adjacent authorities have the same partners for different services, i.e., the same partner for IT, the same partner for Highways. So although previously there was a point that it was difficult if not impossible to work collaboratively, but at least there appear to be opportunities.

It was evident that the working relationship between the public and private organisations has encouraged the authority to adopt a stronger more commercial approach to its business activities. The authority now challenges the real need and value of undertaking a task.

In the past when services were in-house, requests for work would have come from a variety of sources. While many of these tasks were valid, there was little or no appreciation of the cost. Equally, undertaking these tasks would use staff that might otherwise be deployed on more essential work.

This PFI has resulted in behavioural changes to the authority prompted by the authority matching the behaviour of the provider, who is strongly commercially focused and not as a result of governance led change.

The biggest challenge that faced the authority was undertaking the re-organisation that was inevitable that came with this type of project and contract. The work that would otherwise have been undertaken by authority staff is now outsourced to the private sector partner. This has meant transferring some staff members under TUPE to the service provider, re-deploying some and making other jobs redundant.

## **Chapter 11 Scottish & Southern Energy Case Study**

In 2014 four of SSE's businesses, Contracting, Lighting, Utilities and Telecoms were brought together to form 'SSE Enterprise.' SSE Enterprise is a trading name of SSE Energy Supply.

SSE Contracting Limited is claimed to be one of the largest mechanical and electrical contractors in the United Kingdom, managing approximately 1.5 million streetlights in their street lighting services.

SSE established Tay Valley Lighting specifically to be the Special Purpose Vehicle (SPV) for PFI lighting projects. It is a wholly owned subsidiary of the SSE Group and as such is a shell company with no direct employees and is an administrative and management structure. Each PFI lighting contract successfully bid by SSE has its own SPV. For example, for the Hampshire component of South Coast Lighting bid is Tay Valley Lighting (Hampshire) Ltd. These companies are wholly owned subsidiaries of the SSE Group. The Head office for Tay Valley Lighting (TVL) is located in Reading and is the registered office for all SSE's street lighting PFIs.

SSE is understood to be the largest provider of street lighting with eleven PFI projects in its portfolio and it was perceived as a natural progression to bid for this project. This has presented the company with the challenge of maintaining a balance between the credits achieved and the load it places on the organisation as a whole, for although the parent company had eight street lighting projects in other parts of the country, it had to establish an entirely new team to deliver the South Coast Street Lighting PFI implementation phase. The team was largely recruited locally and therefore had little knowledge and experience of this type of project. However, the acquisition of Mayflower Smart control by SSE Contracting ensured that they had design as well as project management capabilities.

SSE confirmed the condition of the street lighting inventory in the early stages of the South Coast Street Lighting project.

## **Governance**

SSE's corporate centre structure includes a Director of Lighting based who has a number of regional directors reporting to him, one of which is the regional director for South Coast Lighting.

At the commencement of the projects, the SSE Commercial Advisor reported to the Head of Operations, identifying the issues to be managed and that outgoing documentation was in order while close liaison with the authorities PFI managers was maintained.

Working closely with the authority managers was essential to get a joint understanding of different clauses and different provisions to be made. But it was a continuous learning experience. The contract is "*about a foot thick in paper*" and fortunately, a good working relationship was established with the three authorities.

Knowledge gaining and sharing was a joint activity between the Provider and the client. The legal partner to the SPV - Dundas and Wilson - held training sessions for both organisations on aspects of the contract that were PFI specific and held particularly administrative burdens to be managed in certain ways.

(Note that Dundas & Wilson, are a Glasgow based law firm with specialisms in PFI.)

It was SSE who originated this work, but it proved more efficient for all the partners, public and private, to receive the training thereby reducing the need for SSE to then to try to explain it to authorities at some later date.

The three authorities collaborated during the bid phase, but following successful completion and award of the bid, separated into three individual projects to meet their own priorities. SSE formed three teams to manage

the three projects for Hampshire, Southampton and West Sussex. The project manager for the South Coast project is responsible for the operational safe delivery obligation of the contract.

There is also a director of PFI Partnerships who receives reports in from the SPV part of the PFI that in this case is Tay Valley Lighting. The Head of Risk is responsible for issues and compliance with the different obligations within the PFI, finding obligations not necessarily covered and ensuring that these are included.

The Head of Risk's role demands a close working relationship with the Hampshire PFI manager and is in effect the 'gatekeeper' in that his main function is to ensure that issues are not presented to the authority manager for resolution, but adopting a "here is a problem and this how it will be resolved" approach ensured that the authority is fully informed and issues are not hidden.

It is important to note that the participant in this study was acting on behalf of SSE and Tay Valley Lighting and is, therefore, both service provider and sub-contractor. What this means in practice is that if the authority makes a request to the Service Provider TVL, the TVL manager writes to himself as the SSE manager to respond and actions the request. SSE is the contracting company.

To measure and guarantee quality of service there is an internal management structure and a set of Key Performance Indicators (KPIs) that are reported on a monthly cycle and identifies items that need to be managed to ensure compliance. The KPIs are internally derived by the SSE management team and include financial measures, safety, planned maintenance and daily tasks. If an activity is planned for a particular day, then the KPI monitoring is there to ensure that the activity happens on that specified day. Current status is shown on a 'dashboard' and there are regular and general depot reviews.

Network Board Meetings are held quarterly and are attended by the participant manager as part of his role. It was observed that both Hampshire and Southampton met regularly once a quarter for their Network Board Meetings (NBMs). West Sussex had not been successful in maintaining a schedule of these meetings. West Sussex initially held NBMs at the beginning of the contract until changes in the authority's organisation introduced a manager who did not see a benefit from the meetings. SSE did not insist on maintaining the meeting schedule. However, in the closing stages of the CIP, the NBMs have been re-established and re-branded as 'partnering sessions' with the intention of running these through to the completion of the contract.

The main part of the client's monitoring is the Monthly Monitoring Review (MMR) and is used to do most of their monitoring with the monthly payment to SSE following successful completion of the review period's targets.

Internal standards and ISO or BSI external audits together with internal audits are reported as a performance standard within the MMR.

Ownership of the lighting stock remains with the authority, but the risk is vinted to SSE with full authority to act on matters of risk. This is the reason that the authority has to be satisfied with the work and this has been a success because of the collaborative nature of the relationship also helping to achieve innovation.

Hampshire and Southampton were able to co-locate at the SSE depot in Southampton and had already been working at the SSE depot on the older maintenance contract prior to the PFI. Co-location with SSE and the other authorities for West Sussex was less practical as this would have taken them out of their county. The alternative was to use SSE's office in Burgess Hill, but that too is at the extreme east of the authority's main base in Chichester. Most of the WSCC staff are based in and around Chichester and therefore still need to travel.

A contract was let by the contractor to a firm to act as the Independent Certifier (IC) for the project, “to protect the customer” by checking and certifying the newly installed lighting system meets and conforms to the agreed design and published standards.

The Independent Certifier has a contract for the duration of the Core Investment Programme and is unlikely to be required later in the contract.

Dundas and Wilson were one of the SSE's strategic partners to SSE's own legal team. These specialists would be seconded to SSE to support specific aspects of law as it related to PFI contracts.

Dundas and Wilson are now part of CMS Law from 2014 following a buy out from the latter.

## **Innovation**

Funding for innovation

*“ It’s built into the PFI, there’s a LED fund. So we put a sum of money up into each of the contracts for the authorities to jointly use with us.”*

Commercial and Risk Manager.

In addition to this, the SPV provide credit for SSE to conduct trials on new lantern types. This is a small fund and one or two lantern types will consume it.

The LED fund is by contrast larger of the order of £2m to spend across the three authorities - to invest in new technology.

The LED fund is used to pay the difference between the cost of a standard lamp and the cost of the LED. The LED fund will be lost if it is not consumed by the end of the CIP. All three authorities are fully committed to exploiting this fund.

SSE have been encouraged to innovate by making the design as efficient as possible and by recognizing that the design can cause significant disruption during installation.

For example of the requirement of a column or columns to be moved there is the need to have large civil works of digging up pavements and pathways with the resulting access disruption and the potential to alienate residents.

A design consideration is that it may have required 36 watt lights, but could a 24 watt be used instead while still able to meet the lighting standard. If the lights are to be controlled through the CMS to meet the dimming policy, then 24 watts might be sufficient and acceptable; similarly, for the larger lighting units of higher wattage, an LED solution may be just as effective. Other options include using LEDs for traffic management systems. LEDs that offer more robust operational performance may be used in areas where there are frequent power outages that have an adverse effect on existing lighting systems. For example, Traffic Management costs include replacing failed lights and the disruption to road users if there are frequent outages.

The Treasury has had meetings with Hampshire following their directive to authorities to seek further savings and to report on the findings from an Operational Savings Review (OSR). Anything coming out of those discussions will be for SSE to wait for the authorities to take the initiative and make an approach.

### **Private Finance Initiative (PFI)**

As one of the more recent PFIs for street lighting, the South Coast Street Lighting SPV presents to the authorities the benefits of the latest fluorescent lighting technology that uses less energy than the previous generation of light sources. LED technology will offer even further

reductions in energy consumption. The payback from such reductions is the payback that the authorities are looking for.

SSE took the view that there should be no reason why changes are unable to be made as the three authorities jointly procured the project. It is, however, a matter of getting all three parties signed up politically.

The contracts have few differences between them, for example, Hampshire has their CMS requirements but West Sussex do not, but setting such requirements aside, there is a complete commonality for legal and funding on all three contracts. SSE suggest lumping all three together to make changes because experience from PFI shows that the costs of introducing changes to the legal, financial and commercial agreements can outweigh the benefit of the proposed change.

Consider the hypothetical example: changing lamp A to lamp B to save £100000, but the legal fees cost £200000? The saving to SSE is that they do not have to engage in three separate change tasks.

South Coast according to SSE is unique in that the Central Management System included in the technical solution means that there are no temporarily compliant units to be re-installed at a later date. West Sussex did not have a CMS by their political decision, but their contract is written to be largely similar to Hampshire's contract and SSE guarantees the equipment until completion of the contract plus an additional five years. West Sussex having omitted CMS has left this authority with a proportion of their equipment that won't be part of the PFI by bringing them into a state of having non-compliant columns later in the PFI.

SSE identified a series of items from the Operational Savings Review (OSR) that they wish to discuss in terms of innovation and changes to the service.

At the time of the study, SSE had determined the cost of these items for presentation to the separate authority boards for their approval. For example, if SSE offered to do a first time repair for every fault attended which is not a temporary fix that needs to be re-visited to affect a complete

repair. This is something that the contract already requires and is current SSE working practice. Another suggestion proposed the introduction of electronic survey cards.

