DEVELOPING A KNOWLEDGE MANAGEMENT FRAMEWORK FOR FACILITIES MANAGEMENT SERVICES FOR THE CONTROL OF EXOGENOUS HEALTHCARE ASSOCIATED INFECTIONS (HCAI) IN NHS HOSPITALS

CHRISTOPHER MACCARIUS EJEH

School of the Built Environment

University of Salford

Manchester - M5 4WT

England - United Kingdom.

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DEDICATION

This work is dedicated to God Almighty for His Grace, Mercy and Protection

DECLARATION

I declare that the research in this thesis was undertaken by me in accordance with the University of Salford requirement for the award of a PhD degree by research under the supervision of David Baldry.

No part (s) of this thesis has previously been submitted to the University of Salford or any other institution for the award of a diploma, degree or any other qualification.

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Christopher M. Ejeh

LIST OF ABBREVIATION

ANHMRC	Australian National Health and Medical Research Council
BMC	British Medical Association
BIA	British Infection Associations
BIFM	British Institute of Facilities Management
BSI	British Standards Institute
CAQDAS	Computer-Assisted Qualitative Data Analysis Software
C.Difficile	Clostridium Difficile
CDC	Centre for Disease Control
CDPC	Centre for Disease Prevention and Control,
CCDC	Consultant communicable disease control
CREM	Corporate Real Estate Management
DIPC	Director of Infection Prevention and Control
DH	Department of Health
FM	Facilities management
ECDPC	European Centre for Disease Prevention and Control
GPKMF	Good Practice Knowledge Management Framework
HCAI	Healthcare Associated Infection
HC	Health Commission
HIC	Hospital Infection Control
HICC	Hospital Infection Control Commitee
HPA	Health Protection Agency
HRM	Human Resource Management
HoC	House of Commons
HIS	Hospital Infection Society
ICNA	Infection control nurses association
IPS	Infection Prevention Society

IAM	Institute of Asset Management
ICD	Infection control doctor
ICN	Infection control nurse
ICT	Infection control team
IFMA	International Facility Management Association
JCHO	Joint Commission on Healthcare Organisation
MRSA	Meticillin Resistant Staphylococcus Aureus
NHS	National Health Service
NAO	National Audit Office
NPSA	National Patient Safety Agency
NCGC	National Clinical Guideline Centre
NHSN	National Healthcare Safety Network
NICE	National Institute for Health and Clinical Excellence
POST	Parliamentary Office of Science and Technology
PPP	Public private partnership
WHO	World Health Organisation

Abstract

The occurrence and adverse complications arising from healthcare associated infections (HCAIs) have been well documented as one of the leading causes of morbidity and mortality by successive governments and healthcare professional bodies in the United Kingdom (UK). The significance of these challenges has led to a plethora of published regulatory guidance and continuous surveillance tools that focus on good practice. These good practice guidance documents are aimed at reducing the prevalence of both endogenous (internal) and exogenous (external) healthcare associated infections in NHS hospitals. However, there is an acknowledgment that a huge gap still exists between the implementation of knowledge accumulated over the years from the use of these good practice guidance documents and the monitoring tools adopted for benchmarking compliance with good practice in the prevention of HCAIs. With the increasing evidence of the contribution of the healthcare environment to the prevalence of HCAIs, expert opinion has affirmed that the scope for the prevention of healthcare-associated infections no longer rests only within the remit of medicines, but includes other key service providers to the healthcare sector, among which the facilities management discipline is paramount. This has led to a research need for a better understanding of the subtleties of knowledge management processes in healthcare facilities management practice. The aim of this research is to examine the issues of the knowledge management process, i.e. the creation, storing, sharing and usage of knowledge in hospital facilities management cleaning services for the control of exogenous HCAIs. This investigation was carried out within the context of hospital knowledge infrastructure capabilities, which consist of the prevailing culture, structure and technological capabilities.

The research is premised on an interpretivist research philosophy and utilises a sequential explanatory mixed methodology approach. This approach consists of the synthesis and review of literature pertinent to the research subject domain, a questionnaire survey and face-to-face interviews. Quantitative data was obtained from a questionnaire survey of 81 NHS hospital facilities managers in England, and was subjected to rigorous statistical analysis. Qualitative data was obtained from face-to-face interviews with 10 NHS facilities managers and subjected to thematic analysis using NVivo software. Findings across the three data collection instruments were contextualised and subjected to further rigorous statistical analysis using the Relative Importance Index (RII), also known as the "weighted models", to ascertain the empirical importance of the variables. The findings obtained were used to develop a good practice knowledge management framework.

Findings from the research showed that efficient management of compliance with good practice guidance protocols in the control of exogenous HCIAs is could be achieve through the provision of cleaning services using directly employed in-house staff. This enables a high level of collaboration between the clinician members of an infection control team and a hospital facilities manager in the control of exogenous HCAIs. The majority of the NHS hospitals surveyed use their bespoke good practice guidance documents in the delivery of hospital cleaning services. These bespoke guidance documents are a combination of key performance indicators (KPIs) drawn from prevailing statutory core guidance documents.

There is evidence of a lack of appreciation and understanding of the relevance of interfacing knowledge management processes to the hospital knowledge infrastructure capabilities in the delivery of facilities management cleaning services for efficient control of exogenous HCAIs.

A conceptual knowledge management framework representing the fundamental empirical interface of the knowledge management process elements within the hospital knowledge infrastructure capabilities was developed to assist in the control of exogenous HCAIs through facilities management cleaning service delivery practices in NHS hospitals. This framework was validated by facilities managers across NHS hospitals in England to ascertain its feasibility from both the analytical (scientific) and pragmatic (operational) perspectives.

Chapter 1.   **INTRODUCTION**

1.1. **Research Background**

Despite the increasing prominence of healthcare-associated infections (HCAIs) and the publication of relevant guidelines on measures to curtail their prevalence, compliance with applicable infection prevention and control protocols remains elusive (European Centre for Disease Prevention and Control, 2012; Department of Health, 2011; National Audit Office, 2000). Sustained media publicity on the prevalence of healthcare-associated infections has now made the public and the government more aware of the avoidable morbidity and mortality associated with HCAIs as a consequence of non-compliance with good infection control protocols (Walsh, 2014; NHS England, 2013a; Department of Health, 2013c; Controller and Auditor General, 2009; Dancer, 2009). With the increasing evidence of the contribution of the healthcare environment to the prevalence of HCAIs, exacerbated by the escalating emergence of new strains of multi-resistant bacteria to antibiotics, healthcare facilities management practice now takes a share of the responsibility for the patient experience and recovery outcomes in hospitals (Walsh, 2014; Dancer, 2009, 2011). The healthcare facilities management profession has now moved from a relatively low-profile function that existed in the shadow of the clinical sphere to a scientific discipline with a high political profile.

Previously known as nosocomial or hospital-acquired infections, healthcare-associated infections remain a burden to both developed and developing countries (World Health Organisation, 2011). Compared to other types of infection, healthcare-associated infections are described as infections which are not present and without evidence of incubation at the time of admission to a hospital or other healthcare facility (European Centre For Disease Prevention and Control, 2012; National Audit Office, 2009). These infections occur in both adult and paediatric patients regardless of gender, religion or race.

It has been reported that the prevalence of HCAIs varies between 5.7% and 19.1% (World Health Organisation, 2011; Department of Health, 2008a). This variation is acknowledged to be dependent on several influencing factors including per-capita income, challenges in the management of knowledge gained from compliance monitoring tools, non-availability of appropriate health-care facilities and lack of relevant collaborative surveillance tools, as well

as inadequate manpower resources. In the World Health Organisation survey of the prevalence rate of HCAIs in high, middle and low-income countries (World Health Organisation, 2011), it was reported that HCAIs are a leading cause of death worldwide. It has been estimated that between 5% and 15% of hospitalised patients acquire these infections in developed countries, with an estimated 4,384 children's deaths attributed to HCAIs. In the report, the UK was ranked 11th highest of the 14 countries surveyed, with a prevalence rate of 9% behind first-place Germany, which had a prevalence rate of 3.6% (Figure 1.1). It was observed in the report that the yearly prevalence rate was not determined, and a typographical error of "prevelence" instead of Prevalence in the adopted graphical representation.
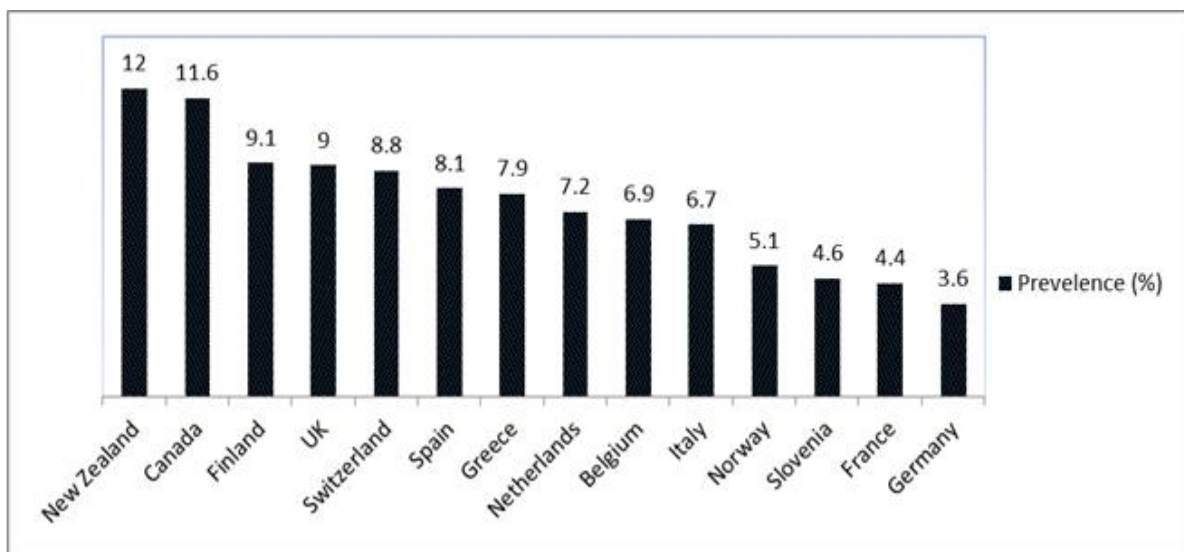
Figure 1.1 Prevalence of HCAI in high-income countries (WHO, 2011)

> *More than one million people admitted to acute care hospital, and long-term care facilities developed healthcare-associated infection annually* (Memarzadeh, 2011b).

Quantifying the exact financial burden of healthcare-associated infections and the proportion of those infections that are acquired from internal or external sources remains a challenging issue in the health sector (Scott, 2009; Stone, Braccia & Larson, 2005). As a consequence, the cost of healthcare-associated infections is often expressed in terms of many factors, including diagnostic and treatments costs. Others include the cost of setting up isolation rooms for the infected, and other associated cleaning and material costs to the hospital, as well as the cost of managing post-discharge complications (Storga, Mostashari & Stankovic, 2013; De Angelis, Murthy, Beyersmann & Harbarth, 2010; Scott, 2009).

The challenging and opaque financial consequence of HCAIs for the NHS has led to increasing calls for more surveillance and accurate reporting of the prevalence of HCAIs over the years (Department of Health, 2013c; Health Protection Agency, 2012c; House of Commons Public Accounts Committee, 2009; National Audit Office, 2000). Despite these challenges, investigations have been undertaken and it has been documented that HCAIs cost the NHS approximately £1 billion per year. Also, the increased length of hospital stays for illnesses associated with HCAIs ranges between five and 29.5 days (National Institute for Health and Clinical Excellence, 2011a; World Health Organisation, 2011; De Angelis et al., 2010; National Audit Office, 2009). The reality of healthcare-associated infection on the global stage is acknowledged to be as familiar as it is distressing (Clancy, 2013).

1.2. An Overview of HCAIs in the UK

The occurrence of healthcare-associated infections (HCAIs) and adverse complications arising from them have been well recognised by successive governments and healthcare professional bodies in the UK. These professional organisations include The British Medical Council (BMC), the Infection Control Nurses Association (ICNA), the Hospital Infection Society (HIS), the Infection Prevention Society (IPS) and the British Infection Association-(BIA). Growing concerns about the adverse consequences of HCAIs led to the publication of the first national guidance on infection control in hospitals in 1959 (National Audit Office, 2009). This was followed by the publication of "The guidance on the role of infection control team" in 1988 (National Audit Office, 2009). Towards the close of the 20th century, reducing the burden of healthcare-associated infections became more of a government priority in England (Healthcare Protection Agency, 2011). In 1995, a report widely referred to as the "Cooke Report" was released by the Department of Health and was the first publication of measures and recommendations aimed at the prevention of infections in UK hospitals. This report gave NHS chief executives an overall mandate to ensure the establishment of infection control teams in their various hospitals to improve the implementation of HCAI policies and guidance (NAO, 2009; Weston, 2008).

The "*NHS Plan: a plan for investment, a plan for reform*" was published in 2000, setting out the UK government strategies for the modernization of healthcare services in England to cope with the challenges of healthcare delivery in the 21st century (Department of Health, 2000). The publication of the NHS Plan led to the construction of new hospitals and the refurbishment of existing "Victorian-era" hospitals to confront inherent challenges. This

exponential investment in healthcare facilities in England is seen as a direct response to the challenges of emerging technologies, increasing population and aging healthcare facilities that no longer support efficient and safe care delivery in the 21st century. It is also seen against the background of a recognition that many NHS hospitals are no longer able to cope with the population that they were originally built to serve. Such hospitals often cover a larger geographical area with different pools of patients suffering from varying illnesses being admitted into an overcrowded environment (Weston, 2008).

The correlation of high population density with the prevalence of HCAIs has been documented in the literature (Department of Health, 2013f, 2003; Ayliffe, 2009; Dancer, 2009; Weston, 2008; Dixon & Dewar, 2000). The challenge of an increasing population has led to high bed occupancy rates, patient turnaround times and the increased movement of patients between A&E and other wards and departments, especially during "winter pressure" months. The increased population continues to place a huge burden on hospital facilities and resources, which invariably impacts on the prevalence of HCAIs, and especially those that could be acquired from exogenous sources (Weston, 2008; Department of Health, 2000).

> *Environmental issues around old, poorly maintained healthcare premises and concern around poor standards of hygiene and hospital cleanliness are also contributing factors...to the prevalence of healthcare associated infection* (Weston, 2008).

The NHS plan is also acknowledged to offer a structure and strategy to improve hygiene in healthcare with the aim of reducing the prevalence of HCAIs (Jeanes, 2005; Department of Health, 2000). The NHS plan has led to several initiatives and the publication of several good practice guidance documents aimed at the control of healthcare-associated infections in NHS hospitals (May & Pitt, 2012). Notwithstanding, the notion that healthcare knowledge is primarily employed to support clinical decision-making persists (Riano, 2008).

The expectation that hospitals should deliver quality healthcare outcomes for all stakeholders continues to increase as a result of investment in physical hospital structures and the publication of good practice policies and specifications (guidance documents). This has provided an evidence-based protocol for the prevention and control of HCAIs further to the publication of the NHS Plan (Department of Health, 2004a, 2011). It is acknowledged that all the national guidance documents consistently contain a requirement to demonstrate effective governance and assurance, hence the need for a day-to-day monitoring and periodic audit protocol (Langford, 2014). However, the extent to which this is achieved remains doubtful.

It has been estimated in several government reports that the mortality rate attibutable to HCAIs in the UK is approximately 5,000 each year, while 15,000 other deaths are attributed to healthcare-associated infections as the underlying cause (Department of Health, 2013; Healthcare Protection Agency, 2012; World Health Organisation, 2011; House of Commons Public Accounts Committee, 2009). In the national survey of HCAI prevalence conducted in the UK between 1981 and 1996 (Weston, 2008), it was estimated that 9% of patients in hospitals had an infection that was acquired in the hospital, which equates to 100,000 patients per year acquiring HCAIs.

Figure 1.2   Infectious disease issues that have made headline news in the last few years
              (Department of Health, 2002)

In another HCAI prevalence survey conducted by the Healthcare Protection Agency (now Public Health England) suggested that 6.4% of patients acquired these infections while in hospital (Hopkins et al., 2012). It is a cause for concern that such substantial percentages have persisted over the years despite the huge investment in the publication of good practice guidance documents aimed at minimising the prevalence of HCAIs in NHS hospitals.

Despite this huge investment in the publication of good practice knowledge documents for the control of exogenous HCAIs in NHS hospitals, there are concerns that there has been neither a formal review nor any local empirical studies to assess the effectiveness of the cleaning and infection control guidance since the NHS Plan (May 2013). There is thus a need for a review of the knowledge management processes in the prevailing good practice guidance within the hospital knowledge infrastructure capabilities in facilities management cleaning services with

a view to developing a knowledge management framework that would assist hospital facilities managers in the control of exogenous HCAIs.

The next section provides an overview of the sources and routes of HCAIs.

1.3. **Sources and Routes of HCAIs**

The literature has consistently suggested that healthcare-associated infections may be caused by infectious agents from endogenous (internal/self-infection) or exogenous (external/cross infection) sources (Healthcare Protection Agency, 2013; National Healthcare Safety Network, 2013; Ayliffe et al., 1999). Infection spreads from a source where the pathogenic organisms grow and from where they are transmitted (Healthcare Protection Agency, 2013). Endogenous sources are body sites such as the skin, nose, mouth, gastrointestinal (GI) tract or vagina that are usually inhabited by microorganisms. On the other hand, exogenous sources of infection are sources that are external to the patient, such as medical devices, staff, patient-care equipment, visitors and the healthcare environment.
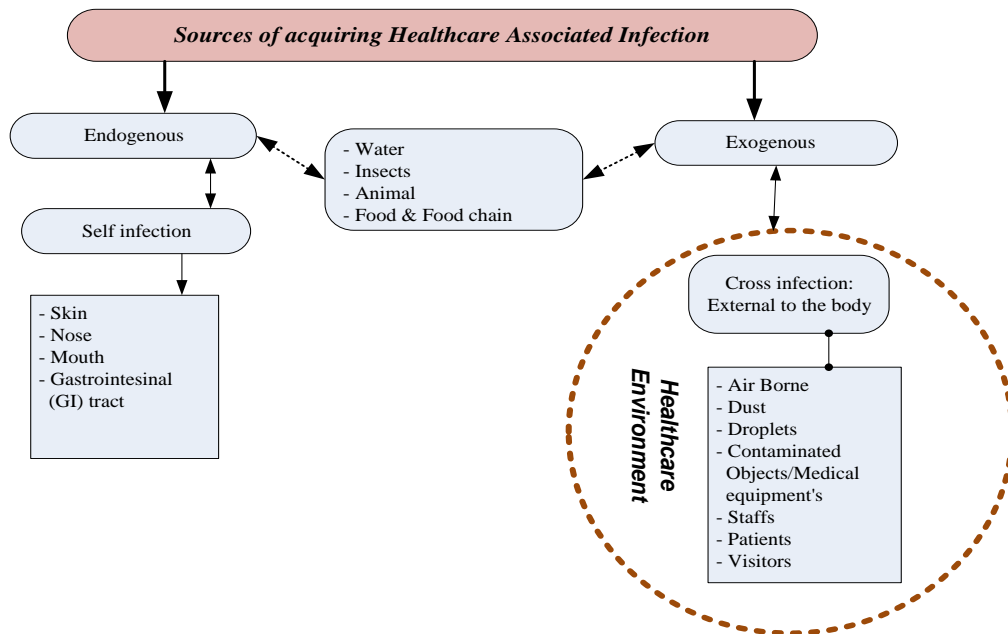
Figure 1.3:   Sources of HCAIs

One model that has been used over the years to facilitate understanding of the spread and management of infection is the "chain of infection" (Figure 1.4). It is a model which is used to describe the sequence of events essential for an infection to occur (HPA, 2010). Understanding the characteristics of each link in the chain of infection and being aware of the mode through which these infections are acquired and transmitted are both vital for sustainable curtailment of the spread of the ever-changing infections within the healthcare setting. Thus, for infection to occur and spread within a healthcare setting, all the links in the chain of infection must be present, which is why it is acknowledged that the fundamental approach to the management and prevention of HCAIs is to break one or more of the links in the chain.
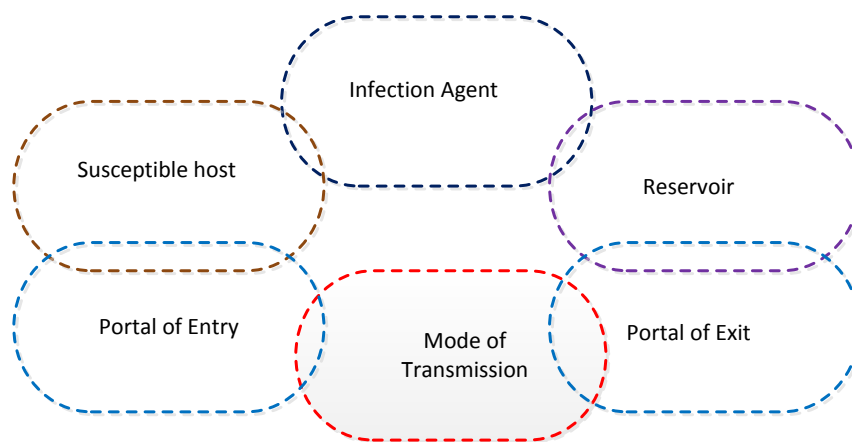
Figure 1.4:   Chain of infection (adapted from HPA, 2012)

Essentially, the chain of infection narratives (Figure 1.5) presents a detailed analysis of the essential elements that allow infection to occur and spread within any healthcare setting (Health Protection Agency, 2014, 2012). Breaking the link between these elements helps in curtailing the spread of infections from a macro perspective and healthcare-associated infections from a micro point of view. The Healthcare Protection Agency (2013) and Ayliffe et al. (1999) both acknowledge that the spread of micro-organisms could occur through one or more of these routes including contacts, airborne transmission and droplets of infectious bodily fluids.