Another example might be to bring non-illuminated signs into the contract if SSE's capabilities and purchasing power can source signs a less cost than the current highways partner.

However, these changes only save a small fraction of the cost of repairs and the tangible benefit of their implementation does not bring the level of substantial savings the authorities are seeking. The focus, therefore, turns to energy savings such that reducing the kilowatt-hours consumed by a fraction results in large savings compared with changes to the repair regime.

Some earlier PFIs have had a break in their core investment programme such that when the programme is re-started, the Independent Certifier is re-engaged to continue checking.

Other expertise at the start of the contract came from within SSE from an earlier bid team although they were now deployed on new contracts they devoted a little time to support South Coast. There were also SSE corporate members available who had an understanding of PFI, and they continued on into the mobilization stage.

Hampshire and Southampton have a small percentage of their stock that was installed just before the PFI and are therefore relatively new although may be less efficient than the systems being introduced in the PFI. West Sussex was in a similar position as they too were installing lights close to the start of the PFI as part of a continuing investment programme.

Hampshire had the most lights in this category. SSE has returned to these newly installed lights to change the lanterns that in turn permit CMS to be fitted. If however, newly installed equipment has not got the requirement or ability to fit the six pin socket needed by the CMS, then the lantern is not changed.

The technical solution was outsourced at the procurement stage, but following the successful bid, SSE now undertakes design work at the Southampton depot. The design was outsourced to a company called 'Eclipse' a victim of the recession and no longer operating. Mouchel was employed to validate the Eclipse design for South Coast.

Mouchel also did design work for SSE on the West Sussex solution and this continued until SSE had achieved their critical mass of designers and the capability to be able to continue and complete the design in-house. SSE did not seem to recognize that they were 'system integrators.'

At the close of the contract in 20 years, there is an additional five years' of guarantee where SSE will maintain and make good any failures of the equipment. This is a risk element that they have taken from the authority, although it should be noted that this is included in the current costs and unitary charge.

Following the contract close, if the authorities do nothing then the lighting inventory will become un-maintained assets.

In the opinion of the participant, there would be another PFI, because having spent a considerable fund in a short timescale in the CIP, there be many lighting units that will need replacement, so a new replacement and maintenance contract will be needed.

### **Further Observations**

The authority has incentivized innovation but it has been a matter of working in partnership to find and achieve the best lighting solution. At the end of the PFI contract, the authority has to be satisfied that they will be able to maintain it themselves.

For SSE the drive has been to look at these opportunities, how they might achieve growth for their business.

As an energy supplier, SSE is also interested in what opportunities may arise by exploiting their capability as an energy supplier to add to their value offering.

The largest feature of replacement is the underground work, "*the civils*" in SSE terminology that includes electricity connections and ensuring the soil sub-structure is able to secure the lamppost in those instances where these are also being replaced and repositioned.

SSE returned to these new installations and replaced the lanterns if they were not fitted with the six-pin socket that enables the CMS.

As noted earlier, in this case, SSE undertakes the design of the lighting systems at their Southampton depot. SSE use sub-contractors for some work and manufacture, but the full concept of system integration was not how they view themselves and this may be as a result of believing that they have the capabilities to do most of the work internally from the design to IT.

An example is lighting columns. SSE do not manufacture these and purchase from established and specialist manufacturers such as Stainton. Other sub-contracted work is usually an on-demand basis to 'dig holes' as required.

Considering future changes that might affect the project, SSE is always alert to other projects such as invest to save projects whose procurement brings additional investment to exploit the latest technology. It is also the case that SSE will invest in new technology and projects to ensure that in those situations where they are not getting the return that was expected they would invest to get that return.

For street lighting, the products are quite narrow in range, with LED technology still expensive compared with basic technology. The SPV and contractor agreed with Hampshire who took the decision to include a

central management system (CMS) that enables control over the lighting system output and helping to save energy.

SSE's power distribution business is another avenue in which savings from existing capabilities may be made. SSE also looks for opportunities to invest and the authorities may also consider the Green Investment Bank.

Given SSE's size and variety of business capabilities, there are attempts to get the authority and SSE subject-matter experts talking to explore ideas and potential opportunities.

Included in the inventory is 'heritage' lighting. This is either to use the old gas lamp fittings - the columns - but install new lights.

There are still a few examples of working gaslights in Southampton and Horsham for example, and requiring changes to the mantles during routine maintenance. The interviewee reflected on the irony of the heritage lighting in Horsham that is now surrounded by new modern buildings!

Any changes and savings that can be achieved within the PFI by agreement with the authorities and by virtue of being in their control will be implemented to obtain the savings.

Further opportunities for improving the efficiency of the organisation post CIP may come from considering how resources can be used more effectively? Where can they be operationally based to give better coverage, for example, one depot instead of three?

One depot, the biggest, is in Southampton. There is another smaller facility in Southampton used as a storage base for the city. The third base is in Burgess Hill - a good position for working in other areas such as East Sussex and Brighton and Hove. It does not give quite such good coverage of West Sussex.

There is also a depot in Basingstoke that is good for covering North Hampshire.

Observations: Observations were not a practical proposition. However, there were opportunities to see work at first hand when visiting the Southampton depot. It did appear to be a very efficiently organised place, very spacious, very tidy, clean, bright and ordered.

The SSE Depot was also interesting with a 'bustling' modern office that was shared with the Southampton and Hampshire authority staff working on the PFI.

East Sussex, Brighton and Hove do not have PFIs, however, their maintenance term contract, currently held by Colas, is due for renewal in 2015, SSE would wish to compete for that business.<sup>2</sup>

SSE has gained considerable experience in street lighting project management and technology application. With this capability, they are prepared to expand this type of business into other authorities as standard projects rather than PFI. Bournemouth and Poole in Dorset are investing in LED in a non-PFI project which SSE implementing on their behalf.

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<sup>2</sup>The contract has been extended annually and a new LED lighting programme worth £7m and £0.9m funded from the Public Works Loan Board and the Local Transport Plan has been commenced. East Sussex County Council have a contract with Costain and CH2M (Jenkins).

## **Chapter 12 Designs for Lighting: Case Study**

“Designs for Lighting” (DfL) are a consultancy and design company specializing in all aspects of lighting from highways and urban lighting, architectural interior and exterior lighting, to sports facilities. In addition, their consultancy and engineering services include inspection, measurement, and certification, energy and lighting environment planning.

Based on prior experience with the service provider and DfL’s proven capabilities in the field, DfL were appointed by the service provider to be the Independent Certifier (IC) for the South Coast Street Lighting PFI. DfL were also the IC for Surrey Street Lighting the Pilot case study.

“Designs for Lighting” (DfL) has been included in the South Coast Street Lighting PFI Case Study as the named Independent Certifier (IC) for the authorities and the service provider and was mentioned by all the participating managers during their interviews. They are also an essential feedback of the service provider’s operating performance.

The scope of this embedded case is directed at the role of the Independent Certifier (IC) and the IC process, reporting and communications, authority-driven differences, the pilot, and innovation opportunities.

### **The Role of the Independent Certifier**

The main role of the IC is to protect the authority by ensuring that the contract design and technical specification is being met by the delivery. The SSE Contracting Ltd contracted DfL to provide this service to the authorities in the South Coast Lighting PFI. DfL did not provide any consultancy as such, although they did support the Hampshire Authority during the due diligence period, see “Authority Driven Differences.”

## **The Independent Certifier Process**

The IC conducts two main checks; the Design check and the FM check. The Design check inspection is based on a drawing or drawings released by the contractor, agreed and approved by the authority. The IC uses the customer's drawing packs to check that the contractor is delivering and installing what has been agreed as specified on the drawings. This is verifying that for a given submission, the columns are situated as specified on the drawings, that the column is the correct height and paint finish, the luminaire is the specified one for that locality, that electrical connections are to the connections standards and that the lighting levels are as specified. This last check, of course, has to be made during the hours of darkness when the lights are in operation. The Central Management System (CMS) is checked in terms of its operation as part of night inspections.

The FM check assesses the responses and coverage of the Facilities Management system, for example how this responds to customer complaints and fault queries and importantly the consistency of the FM data with the actual physical situation. The contractor has an asset management and inventory system database which the DfL IC manager called 'the FM'. The IC notes the discrepancies between the FM data and the data they gather in the course of checking and resolution of these differences helps to keep the FM system accurate.

The five-year South Coast Lighting Core Investment Programme has 10 six monthly milestones. Each milestone specifies a target number of street lighting assets to be replaced. The number totals the number of 'units', i.e., columns and lanterns and lantern only replacements (Table 12.1).

For example, the Milestone 2 target was a total of 8004 installations, approximately 1334 in each monthly submission. The IC has to check

35% of the monthly submission according to the “Proportion of Schemes” list, approximately 466 installations (35% of 1334). If the failure rate for that submission is less than 20%, the whole submission passes, i.e., 1334 pass.

Milestone	%	Units	Lanterns	Total
1	3	2351	1651	4002
2	6	4702	3302	8004
3	9	7054	4953	12007
4	10	7837	5504	13341
5	12	9405	6605	16010
6	13	10188	7155	17343
7	13	10188	7155	17343
8	13	10188	7155	17343
9	12	9405	6605	16010
10	9	7057	4957	12014
Total	100	78375	55042	133417

(Source: Hampshire County Council (2013) Street Lighting PFI Project Guide.)

Table 12.1: South Coast Lighting Milestones (2010-2015)

Each month a portion of the milestone is submitted for checking according to the scheme

Proportion of Schemes:

Milestone 1	-	75% streets notified
Milestones 2 & 3	-	35% streets notified
Milestones 4 & 5	-	30% streets notified
Milestones 6 & 7	-	20% streets notified
Milestones 8, 9 & 10	-	10% streets notified.

If the failure rate is greater than 20% the whole submission fails and the “not inspected” 65% are carried over to the next month. The whole submission also has to be checked. Figure 12.1 illustrates the IC Checking Regime.

The service provider is not able to claim for the percentage carried over and thus penalised for his performance shortfall. The IC is able to charge for each additional check.