> *The war against hospital-acquired infection must be pursued on many different fronts: ranging from tackling the factors which inhibit good practice* (National Audit Office, 2004).

Infection Agent	Any disease causing micro-organism (Pathogens) e.g. bacterial, viral, fungal, parasite, etc.
Reservoir	Where a micro-organism normally lives and produces. E.g. humans, animals, water food
Portal of exit	The route of escape of the pathogen from the reservoir. E.g. faeces, urine, wound discharge, mucus
Mode of Transmission	*The way the pathogens gets from the reservoir to the host:* **Contact:** a. Direct contact – actual contact with an infected b. Indirect contact – contact with contaminated surfaces touched by infected person or where droplets of body fluid have landed, spread or unwashed hands **Airborne**: "airosols" tiny infected particles from an infected person released when they cough or sneeze which can be breathed-in **Blood exposure** - Generally outside the healthcare settings - Vector-borne (parasite bites) or sexual contact
Portal of entry	Inhaling, ingestion, breaks in the protective skin barriers (e.g. surgery, intravenous lines, injury). Mucous membranes (mouth, eyes, nose)
Susceptible host	A person who can get sick when they are expose to a disease causing micro-organism (pathogen)

Figure 1.5:   Chain of infection narratives (Adapted from HPA, 2013; Ayliffe et al., 1999)

1.4. **Importance of Facilities Management (FM) in the Control of HCAIs**

> *Facilities management is the term used in the UK and Europe, whereas facility management is the term used in the USA and the rest of the world* (De Toni, Ferri & Montagner, 2009)

Within the context of this research, the terms facilities management and facility management will be used interchangeably but have the same meaning.

Facilities management (FM) is noted as a core function in managing facility resources, support services and the working environment to support the core business of the organisation in both the short and long term (Chotipanich, 2004). Its activities encompass the management of occupied buildings and their associated systems, including equipment and furniture, to enhance the organisation's ability to meet its business or programmatic objectives (Becker, 1990). Barrett and Baldry (2003) describe facilities management as "an integrated approach to

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operating, maintaining, improving and adapting the building and infrastructure of an organisation in order to create an environment that strongly supports the primary objectives of that organisation". The International Facility Management Association (IFMA, 2003) defined FM as a profession that encompasses multiple disciplines to ensure the functionality of the built environment by integrating people, place, process and technology (Figure 1.6).
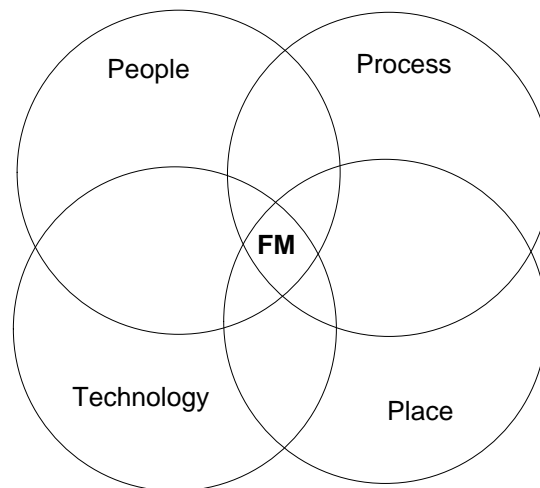
Figure 1.6:   Constituents of facilities management scope (adapted from IFMA, 2015)

The conceptualisation of the facilities management interface as an integral process supporting medical efforts for the prevention and control of HCAIs acquired from exogenous infection sources has proved valuable since the 19th century, starting with the work of Florence Nightingale at the Army hospital in Scutari (modern-day Uskudar in Istanbul), Turkey in 1854. In her effort to combat healthcare-associated infections at the hospital, she carried out a thorough cleaning of the hospital environment, thereby reducing the number of deaths with HCAIs as the underlying cause from 42% to just 2% within just six months (Stark & Macdonald, 1979). Nightingale's views on the importance of cleanliness and sanitation are acknowledged to be the foundation of the concept of "healing environments" today, and the first recognition that infectious diseases could be transmitted from patient to patient, patient to caregiver, and caregiver to patient (Stichler, 2013). Nightingale's notes and findings from other case studies (DH, 2013; Dancer, 2011, 2009; Joseph, 2006) buttressed their historical relevance, and the success achieved through the interfacing of facilities management practices with the medical approach in the control and prevention of healthcare-associated infections are further testimony to their validity.

In the public consultation leading up to the publication of the NHS Plan, which set out a 10-year programme for the modernisation of the health sector, the public ranked cleaning standards in hospitals high among their priorities (Department of Health, 2000). As a consequence, the Department of Health launched several initiatives including "The Matron Charter", "Winning Ways" and the "Standard for Cleanliness" that were aimed at enhancing the patient experience and recovery outcomes in NHS hospitals (Department of Health, 2003b, 2004a; National Patient Safety Agency, 2007). These initiatives were centered on enhancing good practice among external service providers to the NHS, of which the provision of facilities management services is paramount.

Figure 1.7:   Typical facilities management service functions in the NHS
(adapted from NHS Estate, 2010).

Two disciplines are often drawn upon for the control HCAIs: the first of these is the traditional scientific approach to the study of infections and how they can be prevented and treated, while the second is centered on behavioral and human factors science Clancy, (2013). These sciences could be characterised as the knowledge basis for the control of HCAIs. Compared to other professional practices in the Built Environment field, including infrastructure management, estate management, property management and assets management, facilities management practice is unique, dynamic and constantly changing to support the delivery of healthcare services (Department of Health, 2011, 2013b; Codinhoto et

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al., 2009). Facilities management service functions provided to the NHS (Figure 1.7) could work in tandem to mitigate the factors that could promote the prevalence of HCAIs in hospitals. The literature (Department of Health, 2004, 2013d; Health Protection Agency, 2012c; King, 1998; National Patient Safety Agency, 2007; NHS England, 2007a; NHS England, 2013a) identify these factors as including:

- ➢ Aging healthcare facilities
- ➢ The emergence of new strains of infectious bacteria
- ➢ Changing demographics
- ➢ Advances in technology.

1.5. **Identification of Gaps**

Healthcare delivery is a complex endeavour, and it is acknowledged to present unique settings where different professional groups with differing rules, job descriptions, behaviours and values converge and engage in a collaborative process. Healthcare knowledge is therefore fragmented and distributed across professional boundaries (Bordoloi & Islam, 2012; Judy & Ghosh, 2007; Nicolini et at., 2008).

Knowledge management comprises the strategies and methods employed to generate and leverage understanding within an organisation. It is a systematic and organised process of identifying, capturing and transferring information in order to optimise efficiency, ensure competitive advantage and spur innovation (Serban & Luan, 2004). Thus it is a sustained social process constructed by people through their everyday interaction. Judy & Ghosh (2007) described knowledge management systems (capabilities) as including the systems, policies, processes and procedures used to manage the creation, storing, sharing and reuse of knowledge, while knowledge management processes include knowledge creation and the storing, sharing and usage of knowledge.

The World Health Organisation acknowledged that a huge gap still exists between the knowledge accumulated over the past decades in the control of HCAIs from the various performance and compliance monitoring tools used and the level of prevalence of HCAIs (World Health Organisation, 2011). It was also noted that the gap is greater in settings characterised by poor resources. The healthcare sector is a knowledge-driven sector, which makes healthcare delivery a complex endeavour (Bordoloi & Islam, 2012). The sector provides a unique challenge as well as opportunities to incorporate knowledge management practices as a means to improve processes (Nilakanta, Miller & Peer, 2009; Sheffield, 2008).

The Department of Health and the National Health Service (NHS) in England have published overarching policies and guidance and made structural changes across the NHS further to the publication of "The NHS Plan: *a plan for investment, a plan for reform*" (Department of Health, 2000). This publication is acknowledged to have thrown the burden of HCAIs in NHS hospitals into greater prominence and encouraged hospitals to make infection control a top priority, and especially the control of infections acquired from exogenous sources (NHS Commissioning Board, 2014; National Audit Office, 2004). Notwithstanding, there is a recognition of the lack of any review in the form of a knowledge management process to assess the effectiveness of the plethora of policies and guidance documents relating to cleaning services, which is a core service function of facilities management in NHS hospitals that has gained prominence since the publication of the NHS Plan (May & Pitt, 2012). Despite the growing evidence of links between the healthcare environment and the prevalence of HCAIs (Dancer, 2009; 2004, 1999; Department of Health, 2004a; Gillespie et al., 2013), the extent to which lessons learnt from the guidance documents which have been adopted in the delivery of hospital cleaning services for the control of exogenous HCAIs in NHS hospitals are linked to everyday practice remains doubtful.

The next section discusses the justification for the research further in terms of the identification of gaps in the focus of the research.