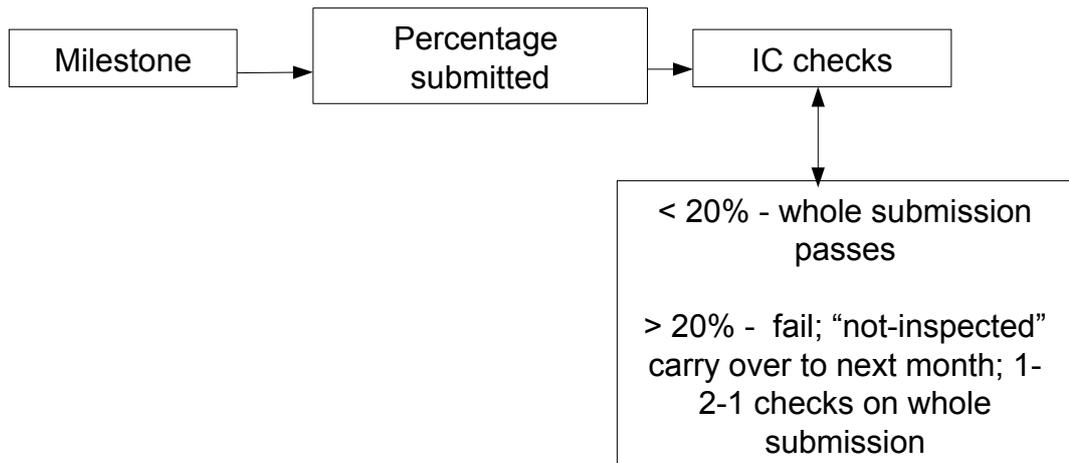


Figure 12.1: The IC Checking Regime

When the failure rate of 20% or greater is found in a submission, the process is then described as '*going into escalation.*' Escalation is a situation that the public and private partners involved wish to avoid. This can and does result in collective working to try to manage the accepted pass rate.

No additional checking is done to ensure that 'critical areas' such as accident black spots and areas of higher crime rates are installed as the design solution specifies. This is surprising given the importance placed on lighting improvements in such areas and the contribution that improved lighting is projected to make in reducing accidents and crime in the business case.

A deviation report (DVR) is an amendment to a lighting design and is an agreement between the authority and the contractor that the design has been changed as specified in the deviation documentation.

Technical issues arising during installation or an installation failing its inspection also cause deviations to be raised. The latter appears to be used to change the failed status to 'pass.'

There is a strong political element to these agreements and entry into escalation has been a very rare event.

The IC checks compliance with the approved and released lighting designs and checks are made when the installation is complete, i.e., not during the installation work. Once an installation is complete, the item needs to be entered into the FM database within a certain time period. This signifies that the item has now left the CIP and is now part of the inventory and will have a maintenance schedule attached to it. Pass or fail status is not, however, tracked or recorded by the FM system.

The IC records the progress and completion of a check on an 'inspection sheet'. DfL has designed and implemented a database system for their own use, that records the inspection sheets and from which reports can be generated. The inspection sheets hold such data as 'inspected', 'not inspected', 'pass', or 'fail'.

The IC is not present during installation work. The IC does not want to be seen to be checking the working practices of the installation teams and is not part of the contract.

Following completed installations, the IC invites authority and contractor representatives to be present during the inspection process. The authority rarely has a presence, but the contractor generally attends so that any differences or discrepancies can be defended.

Successful defence eliminates the need for re-work and helps to maintain their financial profile by not incurring a penalty if work is failed.

The IC will contact all parties by 'phone or email if there are any questions or issues requiring an answer or clarification.

For each monthly working period, there is a cut-off date for submission of that month's schedule. This results in a ten business day period in which

the IC has to complete the inspections, FM, design, and night-time checking for all three authorities. The outcome of this is a very high workload for the IC.

### **Reporting and Communications**

The IC contributes to the reporting structure against Performance Standard 1 (PS1) described in Appendix A of the Hampshire County Council Street Lighting PFI Project Guide, (2013). In particular, the PS1 Performance Target A applies and requires that the Independent Certifier has issued a Certificate of Compliance in respect of the Replacement, and CIP Apparatus is identified in the Certificate of Compliance.

The contract for the IC specifies a format for reporting.

The IC, based on previous experience, held a series of discussions with the service provider/contractor to understand what was expected of the report as sometimes the formality of the contract and the expectations are different. The IC was then able to ensure that their report met expectations while complying with the contract.

The last two weeks of the month are in the reporting period.

It is then that the DVR confirmations and agreements will be intensified to complete the report and have the best possible pass rate.

All three authorities had their reporting periods synchronized and aligned to fit with their respective Monthly Management Report (MMR) schedules, and were reluctant to alter these schedules as this would cause contract changes between the service provider and the IC.

### **Authority Driven Differences**

DfL supported Hampshire in the due diligence process by checking the inventory and included lighting for some of the Parishes in the County.

The IC consulted with Hampshire County Council to clarify and agree on the checklist of 50 items.

West Sussex County Council and Southampton City Council presented no differences.

### **The Pilot**

Designs for Lighting were also the appointed Independent Certifier for Surrey County Council's Street Lighting PFI. The service provider was Skanska-Laing, with Skanska as the contractor and Laing the project managers.

One difference presented by Surrey compared with South Coast is that Surrey has two Designated Network Operators (DNOs), UK Power Networks (formerly known as EDF Energy) and Scottish and Southern Energy. They own and maintain the cables that supply the streetlights with electricity.

This resulted in some submission difficulties if both utilities were involved in a particular set of roads.

Another substantial difference between the Surrey Pilot and South Coast was the IC checklist. For Surrey, this was 16 items in contrast to South Coasts' 50 items.

However, the 16 item checklist for Surrey was somewhat generalized which resulted in occasional disputes. The authority, however, took a relaxed approach to reach an agreement and were able to accept DVRs to aid progress.

The Surrey Street Lighting PFI was in its last Milestone of the five-year Core Investment Programme when DfL participated in the study. The submitted sample is now 5% that translates into a few roads or partial road lighting installations that require to be checked.

The IC's viewpoint was that such a small sample did not provide a representative number with which to inform the failure rate and quality of installations.

### **Innovation Opportunity**

The IC did not contribute to the strategic direction of the street lighting programme because this was not an element of their contract. However, they did make some process improvement proposals, and they had their own observations about what innovations might be achieved in the future these are recorded in this case report for completeness.

The process innovation was more process improvement and was essentially enlightened self-interest on the IC's behalf to even out the monthly 'peaks' of work. The contractor was required to release the checking submissions with a cut-off date in the middle of each month. This left 10 business days for the IC to complete the checking of the submission for all three authorities. This assumed a four-week month and 20 business days per month.

The IC approached the authorities and explained an amendment to the process, proposing that the contractor release the completed elements of the submission when agreed, or better still the scope of the submission, rather than wait for the cut-off date. This would allow the IC to select say 30% of the advance information for which design packs would be needed, but the remaining 70% could be ignored thus saving the contractor work effort. Rather than wait for the full submission to be completed, the individual parts of the submission could be released when completed and authorized, thus allowing the IC to start on the submission as early as possible. A further benefit would be to the contractor if the inspection found that the failure rate for the early release packs and implementations was less than the 20% level, the contractor would not need to complete the remaining components of that submission.

Unfortunately for the IC, this proposal was not accepted.

The IC observed that future innovation could potentially be achieved if the metering of the street lighting assets could be linked to the FM inventory system. Enabling this to be “fully live” means that the amount of energy being used in street lighting becomes visible to the authority and service provider, potentially enabling better switching and dimming decisions as well as tighter spending control. Progress is inhibited by difficulties in obtaining agreement amongst the parties and the utility providers involved.

Contributions to innovation made by the IC were limited to working level improvements rather than the long-term strategy. For example, there was assistance to the Hampshire authority to make their IC checklist of some 50 items easier and more understandable to use.

In terms of technology, innovation is very difficult in the CIP period. Because of the pace of change in lighting systems, the time taken to agree a technical solution is longer than the better or more advanced and more efficient solutions are available. This is particularly true the situation with LEDs.

A key important observation made by the IC is that the authorities need to consider further savings by adopting LEDs during the remaining PFI life. When LEDs are introduced, it will be a matter of changing the luminaires. The columns installed during the CIP will not need replacement. It may be necessary to move columns in some areas because the LEDs will potentially change the lighting design for that area.

### **Related Topics**

It was the IC’s opinion that in the early stages of their engagement there was a palpable “us” and “them” impression between the authorities and the contractors. Over time the impression has given way to a more collaborative, co-operative and consultative approach.

The IC has observed the marked organizational changes within the authorities, which now have management teams but no street lighting design engineers. It was felt that the management teams could be “more integrated”, although most were co-located, i.e., authority and service provider shared the same office location. More integrated meant that together they became the PFI management team.

The IC considered that the project was too big and consequently put all working parties under pressure with too much to do in the time available. An outcome of schedule and workload pressures on the contractor was to cause installation work to be rushed resulting in errors and failures. The IC’s concern was that this had the effect of the contractor relying on the IC to do their on-site quality assurance, which strictly was not the IC’s contracted role.

It also seemed that SSE initially struggled to deploy sufficient support staff to keep the administrative aspects synchronized with the programme. This was something that perhaps had a bigger effect on the IC.

At the close of the CIP, the IC contract comes to a close, although there may be some residual work to do.

## **Chapter 13 Findings and Discussion**

With a contract commencing in 2010 and continuing until 2035, the South Coast Street lighting contract falls into the category of Long Term infrastructure Contracts (LTICs) as described by Hodge and Greve. The contract is an example of two governance families, the first a cooperation between institutions and the second of a long-term legal contract in which tight specification of outputs are made Hodge and Greve (2009) and (2007).

The initial research question asked “What is the scope of innovation encouraged by the governance system in the street lighting Private Finance Initiatives (PFIs)?” The literature review readings and study led to a refinement of the research questions led to a Central Question and six Associated Questions whose purpose is to lead to answering the Central Question. The six Associated Questions formed pairs that address the key domain areas of governance, innovation and PFI.

The first “associated question pair” address innovation.in the street lighting projects.

### **Associated Question 1:**

What lighting innovations have been developed and applied in those projects?

The Final Business Case for South Coast Street Lighting, for example Hampshire County Council (2009) noted the urgent need to address obsolescence and ageing issues of the lighting network and requirement to take the benefits of more efficient lighting improved lighting quality, cost and savings effective and aiding carbon reduction obligations, which are the key investment improvements identified by Belmans et al. (2004) and Hampshire County Council, (2009).

The Central Management System, with its back office computer system, laptop and mobile phone access to a private wireless local area network enabling communication and data exchange between all of these components from and to the nodes that are an integral part of the street lights illustrate a working example of the IoT systems described by Greengard (2015) and represents an innovation in the management and control of street lighting.