1.6. **Justification for the Research**

Healthcare-associated infections are acknowledged to have resulted in serious consequences not only for patients but also employees, healthcare establishments and the government. In recent years, there have been a number of studies focusing on and evaluating cleaning regimes and standards. This may be a reflection of the mass of guidance and policy issued on cleanliness and infection control, combined with the increased media focus on HCAIs (May & Pitt, 2012). It has been documented that:

- ➤ Approximately 5,000 deaths are attributed directly to HCAIs in England each year (Hopkins et al., 2012; National Audit Office, 2009);

- ➤ 15,000 deaths are attributed to HCAIs as an underlying cause in England each year (Hopkins et al., 2012; National Audit Office, 2009);

- ➤ The UK is ranked 11th among the 14 developed countries surveyed, with an HCAI prevalence rate of 9% (World Health Organisation, 2011);

➤ There is increasing media publicity about the burden of HCAIs and the reduction of morbidity and mortality rates through compliance with good practice (Cameron, 2014);

➤ There is limited recognition of the relevance of facilities management's contribution to the prevention and control of HCAIs in available publications (Dancer, 2009, 2011; Jacob, Kasali, Steinberg, Zimring & Denham, 2013).

Concern has been raised about the lack of either a formal review by the Department of Health or of local empirical studies to assess the effectiveness of cleaning and infection control guidance documents since the NHS Plan (May, 2013; May & Pitt, 2012).

> *Since 2000, there has been significant investment in the co-ordination and guidance related to cleaning and infection control. Yet there has been very little done in the way of a review of the impact….* (May & Pitt, 2012).

The authors further posited that

> *Further research should focus on the impacts of the cleaning/infection control related policy and guidance issued by the Department of Health. This should inform the future cleaning related initiatives* (May & Pitt, 2012).

Syntheses of the literature reviewed also reveal little research that is focussed on the interface of knowledge management processes available to healthcare facilities managers within the hospital's knowledge infrastructure capabilities for the control of exogenous HCAIs. Kim & Bernard (2011) suggest that more research is needed to boost confidence that public reporting is accurate about effective in the prevalence of HCAIs, as well as to determine and improve on the existing performance management strategies aimed at reducing the prevalence of HCAIs. This suggests a need for a good practice knowledge management process to ensure the efficacy of the adopted or adapted infection control monitoring strategies (World Health Organisation, 2010a).

Existing practices for combating the prevalence of HCAIs could be argued to have become too "paper-centric" as against "practice centric" relative to the reality of the dynamics of infection, causing organisms resistant to antibiotics. While quite a number of publications on good practice guidance documents and compliance monitoring tools have appeared over the years in an effort to curtail the acknowledged systemic threat of HCAIs, the extent to which the findings and knowledge gained from the use of such tools are implemented to tackle this problem remains questionable (May, 2013; Clancy, 2013; May & Pitt, 2012; House of

Commons Public Accounts Committee, 2009). It is acknowledged that numerous challenges still exist to fully develop a healthcare knowledge portfolio which ensures a dynamic interplay between different types of healthcare knowledge (Riano, 2008).

> *The lack of either a formal review or local empirical studies to assess the effectiveness of the cleaning and infection control guidance since the NHS plan is a cause for concern* (May 2013)

Because of the increasing recognition of the contribution of the healthcare environments to patient recovery outcomes and as a source of exogenous HCAIs, the practice of healthcare facilities management continues to gain increasing recognition as well as a high political profile (NHS England, 2013, 2011; Dancer, 2009; National Patient Safety Agency, 2009). Despite the limited resources available to hospital management, exacerbated by the global economic downturn, it is expected that the objectives set should not to be compromised in the delivery of quality healthcare outcomes to the required standard in the NHS. Hence there is an urgent need for research which focuses on investigating the efficacy of the good practice knowledge management guidance adopted in the control of exogenous HCAIs in relation to facilities management cleaning services, and which seeks to develop a good practice knowledge management framework to assist hospital facilities managers in the control of exogenous HCAIs in NHS hospitals.

Effective knowledge management is acknowledged to be a driver of continuous improvement of infection control strategies with the goal of eliminating all avoidable healthcare-associated infections in NHS hospitals in England (Gould et al., 2009; National Audit Office, 2009). Given that, not all NHS hospitals may be equally ready for the successful launch and maintenance of knowledge management initiatives on the basis of the plethora of infection control guidance documents. It could therefore be argued that a key to the success or failure of effective knowledge management initiatives in facilities management cleaning services for the control of exogenous HCAIs within NHS hospitals is an understanding and assessment of the preconditions for the effort to flourish. These preconditions are capabilities. Drawing on this theoretical foundation, the objective of this research is to identify the key hospital knowledge infrastructure capabilities that directly impact on hospitals in their drive towards knowledge management initiatives in facilities management cleaning service delivery practice in the control of exogenous HCAIs.

This research aims to develop an effective knowledge management framework for the targeted and sustainable management of exogenous HCAIs. The research attempts to fill a gap, i.e. the lack of a review of the existing good practice guidance documents within the context of the knowledge management processes and knowledge infrastructure capabilities in NHS hospitals in England. This will be achieved by contextualizing contemporary knowledge management processes in the form of the available good practice guidance documents and their interface with hospital knowledge infrastructure capabilities, namely the prevailing culture, structure and technological capabilities.

1.7. Research Aim

The aim of this research is to critically investigate the interface between knowledge management processes and the hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management cleaning service delivery practices in NHS hospitals.

The research examines the issues of knowledge process elements, i.e. knowledge creation, storing, sharing and usage, in hospital facilities cleaning services for the control of exogenous HCAIs from the perspective of the hospital knowledge infrastructure capabilities, consisting of the prevailing culture, structure and technological capabilities.

1.7.1. Research Objectives

The following five objectives have been formulated to achieve the research aim:

1. To identify and evaluate the policies, guidance documents and strategies used in facilities management cleaning services delivery for the control of exogenous HCAIs, identifying the advantages and disadvantages.
2. To identify the prevailing procurement strategies in the delivery of hospital cleaning services and the interface with effective knowledge management protocols for the control of exogenous HCAIs in hospitals.
3. To critically evaluate the role of the facilities manager within the infection control team in the control of exogenous HCAIs.
4. To critically investigate the factors that inhibit effective knowledge management processes in hospital facilities management cleaning services within the hospital structure, prevailing culture and technological capabilities.

5. To develop and validate an effective knowledge management framework for the control of exogenous healthcare-associated infections (HCAIs) in facilities management cleaning services.

1.7.2. **Research Questions**

The following research questions have been formulated to address the research aim and objectives:

1. What policies, guidance documents or strategies are used for monitoring compliance with good practice knowledge in facilities management cleaning services for the control of exogenous HCAIs in hospitals?
2. What is the level of effectiveness of the procurement strategy used in the delivery of hospital cleaning services in the control of exogenous healthcare-associated infections?
3. What is the nature of the working relationship between facilities management (non-clinicians) and clinicians?
4. What are the knowledge management processes adopted by healthcare facilities management for the control of exogenous healthcare-associated infections in hospitals?
5. What are the benefits of having a good practice knowledge management framework for the control of exogenous HCAIs in facilities management cleaning services?

Table 1.1   Research aim, objectives and questions interface

Research aim: To critically investigate the interface between knowledge management processes and the hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management cleaning service delivery practices in NHS hospitals.

Research Objectives	Research Questions
Objective 1: To identify and evaluate the policies, guidance documents and strategies used in facilities management cleaning services delivery for the control of exogenous HCAIs, identifying the advantages and disadvantages	What policies, guidance documents, or strategies are used for monitoring compliance with good practice knowledge in facilities management cleaning services for the control of exogenous HCAIs in hospitals?
Objective 2: To identify the prevailing procurement strategies in the delivery of hospital cleaning services and the interface with effective knowledge management protocols for the control of exogenous HCAIs in hospitals	What is the level of effectiveness of the procurement strategy used in the delivery of hospital cleaning services in the control of exogenous healthcare-associated infections?
Objective 3: To critically evaluate the role of the facilities manager within the infection control team in the control of exogenous HCAIs..	What is the nature of the working relationship between facilities management (non-clinicians) and the clinicians?
Objective 4: To critically investigate the factors that inhibit effective knowledge management processes in hospital facilities management cleaning services within the hospital structure, prevailing culture and technological capabilities.	What are the knowledge management processes adopted by healthcare facilities management for the control of exogenous healthcare-associated infections in hospitals?
Objective 5: To develop and validate an effective knowledge management framework for the control of exogenous healthcare-associated infections (HCAIs) in facilities management cleaning services	What are the benefits of having a good practice knowledge management process framework for the control of exogenous HCAIs in facilities management cleaning services?

1.8. Scope of the Research

In a review of 1,022 studies of investigations into outbreaks of infection by Barton (2009), it was noted that the most common sources of infectious agents are, in decreasing order:

➢ Medical equipment or devices,

➢ The hospital environment,

➢ The healthcare personnel.

Facilities management service delivery practices are grouped into two categories, namely "hard" and "soft" services (British Institute of Facilities Management, 2014; Barrett & Baldry, 2003). According to Alexander (2007), the range of facilities management services provided in hospital settings will normally include environmental cleaning, security,

transportation, portering, food, linen, and sterile services. These services fall are under "soft" FM service provision. Other FM services include the maintenance of buildings and building fabric, which are in grouped in the "hard" FM category. Depending on the hospital service management strategy, the provision of cleaning services is often considered as part of domestic, hotel or housekeeping services (Department of Health, 2013e; 2004a; Codinhoto et al., 2009; Barrett & Baldry, 2003).

In the context of this research, the hospital environment means the totality of patient surroundings when in NHS hospital premises. This includes the fabric of the building and related fixtures. This research focuses on hospital environmental cleaning services.
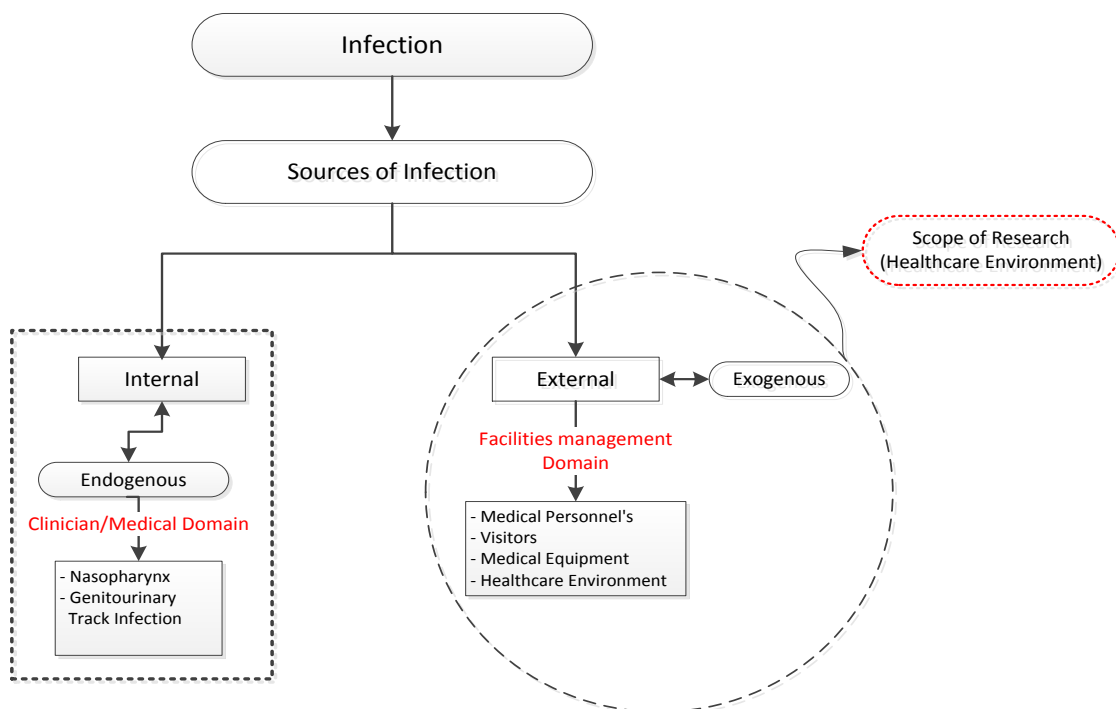
Figure 1.8:   Sources of infection and the research domain

It is posited that knowledge infrastructure capabilities, consisting of the prevailing culture, structure and technological capabilities, together with the knowledge process elements of knowledge creation, storing, sharing and usage are essential preconditions for effective knowledge management (Judy & Ghosh, 2007; Gold et al., 2001). This research explores the interface between the knowledge management process in facilities management cleaning services and hospital knowledge infrastructure capabilities in the control of exogenous healthcare-associated infections in NHS hospitals. Based on the analysis and findings, an effective knowledge management framework will be developed to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management cleaning service delivery in NHS hospitals. The following meanings will apply to some of the keywords used in the context of this research:

Knowledge Creation: This encompasses all the knowledge creation and management processes that are oriented towards the acquisition of knowledge, from the sourcing of data through to its transformation into information leading to good practice knowledge to be used in the control of exogenous HCAIs.

Knowledge storing: This refers to those processes oriented towards keeping the knowledge created safe, and protected against unauthorised interference within and outside the hospital environment.

Knowledge sharing: This refers to those processes intended to make the knowledge thus created and stored appropriate, available, and accessible to the multi-professionals who are likely benefit from its use for the control of exogenous HCAI

Knowledge usage: This encompasses all the processes involved in the application and management of the knowledge that are geared towards its actual use in the most efficient manner for the control of exogenous HCAIs

Hospital Culture: By this is meant the hospital's approach towards collaboration among clinician and non-clinician employees in the control of exogenous healthcare-associated infections. It includes an understanding of the dynamism of the people factors in complying with adopted infection control policies and procedures.

Hospital Structure: This encompasses the hospital departmental structural elements that facilitate the creation and sharing of good practice knowledge across functional boundaries for the prevention and control of exogenous HCAIs.

Hospital Technology: This is used to mean processes including the specific software used by the hospital to facilitate the creation, storing, sharing and usage of good practice knowledge by clinician and non-clinician employees for the control of exogenous HCAIs.

The synthesis and review of existing literature (Table 2.4) pertinent to the research subject area will focus on work published after the publication of *"The NHS Plan"* (Department of Health, 2000). This is to enable the development of further insights that would help in the achievement of the overall research aim and objectives. Some of these publications include:

- ➢ Bespoke environmental audit tools developed by the Infection Control Team (ICT);
- ➢ NHS National Specification for Cleanliness – a framework for setting and measuring performance outcomes (Association of Healthcare Cleaning Professionals, 2009; National Patient Safety Agency, 2007);
- ➢ Patient-Led Assessments of the Care Environment (PLACE) (NHS England, 2013a);

> Bespoke facilities management audit tools for cleaners (checklist and tick box) for healthcare environmental cleanliness.

The research is limited to NHS acute and non-acute hospitals in England. The reason for this limitation is to allow for the practical adaptation of the research outcome stated in Research Objective 5 above.

Data collection for this research was limited to targeted research participants in NHS hospitals in England, including:

> Facilities managers,

> Heads of estate/facilities management, doctors,

> Domestic service managers,

> Works managers..

In summary, the scope of the research includes:

> A synthesis and review of existing policies, guidance documents and strategies in the area of HCAIs published further to the Department of Health publication of "*The NHS Plan*" (Department of Health, 2000);

> The identification and assessment of existing procurement strategies including Service Level Agreements (SLAs) in hospital facilities cleaning service delivery;

> An evaluation of the efficacy of good practice guidance documents which have been adopted/adapted, including bespoke initiatives from available policies, guidelines and specifications used in the creation, storing, sharing, and usage of good practice knowledge. These will be evaluated within the context of the prevailing hospital culture, structure and technological capabilities in FM cleaning service delivery;

> Developing an effective knowledge management framework for facilities management cleaning service delivery for the control of exogenous HCAIs.

1.9. **Anticipated Contribution to Knowledge**

Facilities management cleaning service delivery practice relative to the cleanliness of hospital environment is acknowledged to be crucial in the prevention of exogenous HCAIs (Dancer, S., 2009; Department of Health, 2004a, 2016). While a "clean hospital environment" is capable of preventing and suppressing infections, an infected environment could contribute to the prevalence of disease or death (Selanders, 1998; Osváth, 1970). It is anticipated that findings from the research will:

- ➢ Enhance the understanding of and optimise contemporary good practice knowledge management process elements adapted/adopted for the creation, storing, sharing and usage of good practice knowledge in hospital cleaning service delivery.
- ➢ Provide a basis for a targeted approach within the hospital structure, prevailing culture and technological knowledge infrastructure capabilities for the curtailment of infections that are linked to exogenous sources.
- ➢ Provide a guide for future cleaning-related initiatives using the framework developed that is understandable, usable and adaptable for the control of exogenous HCAIs in FM cleaning services.

The anticipated outcome of the research will also provide facilities managers with an understanding of knowledge management processes from a range of different perspectives, expectations and preferences to underpin a targeted and sustainable approach to the management of exogenous HCAIs in NHS hospitals.

This research is not intended to be based on the development of a theory. It is rather focused on contributing to the existing body of knowledge within the research subject domain.

1.10. Research Methodology

This research was conducted within the paradigm of an interpretivist philosophical stance (see Section 4.3.5.). A sequential explanatory approach based on a mix of methods was adopted for data collection, employing both quantitative and qualitative techniques. In keeping with this approach, quantitative data was collected using a questionnaire survey before qualitative face-to-face interviews were conducted. The quantitative data gathered from the research questionnaires was first analysed using Microsoft Excel and Statistical Package for Social Sciences (SPSS) Software. This method of data analysis helps to show the relationships, differences, and trends in the collected data. The qualitative data gathered from the face-to-face interviews with the research participants (See 1.8), was analysed using a qualitative data analysis software program (CAQDAS) and Microsoft Excel. This program for the analysis of data from qualitative sources is popularly known as NVivo. The data was transcribed, coded and analysed thematically using NVivo 10. The methodology adopted for this research is discussed in Chapter 4.

1.11. **Structure of the Thesis**

This thesis comprises three sections and is further divided into nine distinct chapters as illustrated in Figure 1.9.
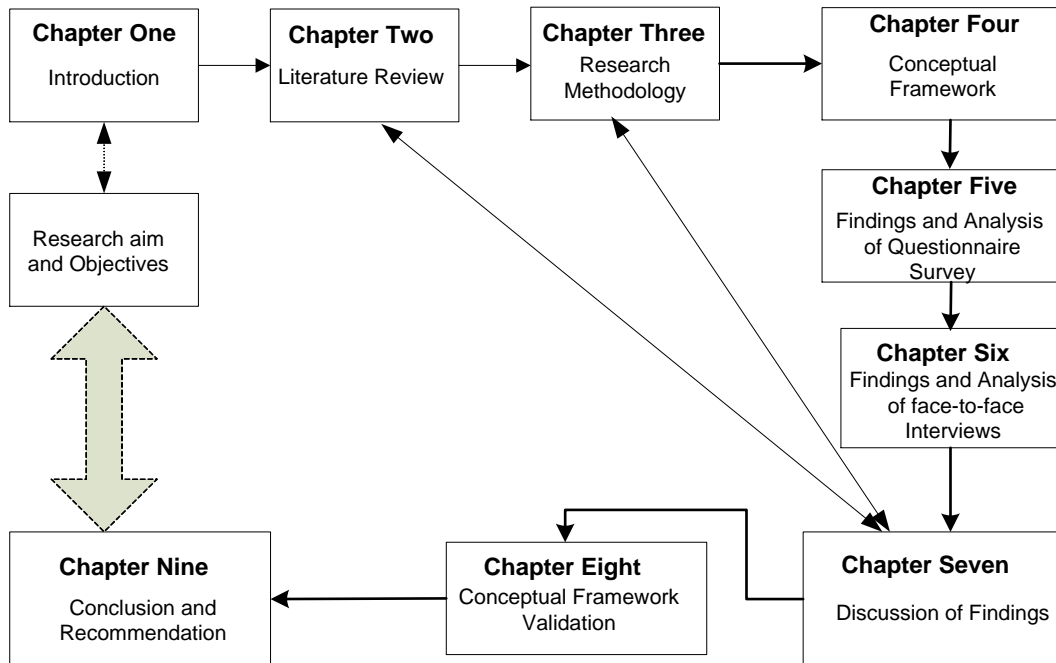
Figure 1.9:   Structure of the thesis

Section one: This phase is made up of the introduction chapter (1) and the literature review chapter (2), which focuses on the synthesis and review of literature in the areas of healthcare-associated infections, knowledge management, facilities management and healthcare facilities management. Chapter 2 also includes a discussion of the pilot study involving semi-structured interviews with clinician and non-clinician (facility management team) members of the infection control team in NHS hospitals in England, which identified further insights into the phenomena to be investigated.