The Central Management System transforms the operation of the lighting system regardless of the operator, either public or private, because it enables the operator to manage and control without technical staff to set mechanical timing, and conduct inspections to check the working and lighting quality. The software in the CMS and the Back-Office system is activity aware which switches on/off and dimming and to detect the working/not-working states. The software is 'policy aware' having the policies of on/off and when and by much to demand return to full light. The system is also aware of the process having sensors to determine the on/off, dimming states against the authority's lighting policy and can determine the activity sequences all of which accords with the fundamental design and architectural principles as presented by Kortuem et al. (2010).

Two sources of funding for innovation are available, one is built into the PFI and the other is a small credit fund from the SVP to the contractor SSE. The latter innovation fund is worth £2m and is shared across the three authorities. It is available only during the CIP. The innovation fund is used in two ways, firstly to experiment with further energy reduction measures, for example, experiments with LEDs. The second use is to fund working efficiencies within the contractor team. The other small fund allows the contractor to experiment with different lanterns but is only sufficient for one or two examples.

The Independent Certifier (IC) noted that further innovation could be achieved by linking metering of the electricity to the FM inventory, thus allowing full visibility of consumption that in turn would enable better dimming and switching off decisions to reduce costs. This would involve negotiations among the authorities and the Designated Operators. The IC considered that innovation in the CIP was difficult given the rate of change in lighting systems. The time taken to agree changes to the technical solution was greater than the changes taking place in the available technology.

The Hampshire authority considered the new white light sources in residential areas replacing the old “orange” lighting, major roads lit by high-pressure sodium lights and the LEDs helping to reduce light pollution in the National Parks are the innovations in lighting that are a benefit to the county.

The West Sussex authority agreed that the white lights that can offer better colour discrimination at night and represents a significant improvement. Reduction in energy consumption was a significant prize for the project, potentially reducing costs by two thirds.

Half of the West Sussex street lighting stock has been fitted with the 6-pin socket that enables fitting CMS node modules to the luminaires. This means that if the authority can afford the investment for CMS, then it will be a very simple task to fit the nodes. Such a project would not be part of the PFI, but fully compatible with the installed lighting system.

The service provider, SSE identified further innovation opportunities as noted in the findings above, where two innovation funds are described and how the funds are used to cover the cost difference between a standard installation and a LED installation.

Opportunity for innovation by the IC was limited to offering simplifications to the authorities’ schedules that were convoluted, HCC for example. However, this could also be a case of self-interest by the IC who had all three authorities monthly submissions arrive at the same date each month.

It was the IC's view that the schedule pressure reduced the contractor's opportunity to consider innovation in their working practices.

Wider benefits from reductions in energy consumption from the application of new lighting technology and the consequent contribution to carbon abatement obligations are also being achieved.

Innovation can be built-in if included in the output specification. Both technical innovation and service delivery innovations can be achieved. It would seem that technical innovation is present and more prevalent in the early stages of the project and less so during the later operational stages while service delivery innovation is more likely to be present in the later stages of the project.

### **Associated Question 2:**

What is the impact of innovation on the organisations involved in the PFI projects?

From the SSE case study (Chapter 11) it is clear that the parent SSE company was prepared to create a new business from four of its separate businesses which is an example of the structural integration discussed by Leiringer (2006) and Leiringer and Schweber (2010). The separate businesses Contracting, Lighting, Utilities and Telecoms were brought together to form 'SSE Enterprise' and with eleven street lighting PFIs in other parts of the UK in addition to the three authorities in South Coast Street Lighting, allowed SSE to claim to be one of the largest mechanical and electrical contractors in the United Kingdom, managing approximately 1.5 million streetlights in their street lighting services. Each PFI lighting contract successfully bid by SSE has its own SPV. For example, for the Hampshire component of South Coast Street Lighting bid is Tay Valley Lighting (Hampshire) Ltd.

In 2009, SSE Contracting purchased Mayflower outright and began development of a brand-new product range – Mayflower Smart Control. SSE demonstrates a willingness to embrace innovative technology and a long-term commitment to PFI but with the ending of PFI continues to support the existing contracts and is also in a position to provide these services under conventional contracts.

These combined capabilities enables the Special Purpose Vehicle (SPV) to compete for other street lighting PFI contracts which is consistent with the research findings in the literature, Davies, Brady, and Hobday (2007); Brady, Davies, and Hobday (2006); (Brady & Davies (2004); Nightingale, Brady, Davies, and Hall (2003); Davies and Brady (2000).

The individual authorities were encouraged by HM Treasury to join up into a single bid project thereby achieving an acceptable scale and increased likelihood that the bid would be approved as related by the Hampshire manager and consistent with the review by Winch (2012).

Both public and private sectors needed to learn about PFI, the contract, its progress and each other. The knowledge transfer framework presented by Carrillo et al. (2006) helps to structure the findings. Starting with the Pilot Study, found that there was no obvious evidence that a first stage assessment had been made. The team that was to manage the PFI used a short period prior to contract commencement, learning about PFI and the contract. There was no formal training arranged for the authority's team.

The 'performance monitoring system' did however, provide a shared real-time view of the progress of the contract in terms of installations completed, adherence to the schedule and formed the formal governance system from which remedial actions or performance payments could be made. A 'learning event', called knowledge management, was held with partial success.

The Hampshire manager's view was that technology had reached a plateau and all that was left was service delivery and process improvement.

Further 'innovation' may be possible by sharing supply depots with the other neighbouring authorities. This might appear to be more improvement rather than innovation, but it is essentially new practice for the authorities. The technology that these programmes introduce is completely innovative in this type of application, indeed surpassing any of the previous lighting systems. There will undoubtedly be benefits from the application of this technology in terms of improved efficiency in the operation of the lighting systems, however, is this application the only source of innovation in public lighting systems? Further, examples of innovation that may be possible are reductions in inspection frequency, cleaning schedules, reporting and clearing faults.

It was appreciated that the new lighting system was resilient to changes in government legislation regarding carbon abatement, either by amending their lighting policies accordingly or by updating the technology because the network can accept LEDs. However, the relative immaturity and high cost of LED technology, resulted in accepting a more conservative solution, but one that could accept LED technology in the future. However, it is also appreciated that other than switching lights off, further significant reductions in lighting energy consumption is limited.

The application of low power mesh networks at the heart of the Central Management System of the lighting systems completely disrupts by displacing aspects of street lighting management and maintenance. The impact might best be illustrated by what functions the West Sussex County Council authority needed to continue resulting from the decision not to include CMS in its requirements for fear of exceeding the available budget. Without the CMS, scouting teams need to be dispatched once or twice a month at night to survey the lighting systems, noting lights not working and

the lighting levels. Lighting levels are set by the authority's lighting policy, for lighting-up and switch-off times and dimming to reduce energy requirements. Faulty lights cause lighting level degradation, and this would result in deployment of a crew to inspect and change the light if necessary although cleaning the lenses and covers might be sufficient to remedy the problem.

The impact in terms of work is on the service provider who will be doing the work in the operational phase of the PFI, but this will be reflected in their unitary charge. For any authority where CMS is deployed, control and diagnosis of the lighting system can be achieved by a lighting operator from a laptop with the result of reducing costs at the expense of employment.

The Surrey authority is of the opinion that the PFI itself was the disruptive innovation as it completely changed the service provision for street lighting with the loss of employees from the authority transferred to the service provider who now undertakes work that used to be the province of the authority.

The IC observed that the rate of change in the development of the technology has already surpassed the PFI installation and meaning the maturity and reducing costs of LEDs. It was also the IC's view that innovation in installation working practices was attenuated from the pressure of achieving the programme in the 5 year CIP.

The Southampton authority believed that solid-state technology would assist them to bring innovation to service delivery and management of the lighting estate.

The next Associated Question pair asks about the Private Finance Initiative street lighting project itself.

**Associated Question 3:**

How did the PFI satisfy the requirements of three different authorities?

Generally, the problem facing the authorities was that the street lighting infrastructure needed renewal. Following financial appraisal, application for PFI funding was seen as the inward investment that would meet the large cost of the projects, if the bids were successful.

For the West Sussex authority, PFI did address the need to replace the street lighting infrastructure that had reached the end of safe working life by providing the level of funding needed for a project of this size. Cost concerns and the risk of losing the bid caused CMS to be omitted from their technical solution. However, there was disappointment on discovering that CMS could have been included in the technical solution. The authority was of the opinion that a failing of the PFI model was that it did not permit costed options that could assist in making better decisions.

The participating manager in the Pilot Study held the view that the second or operational phase of the project was well-defined in terms of its requirements and consequently left little opportunity for flexibility of what innovation could be achieved. If future technical and service innovation is to be exploited, additional funding will be required from the authority.

**Associated Question 4:**

The PFI was the first undertaken by the three authorities, was it treated like a traditional contract or did it caused the authorities to adapt their governance or management arrangements?

Southampton City Council had formed a contracts group for the purpose of managing the Council's high value projects and as a high value, high profile project, the street lighting PFI was placed under the management and control of the group. A strongly developed collaboration with the

service provider and contractor has influenced this authority causing them to be more commercially aware. This awareness carries over into their other council business. This is in contrast to the other authorities who, although collaborative in their relationships with the Service provider and contractor seem somewhat more formal in their management practice.

Access to and sharing of the SSE database in real-time proved superior to a monthly written report and has other benefits in developing trust through encouraging openness and a close working relationship.

**Associated Question 5:**

What form does the street lighting PFI governance system take?

In the Johnston and Gudergan (2007) sense, risk is considered to be an overarching governance concern and was a focus of competitive dialogue with all the bidders. At the South Coast Street Lighting Outline Business Case (OBC) stage, transfer of risk was agreed by both parties with the risk assessment by the councils and their advisors. A risk register was established detailing which party was to be responsible for each of the most significant risks for example, following the PFI convention, the energy/price and consumption risk was retained by the councils. Risks associated with installation and operation together with risks associated with mobilisation and service delivery remaining with the service provider South Coast Street Lighting PFI Final Business Case (2009).

The framework Nisar presented concentrated on risk transfer, a whole life approach and managing partnerships. The whole life approach had to be taken as the project lasted for an additional five years following completion of the contract as a guarantee against technical or operational issues. The partnership was initiated by the PFI itself causing the partners to work together during the CIP. Co-working was facilitated by co-location and a shared database helped to build trust Nisar (2013).

All three authorities demonstrated a three-tier governance model, although West Sussex County Council had some difficulties in the full operation of their Network Board in the early years of the Core Investment Program. Figure 10.1 SCC Three Level Governance Model (p. 191 Chapter 10) is a typical arrangement for the projects in this study, and is consistent with the findings of Demirag et al. (2004) and Nisar (2013).