Section two: This phase of the thesis comprises the methodology chapter (3). This chapter provides a rationale and justification for the research methodology adopted.

Section three: This phase of the thesis includes chapters 4 - 9. The findings of the questionnaire survey and the face-to-face interviews are presented and analysed in Chapters 5 and 6 respectively. Chapter 7 synthesises and discusses the findings from the data collection tools, which include the literature, the questionnaire survey and the face-to-face interviews. Chapter 8 presents the development of the effective knowledge management conceptual framework. Finally, Chapter 9 presents the validation of this framework as well as how the research contributes to the existing body of knowledge in the area and limitations of the

research. Recommendations for further studies are also presented in this chapter. Figure 1.9 presents the structure of the thesis in visual form.

1.12. **Summary**

This chapter provides an overview of the research, starting with an introduction to the research and its background and concluding with the structure of the thesis. The contending phenomenon leading to the justification of the research was identified. This resulted in the identification of a need for an effective knowledge management framework in facilities management cleaning services for the control of exogenous healthcare-associated infections in NHS hospitals. The chapter also outlines the research methodology and the structure of the thesis.

The next chapter presents a comprehensive synthesis and review of relevant literature pertinent to the research domain, thereby providing a theoretical background to the research.

Chapter 2.   LITERATURE REVIEW

2.1. Introduction

The aim of this chapter is to examine existing literature pertinent to the research in order to gain theoretical insights into the current and retrospective state of knowledge of the research domain, and how this has developed as a means of achieving Objectives 1, 2, 3 and 4. The findings presented in this chapter will also guide the development of the initial conceptual framework.

This chapter commences by presenting an overview of the National Health Service (NHS) and concludes with a summary of the literature findings.

2.2. The National Health Service (NHS): an overview

The National Health Service, popularly known as the NHS, was launched on the 5th of July 1948 by the then Minister of Health, Aneurin Bevan. The launch came against the background of a long-conceived ideal that good healthcare should be available to all regardless of wealth (NHS England, 2014b). The introduction of the NHS was based on three broad principles, namely to:

- ➢ Meet the needs of everyone
- ➢ Be free at the point of delivery
- ➢ Be based on clinical need, not ability to pay

The NHS operates autonomously in the four countries (England, Scotland, Wales and Northern Ireland) that make up the United Kingdom (UK). The NHS is funded directly from taxation, and its services remain free at the point of use, with the exception of prescription charges, optical and dental services. Services are available free to UK residents, currently a total of 64.1 million people (NHS England, 2014b).

The NHS employs more than 1.6 million people, putting it amongst the world's five largest workforces together with the US Department of Defense, McDonald's, Walmart and the Chinese People's Liberation Army (NHS England, 2014b).

NHS England is the biggest part of the UK National Health Service. It caters for a population of 53.9 million, employing 1.3 million of the 1.6 million staff overall. NHS Scotland, Wales, and Northern Ireland employ 159,748, 84,817 and 62,603 people respectively (NHS England, 2014b). It is acknowledged that NHS England deals with over 1 million patients with varying

health needs every 36 hours (NHS England, 2014b). Despite the challenges and criticisms it faces, the NHS has been recognised as one of the world's best health systems.

Findings from research on the healthcare systems of developed countries conducted by the Commonwealth Fund (2014) recognised the NHS as one of the best healthcare systems in terms of efficiency, safe care, coordinated care and patient-centred care. The Commonwealth Fund is a private foundation that aims to promote a high-performing healthcare system in terms of better access, improved quality and greater efficiency, particularly for the most vulnerable sections of society including low-income people, and uninsured children and adults (Davis, Schoen & Stremikis, 2014).

A recent international study compared 11 nations on health care quality, access, efficiency, and equity, as well as indicators of healthy lives such as infant mortality.

Overall Health Care Ranking

Source: K. Davis, K. Stremikis, D. Squires, and C. Schoen, *Mirror, Mirror on the Wall: How the Performance of the U.S. Health Care System Compares Internationally*, 2014 Update, The Commonwealth Fund, June 2014.

The Commonwealth Fund
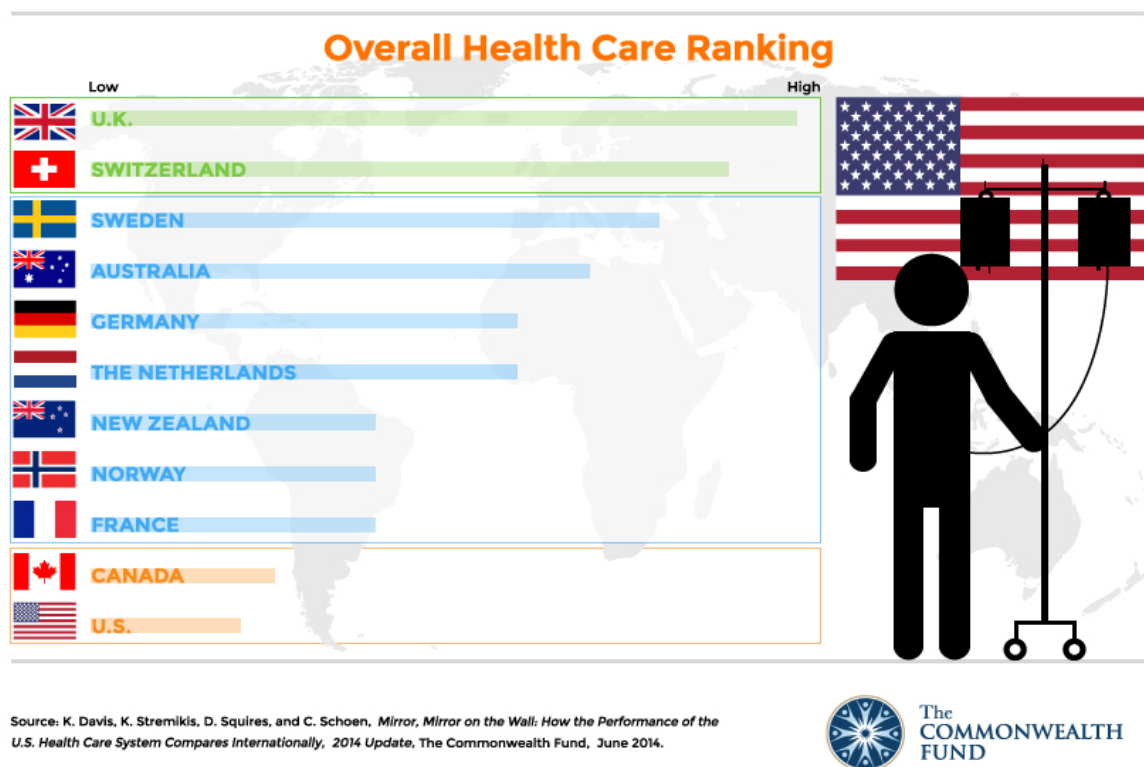
Figure 2.1: Developed countries healthcare system ranking (Davis et al., 2014)

The quality of healthcare in the UK is also rated amongst the highest in the EU. In an opinion poll conducted by the European Commission, 85% of respondents rated overall healthcare in the UK as "good", i.e. higher than the EU (European Commission, 2014). Notwithstanding such accolades, there is a recognition of a need for continuous improvement in patient safety and the management of healthcare-associated infections. Some of the proposals for better standards include developing guidelines on patient safety standards and a common definition of quality of care (National Institute for Health and Clinical Excellence, 2011). It is estimated

that 20 - 30% of healthcare-associated infections, which cost the NHS around £1 billion annually, can be prevented by intensive hygiene compliance by all stakeholders (European Commission, 2014; NHS England; 2007b). The proposals for reducing these infections point towards hygiene, which is a core service function of facilities management.

2.2.1. The organisational structure of the NHS

The UK National Health Service (NHS) is a very large and complex organisation, made up of four autonomous bodies, namely NHS England, NHS Scotland, NHS Wales and NHS Northern Ireland (NHS England, 2014b). The Secretary of State for Health has overall responsibility for the work of the Department of Health, which provides strategic leadership to both the NHS and Public Health and Social Care (British Broadcasting Corporation, 2013; British Medical Association, 2015; The National Health Service, 2015). Following the introduction of the Health and Social Care Act 2012, newly created clinical commissioning groups (CCGs) are now charged with the responsibility of managing the vast majority of NHS services, taking over this responsibility from the Department of Health (The National Health Service, 2015; NHS England, 2014; British Broadcasting Corporation, 2013). Under the new arrangement, the Secretary of State retains overall responsibility for overseeing the work of the Department of Health, and the Department continues to provide strategic leadership for public health and the NHS Commissioning Board (see Figure 2.2). A new body referred to as a "monitor" was established to assume the role of system regulator for all NHS-funded services. This monitor is responsible for licensing healthcare providers, regulating prices for NHS services and addressing restrictions on competition that act against patients' interests (British Medical Association, 2015).
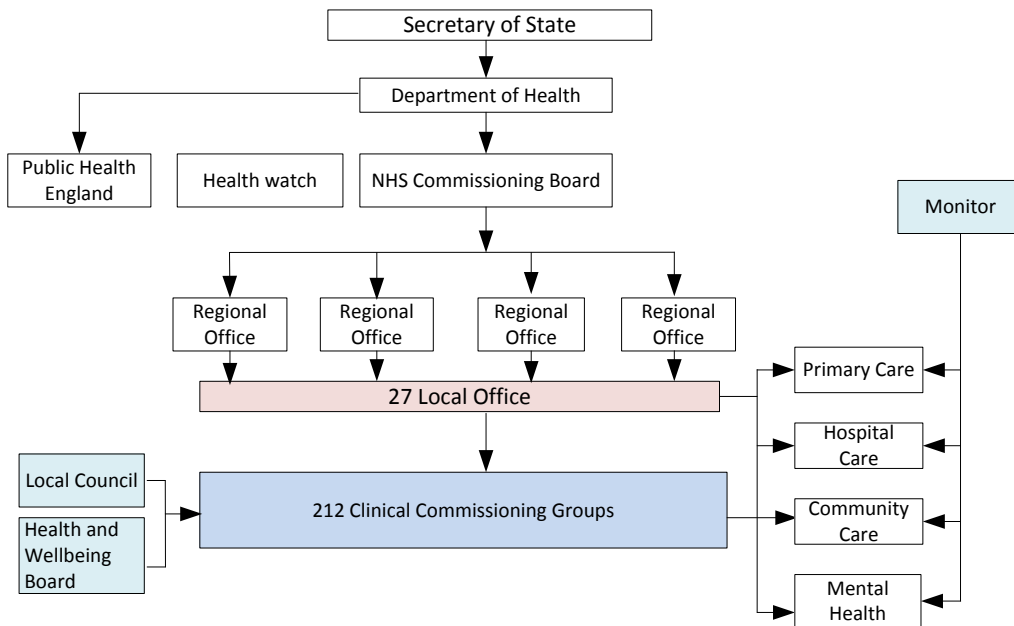
Figure 2.2:   Overall structure of the new NHS in England (British Medical Association, 2015; The National Health Service, 2015)

Public Health England (PHE) was launched in April 2013 to replace the Health Protection Agency (The National Health Service, 2015). Public Health England is an operationally autonomous executive agency of the Department of Health, and it has taken over the responsibilities of the Health Protection Agency, the National Treatment Agency, Public Health Observatories and cancer registries (British Medical Association, 2015). It is thus responsible for leading and managing an integrated public health delivery service in England. It has 15 offices across England, providing leadership and support services across the three domains of public health, which include public health protection and improvement, and healthcare (British Medical Association, 2015; The National Health Service, 2015). The agency is also charged with the following responsibilities:

➢ Ensuring the delivery of consistently high-quality healthcare services including those provided by the national microbiology unit.

➢ Improving healthcare facilities to 21st century health and wellbeing service standards.

➢ Addressing inequalities in healthcare provision, including health promotion and screening services.

➢ Providing leadership in responding to emergencies, as well as disseminating information and knowledge of major incidents including disease outbreaks and prevention, as well as disease registration, including research and development.

➢ Supporting local government in its leadership of the local public health system.

> ➢ Supporting directors of public health, and working with the NHS on commissioning key specialist services and national public health programmes.

Health Watch is another new patient advocacy body that was established to serve as a point of contact for individuals, community groups and voluntary organisations (British Medical Association, 2015). It is a platform through which patients and other stakeholders can have their say about the NHS.

The NHS Commissioning Board is charged with improving health outcomes for people in England in line with the NHS mandate set by the government. It oversees the work of the newly created Clinical Commissioning Groups (CCGs), including managing a significant part of their budget. The board allocates resources, and commissions certain services that can be organised better and more efficiently at a regional and national level (British Medical Association, 2015; The National Health Service, 2015; BBC, 2013). It has four regional offices, and 27 local offices across England.

Following the abolition of the Primary Care Trusts (PCTs) and Strategic Health Authorities (SHAs) under the old NHS structure, local councils now have an integrative responsibility to protect and improve public health as part of the new structure (British Medical Association, 2015). In partnership with the new Health and Wellbeing Boards and Health Watch, local councils provide public health services, tackle public health problems such as obesity and encourage patients to have their say about the NHS (British Medical Association, 2015; BBC, 2013).

The Health and Wellbeing Board was established to promote integration across the health and social care sectors (British Medical Association, 2015). The Board has a presence in each council and is made up of representatives from the council, the health, social care and public health sectors and patient groups. Part of their responsibility is to produce a Joint Strategic Needs Assessment (JSNA) and a Joint Health and Wellbeing Strategy (JHWS), identifying local priorities for commissioners (British Medical Association, 2015).

2.2.2. **Delivering NHS services**

NHS services are categorised into primary and secondary care, and are delivered through a number of different organisations called providers (The National Health Service, 2015). Hospitals in England are managed by an acute trust which provides secondary care and more specialised services (NHS England, 2014b). Secondary care services involve hospital care, community care and mental care (The National Health Service, 2015).

- **Hospital care:** Hospitals are healthcare institutions which have organised medical and other professional staff, offering inpatient facilities and delivering medical, nursing and related services 24 hours per day (World Health Organisation, 2015). The traditional orientation of hospital care, sometimes called acute care or individual care, is now changing with the changing face of healthcare delivery in the 21st century. Hospitals are now forging closer links with other parts of the health sector and with communities in an effort to optimise the use of resources for the promotion and protection of individuals, including a collective effort to control healthcare-associated infections. Hospitals offer a diverse range of acute, convalescent and terminal care using diagnostic and curative services in response to acute and chronic conditions arising from diseases, as well as injuries and genetic anomalies (World Health Organisation, 2015; NHS England, 2014).

- **Community care:** Demographic changes, technological advances and the changing pattern of disease are pushing up the numbers of patients with complex needs who require treatment in the community (Ruth, Sonola, Honeyman, Brooke & Kothari, 2014). Community healthcare services are delivered by NHS foundation and non-NHS foundation community trusts. They cover services ranging from health visiting and home-based rehabilitation programmes, school nursing, hospital at home, specialist diabetes services and other community and health improvement services as well as managing long-term health conditions (NHS England, 2014b; Ruth et al., 2014).

- **Mental health care:** Mental health care is provided by the Mental Health Trust (NHS England, 2014b). The Trust provides a broad range of specialist, community, inpatient and social care services to people experiencing psychiatric and psychological illnesses including depression, the impact of bereavement, stress or anxiety (NHS England, 2014b; The National Health Service, 2015). Mental health care and services are also provided through GP practices, primary care service providers and local council social services departments.

This research is conducted within NHS acute and non-acute hospitals in England. The research is focused on developing a knowledge management framework for the control of exogenous healthcare-associated infections through facilities management cleaning service delivery practice in NHS hospitals.

2.2.3. **The NHS estate**

The NHS has one of the largest property portfolios in Europe, with over 15,782 hospitals and other facilities valued at almost £40 billion (Department of Health, 2013c). This array of facilities ranges from large acute hospitals to small community clinics, ambulatory care units and buildings that house administrative and administrative support workers across England. It is recognised that 25% of the NHS annual budget (excluding capital and finance charges) equating to £7.4 billion is spent on its estate and facilities maintenance. This makes expenditure on its estate and facilities management the third largest cost after staff and drug costs (Department of Health, 2013c).

Following the report from the public inquiry into the Mid-Staffordshire NHS Foundation Trust's failing healthcare facilities management, "soft facilities management services" in particular have gained a high political profile in England (Department of Health, 2013, 2014a). Other recent key reports, proposals and findings have highlighted the relevance of the healthcare facilities management services discipline and the need for an effective knowledge management framework in the control of exogenous HCAIs, and include:

- ➢ Hard Truth: "The Journey to Putting Patients First" (Department of Health, 2014a).
- ➢ The Keogh Mortality Review outcome reports (Keogh, 2013).
- ➢ The "Winterbourne-view Review": Good practice examples (Department of Health, 2012).
- ➢ The Berwick Review into Patient Safety: A promise to learn – a commitment to act: Improving the Safety of Patients in England (Berwick, 2013).

"Proposal to Change The Care Quality Commission Registration Regulations" and changes proposed in the draft "Health and Social Care Act 2008 (Regulated Activities) Regulations 2014" are recent proposals that have emphasised the relevance of facilities management the practice (Department of Health, 2014c). The integration of "soft" facilities management service functions into the revised "NHS Premises Assurance Model" is intended to support the NHS in meeting its constitutional pledge "to provide services from a clean and safe environment that is fit for purpose based on national best practice", and has further highlighted the relevance of FM in the control of exogenous HCAIs (Department of Health, 2014c).

2.3. **Healthcare-associated infections (HCAIs): an overview**

"Infection" is defined as the deposition and multiplication of bacteria and other micro-organisms in tissues or on surfaces where they can have an adverse effect (Brooker & Gould, 2008). Infection is also defined as the successful invasion, establishment and growth of micro-organisms within the tissues of the host (Brooker & Gould, 2008; Ayliffe et al., 1999).

On the other hand, "healthcare-associated infection" is acknowledged to cover a wide range of infections (Healthcare Protection Agency, 2011). The literature has defined healthcare-associated infections using a wide range of terms such as "nosocomial," "hospital infection" and "hospital-acquired infection" to mean infections acquired within the hospital environment (Department of Health, 2002; Healthcare Protection Agency, 2011; National Audit Office, 2000; World Health Organisation, 2010b). The current preference for the use of "Healthcare-Associated Infection" is acknowledged to be a reflection of a complex reality in which healthcare is now not always provided only within hospital settings, but also by and within other facilities in the built environment.

Among these various definitions, the World Health Organisation defines "healthcare-associated infection" as an infection occurring in a patient during the process of care in a hospital or other healthcare delivery facility. This includes infections that were not manifest or incubating at the time of admission, as well as occupational infections among healthcare workers acquired in the course of delivering healthcare (World Health Organisation, 2011).

The European Centre for Disease Prevention and Control defines HCAI as an infection acquired in hospital by a patient who was admitted for a reason other than that infection (European Centre For Disease Prevention and Control, 2012). This includes an infection acquired in the hospital but manifested only after discharge.

The Health Protection Agency (2012), now Public Health England, aligned its definition to that provided by the European Centre for Disease Prevention and Control, defining "healthcare-associated infection" as any infection that occurs within two or more days after admission to or discharge from any hospital setting. These include infections such as Clostridium Difficile (C. difficile) presented within 28 days of discharge from any hospital.

The European Centre for Disease Prevention and Control grouped healthcare-associated infections into 13 broad categories, under which their occurrence is benchmarked in most European countries including England (Health Protection Agency, 2012c). These categories

are grouped according to whether they are bloodstream and urinary tract infections (see Table 2.1).

Table 2.1:   Categories of healthcare-associated infections

Bloodstream Infections	Urinary tract infections
Cardiovascular system infections	Gastrointestinal infections
Bone and joint infections	Pneumonia
Central nervous system infections	Clinical sepsis
Eye, ear, nose, throat and mouth infections	Reproductive system infections
Skin and soft tissue infections	Surgical site infections
Lower respiratory tract infections other than pneumonia	

2.4. Factors involved in the prevalence of HCAIs

There is a complex web of factors which can contribute to the acquisition of HCAIs, and strategies for the prevention and control of HCAIs within healthcare settings are dynamic, as the evidence shows that they are rarely triggered by a single factor. According to the literature (Ayliffe, 2009; Brooker & Gould, 2008; Healthcare Protection Agency, 2013), the occurrence of HCAIs is largely dependent on several factors, including:

➢ The nature of the pathogens - relative to the pathogen's resistance to antibiotics,

➢ The patient's susceptibility – relative to the patient's underlying illnesses, age and gender, and,

➢ Environmental factors impacting on the healthcare facilities.