With the operational or working side of the project outsourced, there was no longer a need for the public organisation to manage the project and their management role reduced to monitoring the performance of the service provider and the contractor.

The Southampton Council has created a single group, called the contracts group, which oversees and manages the key contracts held by the City Council.

A governance team with responsibility for governance of the contracts groups is established. This governance team also takes responsibility for the street lighting and highways contracts. Governance is generic across the contracts within the group, but tailoring is permitted to support individual contract requirements. The governance team monitors the standard. The team governance manager promotes and ensures cross contract governance policies over the contracts in the team's control. Responsible managers at lower levels have the role of ensuring governance for their charges only. The governance team leader is also the PFI manager. The only process by which the governance system appears to be assessed, that is, it is working effectively, is through a process called 'benefits realization.' In this process, governance is examined to determine if it is undermining or inhibiting the contract thus having an adverse effect on the benefits of the contract. Generally, governance arrangements were not documented.

Monitoring plays an important part of the governance system for these projects. This is noted in the literature and in what was found in the projects. From a brief study of the literature it was found that the OECD included in corporate governance a provision and structure that supported monitoring to measure performance and the delivery of benefits OECD (2004). In the context of street lighting, a monitoring process was advocated by Well-Lit Highways to determine the operational status of the lighting systems Well-Lit Highways (2004), considering PFI and the need to demonstrate value-for-money, took efficiency and effectiveness as drivers and stated that managerial accountability could be informed by internal monitoring. The progress and performance would be reviewed by operational meeting with managers from the public and private sectors involved in the project. Performance monitoring UK PFI projects was also seen as a necessary activity by Robinson and Scott (2009) to demonstrate value-for-money although they found that the literature was sparse on this topic. For the South Coast street lighting PFI, there is strong evidence that monitoring systems were in place during the core investment phase, and collected operational performance of the lighting system. The data collected from the Central Management System is hosted on a shared, common database. The data contributes to the review of the monthly monitoring report, thereby reviewing the performance of the lighting system.

The governance system depends on a feedback mechanism that compares the output, i.e., the achievement the contractor makes against an agreed set of standards. This is a check against the standards as represented by the specifications and key performance indicators (Type I learning). However, there was no debate to challenge these indicators whether they were still representative of the required service (Type II learning) This is consistent with the Type I/ II or OI organisational learning models of Argyris and Schön (1978) and (1974).

The development of the work by Argyris and Schön on theories of action from interpersonal to organisational led to the concept of learning cycles

for group and organisations as Type I and Type II (organisationally O I and O II). The monitoring system for the management and control of the street lighting is an example of Type I or single-loop learning. Here the goal is to use the output Specifications as the standard to be adhered to and to take action to preserve performance to maintain them. Any reported changes to the specifications causes management action to return to the specification values. In the implementation phase there was no evidence to move to Type II learning that would challenge and potentially change the specifications.

This feedback is used as input to an important meeting that all the authorities conduct, called the “Monthly Monitoring Review” (MMR). This review assesses the performance of the contractor and leads to the level of monthly payment made to the contractor.

In the Core Investment programme, there are three levels of monitoring. The first measures performance against the installation of new lights. The second deals with the installation and commissioning of the Central Management System and the third is performance against the required maintenance standard, including preventative work, repairs, cleaning and customer response.

The essential component of the feedback system that makes monitoring possible is data collection and conversion into the information process assembled to form the Monthly Monitoring Report (MMR). The MMR details are held within a spreadsheet containing contact lists, report formats, and reporting responsibilities. However, there is no indication about measures taken to support innovation. It was conceded that this does need to be documented.

Initially, the shared database had no report formats to assist the authorities to confirm the figures that were feeding into the performance reports.

The Hampshire PFI manager overcame this problem by devising a series of reports that included data from the monitoring work of the customer

care and customer service teams, from the maintenance and repair teams and data automatically captured from the CMS. The CMS provides performance, faults and usage data. SSE recognised the value of this set of reports and adopted them for all their contracted street lighting PFI projects.

Although the Independent Certifier (IC) did not contribute to the strategic direction of the projects and was not represented on the Network Board, they did, however, have process improvement proposals and had views on what innovations might be achieved at the operational level.

The process improvement was primarily for the IC's benefit and was intended to even out the 'peak and troughs' of work that was experienced by the way the authorities scheduled their monthly plans to the IC.

Unfortunately, this proposal was not adopted.

An element of the standard contract pack for street lighting PFIs includes a document called Schedule 18 that defines the establishment of the network board and its responsibilities. The Schedule 18 'innovation' obligation on the Network Board was achievable by both Hampshire and Southampton authorities in that they establish their boards and held them regularly. The West Sussex authority had difficulty with this obligation until later in Core Investment Programme when they were able to re-establish their Network Board.

The daily working practices as indicated by van Tatenhove et al. (2006) are much in evidence in all the cases studied and exhibited an early identification of operational problems. These problems often required some ingenuity to resolve and this was achieved by joint collaboration to find solutions thereby avoiding escalation into the formal reporting system. The West Sussex authority was without a formal Network Board for the first half of the Core Investment Programme, and used an ad hoc approach to avoiding problem escalation.

**Associated Question 6:**

How does the governance system promote and encourage innovation in the project?

The importance and advantage of the three-tier governance structure is that the primary public and private managers of the PFI at the operating level attended the Network Board and thereby achieve 'continuity of purpose' between the board and operating levels.

Lack of a full CMS in the West Sussex technical solution was mitigated by including in their street lighting standard a requirement the 6-pin S6000 socket, the patented device that permitted either a Node or Sub-Master element of the Mayflower control system to be fitted to new or replacement lanterns. If future investment is made by the authority to enhance the lighting network to convert to LED lighting, then the standard will already be made to include CMS.

Evidence that the governance system promotes and encourages innovation is sparse with the Pilot and Hampshire County Council even to expressing the opinion that the governance system does not support innovation. This is ameliorated somewhat by the presence of the "innovation fund" that is a feature of the contract. However, the view is that the street lighting PFI is not innovative.

Contradicting these remarks is that HCC and SSE state that discussions are jointly held at the network board to "offer strategic guidance on bringing new technology into the PFI." HCC did reflect by stating "innovation here is looking at continuous improvement across the project." This is further evidence of one of the "flaws" described by Osborne and Brown that innovation public policy is undermined by re-framing innovation as continuous improvement.

The commitment and spirit of collaboration between the public and private actors in all the cases studied coupled with the collocation where possible

showed a strong willingness to avoid the formal escalation of operational issues, but work together to achieve the desired performance from an innovative orientation as described by Wynen et al. (2014, p. 46).

The **Central Question** asked

“What is the scope of innovation encouraged by the governance system in the street lighting Private Finance Initiatives (PFIs)?”

Inputs from the six associated questions help to form an answer stating the scope of innovation is restricted to the “state-of-the-art” technology available during the bid phase of the project and the exploitation of the Internet of Things to disrupt and eliminate the need for night-time “scouting” surveys to check the operating condition of the lighting system. The authorities involved in the South Coast project faced identical problems of a street lighting infrastructure in disrepair and the challenge of achieving the inward investment needed for renewal. Two of the authorities have appeared to process the PFI as just another contract but their behaviours have become more collaborative and commercially oriented. Collaboration at the board and project levels is evident and is continuing into the operational phase of the project. The multi-level governance system does encourage innovation within the limits of the technology solution and service delivery although, perhaps surprisingly, the respective PFI managers were of the view that governance does not encourage innovation, but that they were delivering improvements to the street lighting system.

The key findings from the associated questions show that governance is multi-level.

Governance from the centre, besides the introduction and promotion of PFI contracts, was concerned in the pre-bid phase with cost reduction from collaboration and encouraging external advisors.

A contrast was found between the view held by the researcher, who recognised innovation as defined by Thompson (1965, p.2) and West and Anderson (1996) and that of the participants who believed that the projects were not innovative but improvements to the lighting systems, a corollary to the definition proposed by Van de Ven (1986).

The review of the journal article by De Lemos et al. (2003) in Chapter 4, noted the likely expectation that the contractor take a more cautious approach to risk particularly if they were expecting to become the operator in the contract. Their point can be illustrated by the actions of the South Coast project contractor. The requirement of the collective lighting authorities was to want a contractor who would provide maintenance, repair and replacement of lights that did not need replacing during the initial tranche, but subsequently reach the end of their operational life. The contractor could have transferred all the authorities lighting staff under TUPE and did transfer a few. The advantage of this would be to have staff thoroughly familiar with the service in all its aspects. Instead, the contractor took the following actions. The first was to exploit technology to enable management and control of the lighting systems using PWAN and IoT capabilities to power the Central Management System and thereby reduce the number of staff that would be need in the operational phase. The contractor acquired the company that designed and produced the CMS, thereby securing a new capability and ensuring its availability while reducing risk. During the operational phase these benefits undoubtedly reduced costs and risks to the contractor and the client authorities.

Assuming the importance of collaboration between public and private partners in a project, the opportunity was taken to examine South Coast Street Lighting PFI using the six critical factors identified by Ansell and Gash (2007).

The definition has six criteria and examining the South Coast Street Lighting PFI in terms of these gives an emphatic endorsement of the public and private partners "collective" approach.

Using the criteria found the following results.

(1) *"The focus is initiated by public agencies or institutions."*

PFI was introduced in 1992 by the central government. The opportunity to attract inward investment to achieve pressing re-Newark projects was taken up at a "local" authority level. The nature of the approach under PFI inevitably led to joint discussions, planning and ultimately joint management of the project.

(2) *"Participants in the forum include no state actors."*

Following the initiation, the "non-state actors", i.e., the service provider and the contractor and the financiers jointly with the public sector actor/s worked to prepare the proposal. Subsequently, following the successful approval both public and private actors, now, at the project level, work together to achieve the delivery, of the project.

(3) *"Participants engage directly in decision-making and are not merely "consulted" by public agencies."*

In the South Coast PFI, the public sector authorities worked together with the private sector service provider and sub-contractor to deliver the three projects with engagement at the executive board levels and the project management levels. There was also joint working to achieve an effective performance monitoring system, which contributed to the governance system.

The collaboration was greatly facilitated by the co-location of the public and private actors.

(4) *"The forum is formally organised and meet collectively."*

The forum is formally organised by appointment of members from both public and private organisations involved in the projects. They attend

scheduled meetings that have formally issued agendas and records. As noted in the third criteria, co-location facilitated these events and encouraged day-to-day interaction and collaboration.

(5) "*The forum aims to make decisions by consensus (even if consensus is not achieved in practice).*"

Decisions were taken jointly and collaboratively at the governance forum and on a day-to-day basis at the working / operational level when problems arose. If a resolution and decision could not be made at the project level, then there is a route for decision-making or resolution by escalation up to the next level.

(6) "*The focus of collaboration is on public policy or public management.*"

Assuming that "public management" can be interpreted as managing public assets, strong evidence that the public and private partners collaborated to achieve the management of the street lighting assets of the respective authorities has been found.

The critical variables of face-to-face dialogue, trust building, development of commitment and shared understanding identified in Ansell and Gash's study, are also found to be present in the projects.

The conclusion is that the South Coast PFI is governed through a well-structured and well-defined organisation of both public and private actors who work together in close collaboration to fulfil the objectives of the PFI programme in the fullest sense of the Ansell and Gash definition.

It is ironic that one of the PFI managers in the public sector did not believe that their governance system supported innovation. This is despite the claims of the private partner that they have developed and installed the largest centrally managed street lighting in the world. The authority and the service provider also have a small joint team that monitors the emerging technologies, particularly those that are compatible with the new

lighting system and costed proposals are made. Who would sanction the adoptions of these proposals? Ultimately, it would be the full Council who would sanction the adoption but only after the funding had been secured. This is an investment that is in addition to but not part of the PFI contract.

It was also a commonly held view that once the CIP was completed, any opportunity for further innovation would be limited to service improvements and innovation beyond that was very limited if not completely exhausted.

Taking a look forward to what PF2 and the reform of PFI was trying to achieve, the following can be observed.

A call for innovation:

as stated by Eaton et al. a critical factor for PFI is the ability to bring innovation into project delivery HM Government (2012), HM Government (2011), Eaton et al. (2006). The reform proposals for PFI also continued with this call and expectation, and the research shows that the SPV did bring an innovative approach into the management and control from the CMS system. It was less clear if the SPV had been incentivised to innovate or if this was as much self-interest in making the management and control task easier.

Delivery and investment in public infrastructure and services from private finance and expertise:

The private financing was arranged, however the small additional “experimental fund” was only available in the implementation phase of the project.

Lack of transparency:

The progress was reported by the council/local authorities in their proceedings available on their respective web-sites.

Flexibility in what is contracted for:

There was no data for this but the lighting service was quite limited to the installation of the new lighting system and subsequent maintenance.

Invest to Save:

The major input was the inclusion of the CMS system that required investment, but resulted in savings over the life of the project from a smaller contractor organisation compared with the original lighting authorities.

The private market sector causes companies to be as efficient as they can be:

As noted above, it could have been enlightened self-interest on behalf of the SPV/Contractor in introducing the CMS which reduced the need for a larger organisation to maintain the lighting system and for night-time scouting patrols.

From this it can be said that this type of project was achieving much of the desired expectations from the reform.

As a post-script to the research, the following were noted as ongoing developments in lighting policy and innovation.

The first development is that Surrey County Council approved part-night street lighting following a public consultation that saw 75% of respondents in favour of switching off-street lighting in some areas. This is a clear example of the Coats and Passmore call for consultation for a particular service thereby addressing the needs and concerns of the public affected by the proposed change in lighting policy.

The council was also guided by the LANTERNS Project, conducted by the London School of Hygiene and Tropical Medicine with contributions from many authorities including Surrey County Council. The results of the project were published in 2015 concluding that it did not find a link between switching street lighting off or dimming and with any increases in

road traffic accidents or crime when compared with published data on accidents and crime.

The majority of street lighting in the county is dimmed, by reducing the power by 50% between 2200 – 0530 each night. The cost of street lighting in Surrey is £3m per annum, consuming 25 million kilowatts of electricity and releasing 12,500 tonnes of CO<sub>2</sub>. Turning lights off in some residential areas will save approximately £210,000 per annum. The Central Management System is facilitating the implementation of the lighting policy from a single control point.

The second development concerns the Mayflower Complete Lighting Control System that forms the basis of the lighting central management system in the case studies in the South Coast Street Lighting cases. The Mayflower system is an Elexon approved CMS. The relevance of this is that the CMS can enable metering of electricity consumption. This was considered a potential future innovation suggested by the Independent Certifier as described in Chapter 12, the Designs for Lighting case study. Great Britain has an electricity market that allows customers to choose the electricity supplier of their choice. There is a number of electricity generating companies from which suppliers can choose to meet the demands of their client base. There are also organisations that do not generate, distribute or supply electricity and are known as non-Physical Traders.

The Gas and Electricity Markets Authority who operate from the Office of Gas and Electricity Markets (Ofgem) regulate the market. Ofgem's role is to protect consumers by providing competition in the market and amending the rules as necessary. In 2001, the Balancing and Settlement Code (BSC) was introduced and administered by an organisation called Elexon. The purpose of this organisation is to compare the amount of electricity the generators and suppliers plan to produce with the amount they actually produce. The difference between the planned and actuals is

used to calculate a price for the funds to be transferred in accordance with the code.

In the case studies, Hampshire and Scottish and Southern energy both discussed what they called the Operational Savings Review by which they meant the Operational Saving Programme. At the time of the interviews, work on the OSP was in progress. Although there was no obvious evidence of collaboration, there had been discussions about what could be done to make savings. SSE identified a number of topics that they wanted to present to all three authorities in terms of innovation and changes to the service. These proposals had been costed and examples were offered. It was not obvious from the cases how collaborative the OSP work had been, but there did appear to be the prospect of ongoing dialogue. The OSP was not without casualties as the Hampshire authority had to confront the issues regarding redundancies stemming from the review.

Finally, supporting the whole research project, the use of QDAS is noted as a valuable aid in managing the corpus of material collected in the course of the work, but it is essential to appreciate that it does not provide answers to research questions, but enables storage and analysis of the field notes, quotations and codes as well as the partitioning of the data and other documents from the literature to the transcripts.

In the next and last chapter, a conclusion to this research is presented.

## **Chapter 14 Conclusion**

### **Introduction**

The thesis concludes in this chapter and includes a summary of the contribution to knowledge, limitations of the research and suggestions for future research

The research opened with the public notice of an innovative programme to replace obsolete street lighting systems. The study of the largest of these projects in the United Kingdom was undertaken with the objective of discovering to what extent the governance system influenced that innovation. The proposition that governance influences innovation in the PFI project is only partially demonstrated at the project level as described by the cases. The PFI project managers did not think that they were innovating, but just improving the lighting service and no mention was made of the Schedule 18 Terms of Reference stating an accountability to encourage innovation. However, there was strong commitment from each partner to collaborate to resolve operational issues innovatively, encouraged through unspoken informal working practices. All authorities rigorously adhered to the formal Monthly Monitoring Report regime. An exploratory qualitative data analysis approach was employed to gather data from the empirical context.

### **Contributions to knowledge**

The significant contribution arising from the empirical data in this research demonstrates that the innovation that might occur within a project consisting of multiple coordinated public and private sector actors is not generated through an overt governance structure. Chapter 4 reviews a wide range of governance topics all of which reflects the formal nature of the subject. Ayres (2017) departs from this formality by showing that informal structures are also present as well as formal structures. This research has found a range of governance from formal to informal in the

PFI, from formal central government policy HM Treasury (2012b), HM Treasury (2008) and requirements to the Schedule 18 Terms of Reference for the Network Boards of the Public-Private Partnerships forming the PFI to informal undocumented arrangements that enabled the projects to make progress at the operational level rather than escalate to the Network Board. Rather, operating project managers generated workarounds to solve boundary-based and complex hidden problems in the attempt to achieve what they perceived as continuous improvement that was, in fact, genuine incremental innovation as noted in the literature NESTA (2007) and Bessant and Caffyn (1997).

The obvious innovation was the PFI itself as none of the authorities had employed this type of funding and partnering approach previously. In terms of the technical solution there was innovation from the inclusion of the Central Management System enabled by the Internet of Things technologies. A very limited “innovation fund” was sponsored by the SPV / Sub-contractor during the Core Investment Programme for new lighting technology experimentation, but note and emphasise that this was technology based and not available for process or organisational changes. The research has shown how many of the actors only really perceived innovation as being technical innovation.

The empirical work in this research revealed examples of what can be called hidden or unrecognised innovation. The Standard Documentation of the South Coast Street Lighting PFI titled “Schedule 18” that describes the Terms of Reference for the Network Board does state a responsibility to foster innovation yet the empirical data shows that at the project level, managers did not perceive their work as innovative but just improvement. The approach taken by one local authority to form an internal organisation to govern, manage and control their highest value projects including the street lighting PFI project, was itself an organisational innovation, however this organisational change was not seen as innovative by the project actors. These findings are examples of what a NESTA report categorised

as Type II hidden innovation in non-scientific and technological forms such as new forms of organisation and process NESTA (2006).

The contribution confirms findings from earlier work on continuous improvement such as Bessant and Caffyn (1997), who recognised the need for creative problem-solving and innovation in the organisation and its structure. This was perceived to be just as important as the applied technology, indeed possibly more so. The empirical evidence from this research adds more examples of these issues in a project context rather than in manufacturing.

Central government literature sends mixed or inconsistent messages with respect to promotion of innovation through governance. For example “Modernising Government” HM Government (1999) promotes approaches to encourage innovation, while later “A New approach to Public Private Partnerships”, HM Treasury (2012b) pushes the belief that private sector innovation should play a role in delivering public infrastructure projects and services by encouraging innovation through output performance and by reducing the scope for innovation as a result of inhibiting approaches during pre-contract negotiations. However, “Project Governance: a guidance note for public sector projects” prepared by HM Treasury (2007) makes no mention of innovation.

The project management literature recognises that difficulties that arise in so-called megaprojects such as HS2 and CrossRail are caused by unexpected contextual complexities that cause delays and costs. This research shows that similar contextual complexities are prevalent in smaller projects too. For example, when the lighting design required a lamp post to be moved, a seemingly simple task often proved to be unexpectedly complicated because the new location had services such as water, gas, electricity or communications that prevented the installation. The consequence of this was to re-design with the resultant delays and associated costs. These problems, often “wicked” Rittel and Webber

(1973), mean that flexibility and adaptability in delivery approaches are needed and the governance arrangements should reflect this. Shenhar and Dvir (2007) identified three perspectives when considering project management, the strategic – business view; the operational – process view and the team – leadership view. This thesis contributes empirical data to the operational – process view and the team – leadership view.

### **Limitations of the study**

The major limitation of the inquiry is that it was conducted during the Core Investment Programme and therefore cannot inform us about the following operational phase of the project and its innovation performance, indicating a further assessing study. Street lighting projects employing a straightforward term contracts would have made informative comparisons. The executive perspective would have offered insight into their understanding of innovation and their role in its promotion, unfortunately they declined to participate in the research.

### **Directions for future research**

In the foregoing, the contributions have indicated literature domains that are informed by this research, such as policy development, governance, project management and organisational learning.

Other research topics to generalise from in the PFI could include studying the behaviours of the agents involved, what learning mechanisms and processes have been made.

There is also an appreciation that there are other literatures such as project governance, Too and Weaver (2014) and Miller and Hobbs (2005), and project management Flyvbjerg and Turner (2018) and Flyvbjerg (2014) in which similar issues are discussed for research in social and public policy development and on major infrastructure projects such as

HS2. The street lighting projects are not megaprojects compared with the Channel Tunnel or HS2 in terms of scope, scale or size. However, one area of similar problems is that as the planned activities progressed there were emergent issues that impeded that progress and required amendment to the design or other work-arounds. HS2 and the street lighting projects in this research both experienced unanticipated ground conditions (Financial Times, 2019, “Why HS2 rail line is way over budget and badly delayed”, Financial Times, London, September 19, 2019; Chapter 11, p.223 of this research).

In Kreiner (2020, p. 407) a thought is expressed in the conclusion that project managers might act in the interest of the project by adopting compromises to the original project premise. The street lighting projects in this study did exhibit compromise to the design where needed to preserve the schedule. Kreiner uses the conflicting concepts of “the project” and the controversy between Hirschman (2014, orig. 1967) and Flyvbjerg (2017) to present the restricted notion of project to move towards a wider more inclusive perspective.

The complexity of the issues described here call for further research, particularly in the formal vs informal governance of projects and the extent which the formal allows for informal guidance and decision making.

In the timescale set for this research study, there was insufficient time to use the framework developed by Appuhami, Perera, & Perera (2011) with the empirical data from this research to assist in validation of the framework from a working example from a different sector.

A point made earlier in the thesis was that during the lifetime of the PFI, there would be changes likely to impact the contract. Some of these changes can already be anticipated and will need to be considered by the partners. A proposal and consequent major change is that some of the boroughs in the south and east of Hampshire may “break away” to come

under the management and control of a mayor. The issue would then become one of whom is responsible for the provision of services, that in our interest here is with street lighting. This could simply be resolved by the mayoral district (or districts) making the same arrangements with the county authority as some of the boroughs currently have for the county to provide the service on their behalf. Research to study changes such as this is proposed.

The use of the QDAS tool presents the need to study to consolidate the processes of research question memos and corpus quotation linkages and to present as a method framework in a paper. A further study to investigate morphisms between methodology and methods and the tools themselves would be useful in advancing the use of these tools.

Future researches on complex multiple actor-projects need to take account of the emergent nature of the innovation discovered in this thesis rather than predicting it at the outset.

In the 2018 Budget, the use of private finance initiatives (PFI) was abolished for future infrastructure building projects in the UK, therefore if not PFI, councils needed to revert to conventional, term contract management which they would govern and project manage. Alternatively a project management organisation, employed by the council, may be engaged to deliver the contract. Because of the different governance and management arrangements it is not practical to list or attempt to describe them.

Past public sector project performance has not offered an optimistic record if future performance is to be predicted. A National Audit Office report (2003, Fig 1, p. 3) in a Government Survey, recorded 73% of public sector construction projects showed cost overruns whereas 22% of PFI projects exceeded the contract price. In terms of delivery performance, 70% of public sector projects were late compared with 24% of the PFI projects.

However, some councils in this study had recruited commercially experienced project managers from the private sector to enhance the council's project management capabilities.

From the findings of this research study, an emphasis is made to promote input to policy and governance development research to include and encourage a more collaborative approach and a relaxation to allow informality where possible and a framework of regular formal project progress reviews supported by shared data and by performance indicators and to consider further innovation opportunities. The freedom to openly meet and discuss the solution to operational problems without the need to seek higher level decisions contributes to improved performance. It also offers the opportunity to find innovative approaches in solving operational problems.

### **Recommendation**

It is argued that innovation in public service provision must be consistently advocated across policy development. The governance of public service projects must also take account for a need to innovate at the project level to overcome implementation issues.

To ensure that the Terms of Reference (ToR) for the Network Board – Schedule 18 – is included in the PFI/PF2 contract and its inclusion is necessary for approval of the contract and although the use of PFI/PF2 is now abandoned, it should be remembered that there are projects with 15 to 20 years' remaining to be consumed.

Contracts should also have a financial provision to be drawn down during the contract to enable technical, process and service delivery development leading to potential innovations.

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## Appendix A

### Interview Question Guide

Note: Q<sub>PUB</sub> & Q<sub>PRIV</sub> = a question to be put to both public and private participants.

The “Qn” numbered questions are selected from a larger set to reduce or eliminate duplicate or similar issues for discussion.

Where a question was derived from the literature, the reference to that literature is included.

Governance		
Q2: How do you measure and guarantee quality of service?	Q12: Do you believe, or is it your experience that governance needs to change to suit the various stages of the programme’s life cycle?	
Q6: How do you measure your organisation’s performance? Who sets the performance parameters? How are the results used in this organisation?	NEW Prompt particularly post-CIP.	
Infrastructure Standardisation of Contracts 05 Q <sub>PUB</sub> & Q <sub>PRIV</sub> : Question: How was the performance level established to		

<p>encourage innovation (for example, based on current performance of the lighting system with defined improvements)?</p> <p>Infrastructure Standardisation of Contracts 05 <u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: At what point were the contractors and specialists involved during calibration?</p> <p>Prompt to Q6: performance measures might be unrelated to real/actual work.</p>		
<p>9 (10) Davies, Gann and Douglas (2009) <u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: Is the governance structure shared / joint for the project? May I see / or have a copy?</p> <p>10 (11) Davies, Gann and Douglas (2009)</p>	<p>21 (26) Johnston and Gudergan (2007) <u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: Does the governance framework have anything to say about the behaviours of the participating organisations/companies?</p>	<p>24 (29) Meunier and Quinet (2010)  <u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: Does the contract call for changes to the governance structure as a result of changes to requirements during the life-cycle?</p>

<p><u>Q<sub>PUB</sub></u> &amp; <u>Q<sub>PRIV</sub></u>: Who developed the governance structure?</p> <p>11 (12) Davies, Gann and Douglas (2009)</p> <p><u>Q<sub>PUB</sub></u> &amp; <u>Q<sub>PRIV</sub></u>: Who manages and maintains the governance structure?</p> <p>12 (13) Davies, Gann and Douglas (2009)</p> <p><u>Q<sub>PUB</sub></u> &amp; <u>Q<sub>PRIV</sub></u>: How is the governance structure assured?</p> <p>HMT Delivering long term value 2008</p> <p><u>Q<sub>PUB</sub></u> &amp; <u>Q<sub>PRIV</sub></u>: How is the need for external scrutiny addressed?</p>		
<p>Q11: How will the street lighting programme respond to changes in requirements within its life time, for example in response to a requirement for further reductions in</p>	<p>Q14: What challenges have you had to face, and how did you resolve them?</p>	

<p>carbon footprint.</p> <p>Prompt: The value of the change had to outweigh the cost of changing the contract</p>		
<p>Governance continued...</p>		
<p>16 (19) Infrastructure Standardisation of Contracts 05</p> <p><u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: What use of 'specialist advisors' was made in the (street lighting ) PFI, and at what point in the project?</p>	<p>17 (20) Infrastructure Standardisation of Contracts 05</p> <p><u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: Was there any need for lease back in the street lighting programme?</p> <p>19 (22) Infrastructure Standardisation of Contracts 05</p> <p><u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: When did transfer of interests take place? Or, At what point did the private partner / take control of the assets?</p>	<p>18 (21) Infrastructure Standardisation of Contracts 05</p> <p><u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: To what extent was there / is there public sector investment in the street lighting project?</p>
<p>20 (25) Infrastructure Standardisation of Contracts 05</p> <p><u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: What arrangements does the governance system call for in the event to need dispute</p>	<p>Nisar (2013)</p> <p><u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: Does the governance framework include risk transfer, a whole life approach and management of the partnership/s?</p>	

resolution?	NEW Prompt: project governance	
<b>Innovation</b>		
Q7: How was innovation encouraged and managed in the street lighting programme? NEW Prompt: gainshare.	NEW Is CMS viewed as innovation in the street lighting service delivery?	7 (8) Da Cruz and Marques (2012) <u>Q<sub>PUB</sub></u> & <u>Q<sub>PRIV</sub></u> : In that the 'new' technology applied in the street lighting project is technologically innovative, what risk was perceived and what was the mitigation? Da Cruz and Marques (2012) <u>Q<sub>PUB</sub></u> & <u>Q<sub>PRIV</sub></u> : In that the 'new' technology applied in the street lighting project is technologically innovative, what risk was perceived and what was the mitigation?
Q8: What role and influence did your governance system have in encouraging and managing innovation in the	Q10: What role and influence did your governance system have in encouraging and managing innovation in the street lighting	

<p>street lighting programme?</p>	<p>programme in the private/provider/supplier organisations?</p> <p>English and Baxter (2010)  <u>Q<sub>PUB</sub> &amp; Q<sub>PRIV</sub></u>: What arrangements are made to adapt commitment to innovation in the long-term agreement of the project?</p>	
<b>Private Finance Initiative</b>		
<p>Q1: Why/How was PFI chosen over the (more) “traditional’ procurement approaches?</p> <p>This is two questions really, so, (1) what were the circumstances that led to PFI for Hampshire and (2) to “South Coast”?</p>		
<b>Supplementary...</b>		
<p>NEW: from the job title – is the role just for the PFI contract or</p>	<p>NEW: what changes will take place post-CIP?</p>	<p>NEW: DfL Contact/s</p>

<p>for the Council Portfolio?</p> <p>Q15: Any observations, comments, or omissions that you wish to add?</p>		
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## Appendix B:

### Interview Schedule

Name of Informant:	
Role Title & Position in Organisation:	
Date (of Interview):	
Time (of Interview):	

#### Research Question

Is there a theory of governance that learns from its practice, adapts and continues to maintain control while innovating and encouraging innovation?

#### Target Informants

This interview schedule will be used to interview those engaged or involved, from the public or private sectors, in providing street lighting services under PFI/PF2 procurements.

#### Duration

It is expected that the required data/evidence will be collected within 70 minutes including 10 minutes introduction/explanation.

#### Descriptive Questions

Name of organisation: Department, Group, Team: Name of Informant Given Name: Family Name: No of years service in the organisation: No of years in current role:	
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**Research/Interview Questions**

Q1: Briefly describe your view of the process that resulted in Surrey Lighting.

Q2: How do you measure and guarantee quality of service?

Q3: What core competencies do you believe council staff needed in this programme?

Q4: What core competencies were sought in the private/provider/supplier organisations?

Q5: Is there an active programme to develop core competencies in the council?

Q6: How do you measure your organisation's performance? Who sets the performance parameters? How are the results used in this organisation?

Q7: How was innovation encouraged and managed in the street lighting programme?

Q8: What role and influence did your governance system have in encouraging and managing innovation in the street lighting programme?

Q9: What role and influence did your governance system have in encouraging and managing innovation in the street lighting programme within the council?

Q10: What role and influence did your governance system have in encouraging and managing innovation in the street lighting programme in the private/provider/supplier organisations?

Research/Interview Questions	
<p>Q11: How will the street lighting programme respond to changes in requirements within its lifetime, for example in response to a requirement for further reductions in carbon footprint.</p> <p>Q12: Do you believe, or is it your experience that governance needs to change to suit the various stages of the programme's life cycle?</p> <p>Q13: What do you see as the benefits of PPP/PFI/PF2 for this type of programme, its products and, delivery and service?</p> <p>Q13: What challenges have you had to face, and how did you resolve them?</p> <p>Q14: Any observations, comments or omissions that you wish to add?</p>	

(Adapted from : Exhibit 1.5: An example interview schedule in, Remenyi, D. (2012) *Field Methods for Academic Research – Interviews, Focus Groups and Questionnaires*, 2<sup>nd</sup> edition, Reading: Academic Publishing International Limited. )

## Appendix C:

### Research Participant's Information Document

	Issue	Detail
1	Name of researcher  Contact Details	Ronald Davidson  Tel: Mob:
2	Title of Research Project	Sustaining Innovation in the UK Public Private Partnerships Environment.
3	Purpose of the Study	How can innovation be sustained throughout the PPP life cycle?
4	Description of the Study	<p>The purpose of this research is to investigate innovation in the UK PFI/PF2 environment, and to understand the influence of programme governance systems throughout the life cycle, using street lighting PFIs as example programmes.</p> <p>1: To identify the differences between public and private governance systems.</p> <p>2: To investigate the capability of PPP programme governance to sustain innovation throughout the PPP life cycle.</p> <p>3: To assist in understanding the impact and outcome of programme governance on innovation throughout the PPP life cycle.</p> <p>4: To identify the characteristics of programme governance framework that sustains innovation throughout the PPP life cycle.</p>
5	Duration of the Study	36 months.
6	What is involved and how long will it take?	A series of interviews with executives and managers involved

	<b>Issue</b>	<b>Detail</b>
		in the programmes. Each interview should take 50-60 minutes.
7	Why have you been asked to participate?	You have been invited to participate in this research due to your involvement and expertise in this field.
8	What will happen to the information that will be given to the study?	The information will be held in a confidential manner while the work is being collated. Notes and transcripts will be kept under lock and key.
9	What will be done with the results of the study?	The results of the interviews will be reported in the findings section of the research work. This will be done in a completely anonymous manner, i.e., free of attributions to individuals/contributors.
10	What are the possible disadvantages?	There are no costs to you associated with your involvement with this study. It is not envisaged that any negative consequences will accrue to you from your contribution to this research.
11	In what way will the study be beneficial and to whom?	The study will develop an understanding of the stages of governance and opportunities for innovation in PPP/PFI/PF2 programmes. The benefits will be to those directly involved in leading, governing and managing such programmes and those academics and researchers who work in the development of innovation and governance.
12	Who has reviewed this study to ensure that it complies with all the requirements and ethical standards of the university?	The University has a three-tier ethics and governance review system in place. This research proposal has been scrutinized at business School level (Tier 1), by the researcher's

	<b>Issue</b>	<b>Detail</b>
		Supervision and Research Panel.
13	Can I see a transcription of the interview?	YES. A transcription of the interview will be sent to the interviewee for validation.
14	Can you refuse to answer any question?	YES. The contributor has the right to refuse to answer any question in any part of the interview.

**Appendix D:**

**Letter of Informed Consent**

I, < insert name > agree voluntarily to take part in the research project being conducted by Ronald Davidson as part of the requirements for his Doctorate at the Doctoral College, Brighton Business School Division of the University of Brighton.

I have read the Research participant's Information Document and I understand the contents thereof. Any questions that I have asked have been answered to my satisfaction.

I understand that the information that I will supply is confidential and that it will be anonymised and will only be used in the findings of the research.

I understand that I do not have to answer all the questions that may be put to me.

The information that I provide will be held securely.

The information that I provide will not be used for any other purpose other than research.

I understand that I am entitled to ask for a de-briefing session or a copy of the research at the end of the project.

Signed .....

Date .....

## Appendix E:

### The PFI procurement process

Steps	Description
1. Establish business needs	Procurement proceeds only after a rigorous examination of business objectives, needs and constraints including that of affordability.
2. Appraise options	The cost and benefits of the various options including do nothing, do minimum, traditional procurement and PFI are examined.
3. Prepare an outline business case (OBC) and a reference project	An OBC, supporting the case for investment and for the PFI approach, based on the options appraisal, is prepared. It specifies the output specification rather than 'how' the service is to be delivered. A reference project, usually a public sector comparator (PSC), is prepared for benchmarking purposes.
4. Create a project team and project board	A procurement team, led by a full-time project manager, and a project steering board to which it reports and which can take decisions, are appointed. The project team needs to include people with the relevant skills required in the PFI negotiation process and users.
5. Decide tactics	This involves deciding how much information to request at the pre-qualification, when to seek fully costed proposals and when to select a preferred bidder.
6. Invite expressions of interest; publish Official Journal of European	Advertisement includes explanation of the project, indication of the information required for any assessment of the potential supplier's

<b>Steps</b>	<b>Description</b>
Community (OJEC) notice	economic and financial standing and technical capacity, and the criteria for award.
7. Pre-qualify bidders	The general competence of the interested suppliers is assessed. Proposals for the particular project are not covered.
8. Shortlist bidders	Bidders are shortlisted based on specific competence (e.g. risks management). Bidders not taken forward are informed and debriefed quickly on why they were not selected.
9. Refine the appraisal	The OBC and any PSC are further refined in the light of new information. The affordability and funding arrangements are reaffirmed.
10. Invitation to negotiate (ITN)	The ITN specifies the services required in output terms; the constraints on the project scope; the proposed contractual terms (lengths and payment mechanism); the criteria for evaluation of bids and the scope for variant bids (such as variations on proposed contracts duration, risk allocation).
11. Receipt and evaluation of bids	Bids received are evaluated in accordance with the principles and criteria set out in the ITN document. From the best and final offers received, the preferred bidder is then chosen.
12. Selection of the preferred bidder and the final evaluation	The preferred bidder is selected and the PFI proposition is retested against the key VFM and affordability criteria. Risks transferred to the private sector under PFI are costed and added to the PSC. The expected accounting treatment

Steps	Description
	of the contract is reconfirmed with the client's auditors.
13. Contract award and financial close	Once the contract is signed and a contract award notice placed in the OJEC, the contract is implemented.
14. Contract management	New processes, systems and management systems are put in place.

(Adapted from HM Treasury 1997 and 1999 as presented in Demirag et al. (2014).)

## Appendix F:

### Coding Definitions / Descriptions (1<sup>st</sup> cycle)

<b>Code description</b>	<b>governance</b>
<b>Detailed description</b>	Is used to label any/all text and in vivo quotations that include or reference governance of the target projects. This also includes management and control mechanisms, primary documentation and academic sources – journal articles, papers, books.
<b>Inclusion criteria</b>	All responses on governance, interview transcripts / dialogue
<b>Exclusion criteria</b>	None identified
<b>Code description</b>	<b>innovation</b>
<b>Detailed description</b>	Is used to label any/all text and in vivo quotations that include or reference to innovation in the target projects. This also includes management and control mechanisms, primary documentation and academic sources – journal articles, papers, books.
<b>Inclusion criteria</b>	All responses describing innovation in interview transcripts / dialogue
<b>Exclusion criteria</b>	None identified
<b>Code description</b>	<b>PFI (Private Finance Initiative)</b>
<b>Detailed description</b>	Is used to label any/all text and in vivo quotations that include or reference to the PFI project of the target projects. This also includes management and control mechanisms, primary documentation and academic sources – journal articles, papers, books.
<b>Inclusion criteria</b>	All PFI related interview transcript / dialogue issues
<b>Exclusion criteria</b>	None identified

A list of codes follows, including 1<sup>st</sup> and 2<sup>nd</sup> cycle codes

Carbon footprint	2 <sup>nd</sup> cycle coding
Change management	2 <sup>nd</sup> cycle coding
Collaboration	2 <sup>nd</sup> cycle coding
<b>Contract governance</b>	<b>1<sup>st</sup> cycle coding</b>
Customer service	2 <sup>nd</sup> cycle coding
Data	2 <sup>nd</sup> cycle coding
Data management	2 <sup>nd</sup> cycle coding
Depot	2 <sup>nd</sup> cycle coding
Energy management	2 <sup>nd</sup> cycle coding
Funding	2 <sup>nd</sup> cycle coding
<b>Governance</b>	<b>1<sup>st</sup> cycle coding</b>
Independent monitoring	2 <sup>nd</sup> cycle coding
<b>Innovation</b>	<b>1<sup>st</sup> cycle coding</b>
Inspections	2 <sup>nd</sup> cycle coding
Investment	2 <sup>nd</sup> cycle coding
Learning	2 <sup>nd</sup> cycle coding
Meetings	2 <sup>nd</sup> cycle coding
Organisational change	2 <sup>nd</sup> cycle coding
Performance monitoring	2 <sup>nd</sup> cycle coding
<b>PFI</b>	<b>1<sup>st</sup> cycle coding</b>
post CIP	2 <sup>nd</sup> cycle coding
Project management	2 <sup>nd</sup> cycle coding
Risk	2 <sup>nd</sup> cycle coding
Risk management	2 <sup>nd</sup> cycle coding
Security	2 <sup>nd</sup> cycle coding
Service delivery	2 <sup>nd</sup> cycle coding
Strategy	2 <sup>nd</sup> cycle coding
Synergy	2 <sup>nd</sup> cycle coding
Technology	2 <sup>nd</sup> cycle coding

(Source: adapted from Saldana (2015, p.28))