These factors (Figure 2.3) combine in a chain-like process known as "the chain of infection" (HPA, 2012b). The chain of infection (See Figure 1.4) is the model that has been used over the years to facilitate understanding of the spread and management of infections. It describes the sequence of events essential for an infection to occur. It is therefore vital to understand the characteristics of each link in the chain of infection, as well as to be aware of the way in which these infections are acquired and transmitted, if the spread of infection is to be curtailed in a sustainable way in healthcare settings.
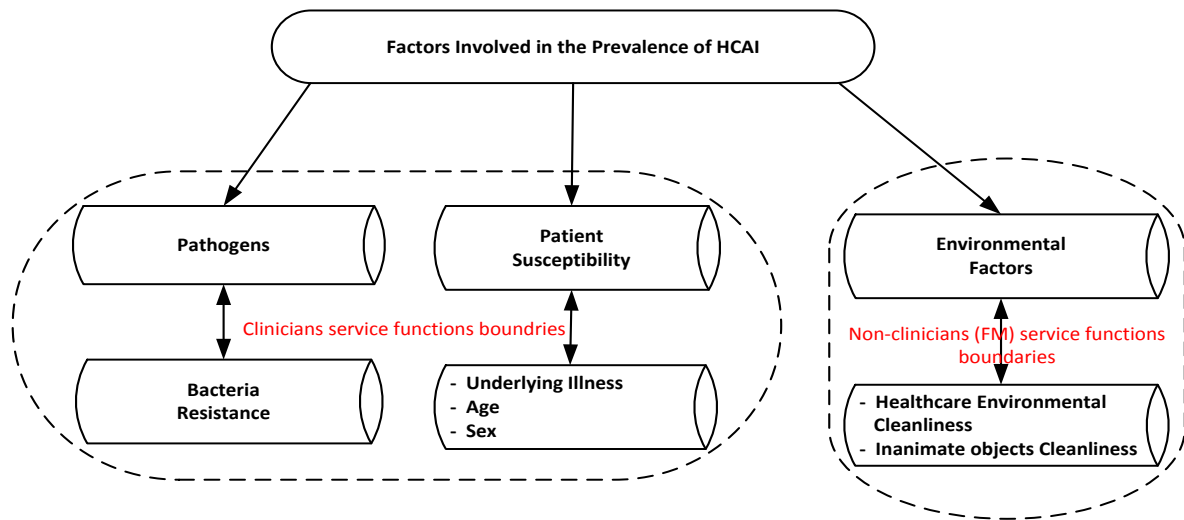
Figure 2.3:   Factors involved in HCAIs – (Adapted from HPA, 2012b; Brooker & Gould, 2008)

The narrative of these factors is presented in the next section.

2.4.1. **Pathogens associated with HCAIs**

The term 'pathogen' comes from the Greek word 'pathos' meaning a disease and 'genesis' meaning bringing into being, and thus has the sense of bringing disease into being (Wright, 2014; WHO, 2010a).   There is a wide range of pathogens (micro-organisms) that cause HCAIs and result in a range of illnesses, and these are broadly categorised into viral, bacterial and fungal organisms, and parasites. These pathogens may be derived from the patient's own flora or acquired from other patients or staff, or from the healthcare environment, which includes inanimate objects within the healthcare facility (HPA, 2012b; Ayliffe, 2009; Department of Health, 2002). The most common pathogens known to cause HCAIs in healthcare settings include Methicillin-resistant Staphylococcus aureus (MRSA), Vancomycin-resistant enterococci (VRE) Norovirus and Acinetobacter baumannii (see Figure 2.4)
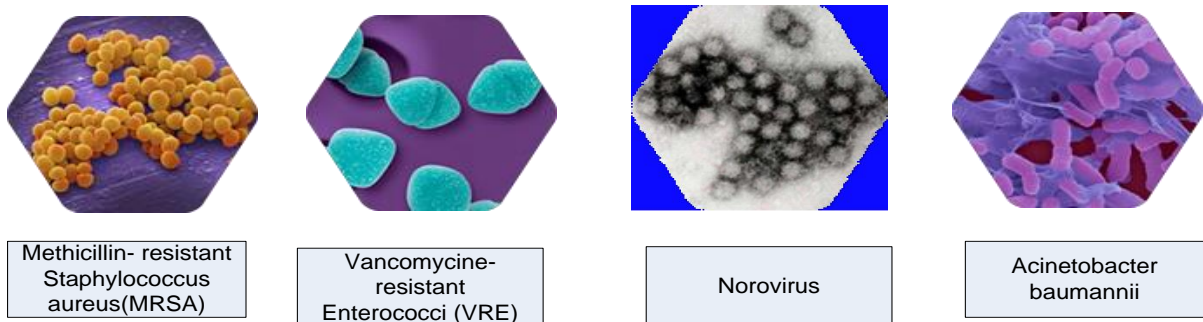
Figure 2.5:   Key pathogens causing HCAIs (Adapted from HPA, 2012)

These infecting pathogens which cause HCAIs and occasionally result in epidemics are binary in nature. They vary between patients, populations, healthcare settings, healthcare facilities, regions and countries (Health Protection Agency, 2012b).

2.4.1.1. Methicillin-resistant Staphylococcus aureus (MRSA)

Methicillin-resistant Staphylococcus aureus (MRSA), also known as a "superbug", is said to be one of the most important and most difficult antibiotic-resistant organisms that commonly cause (9% -10%) HCAIs in healthcare settings (HPA, 2013). In contrast to other micro-organisms, those produced by MRSA can linger in their host for several months (HPA, 2012; Dancer, 2011). Surfaces on which these organisms may be found in hospital settings include radiators, floors, furniture, clinical equipment, linen and beds. These are areas that are within the scope of FM maintenance services in healthcare facilities. It has been reported that there is a significant risk of patients acquiring HCAIs when admitted into a room previously occupied by carrier patients of MRSA (Dancer, 2009).

In a case study of the cleaning regime of a hospital ward environment following an outbreak of MRSA, it was found that the molecular fingerprint of surfaces showed a strain of MRSA that had been left by MRSA-positive patients in the patient environment. It was recounted that a deep cleaning regime had been employed after alternative methods to reduce the spread of the bug had failed. This resulted in a decrease in the number of infected patients, thereby saving the Trust a significant amount of money (Dancer, 2009). This shows the importance of the core service function (cleaning) of facilities management in the control of a healthcare-associated infection. It also highlights the need for adequate and efficient knowledge management in facilities management cleaning services for the targeted and sustainable control of exogenous HCAIs.

2.4.1.2. Vancomycin-resistant enterococci (VRE)

Although Vancomycin-resistant Enterococci (VRE) pathogens are not ranked as highly as MRSA, they are among the five most common healthcare-associated infection-causing pathogens, responsible for between 4% and 5% of HCAIs (Healthcare Protection Agency, 2013; Dancer, 2009). Compared to MRSA, VRE outbreaks are hard to control within healthcare settings and can survive for several months on surfaces including healthcare workers; gowns and in rooms previously occupied by infected patients (HPA, 2013, Dancer, 2009). As a result, patients admitted to a room previously occupied by infected patients are often at risk of acquiring this infection.

The VRE gene (van A) metamorphoses to MRSA, making the latter more resistant to antibiotics and difficult to treat (Health Protection Agency, 2012b). The extreme longevity of VRE in a healthcare environment and its resistance to routine cleaning mean that this pathogen poses a significant problem for the infection control team. However, it has been established that improved and sustained cleaning of the healthcare environment reduces the spread of VRE and the risk of acquiring this infection within that environment. The findings of another case study ("hospital cleaning in the 21st century") confirmed the relevance of improved environmental cleaning (Dancer, 2011).

2.4.1.3. Norovirus

Norovirus, also known as the "winter vomiting bug", "Norwalk-like virus" or "Calicivirus", is another key pathogen which may cause HCAIs and can be found on a huge variety of surfaces in healthcare settings. Norovirus is acknowledged to be the leading cause of the stomach illness (gastroenteritis) which affects people of all ages (HPA, 2012; CDPC, 2003). In the UK, it is estimated that between 600,000 and 1,000,000 people are affected by norovirus every year, with huge financial consequences for the NHS (Health Protection Agency, 2012a). Contaminated surfaces and the care environment have been shown to be associated with the prevalence of this virus, with up to 30% of infected individuals showing no symptoms of the infection while in hospital (Dancer, 2009; Health Protection Agency, 2008, 2012c). Compared to other types of HCAI-triggering organisms, norovirus is particularly contagious, which makes it difficult to control. This has increased the spread of the virus in outbreaks within healthcare settings (Health Protection Agency, 2012c).

It has been shown that a poor cleaning regime inhibits the control of infection within hospital settings, while enhanced cleaning of shared medical equipment and of hard and soft furniture has been widely documented and accepted as a worthwhile strategy for controlling the spread of norovirus (Gillespie et al., 2013; HPA, 2012; Dancer, 2009).

It has thus been shown that norovirus may be prevalent for longer and outbreaks may be more frequent unless specific attention is paid to the cleaning of the hospital environment. The ability of the virus to survive for long periods in a warm clinical environment allows it to retain its contagiousness. It is readily transferable from patients, staff and visitors (HPA, 2012; Dancer, 2009).

2.4.1.4. Acinetobacter baumannii

Acinetobacter is a group of bacteria that account for about 80% of all bacteria-associated infections in healthcare settings worldwide (Sehulster & Chinn, 2003). It is important and challenging to treat this pathogen, whose patterns of resistance to antibiotics remain a significant challenge to infection control practitioners worldwide (Wright, 2014; CDPC, 2003). Findings from a survey of 75 countries ranked Acinetobacter as the sixth most common bacterial pathogen associated with healthcare infections, resulting in prolonging hospital stays (CDPC, 2003). This pathogen survives on surfaces for a prolonged period, increasing its ability to spread within the environment.

Several case studies have shown the significance of enhanced cleaning regimes and environmental decontamination as a targeted approach to the control of Acintobacter outbreaks (CDPC, 2003; Dancer, 2009). One of these studies described an outbreak of multiple resistant strains of Acinetobacter baumannii, infecting more than 30 patients in two hospital wards. The hospital ward environment was identified as an important reservoir of the infectious strains. As a consequence, the two affected wards were closed, and terminal cleaning and decontamination were carried out. It was reported that this targeted approach eventually lead to the curtailment and eventual termination of the epidemic (Dancer, 2009).

A further study by the Centre for Disease Prevention and Control (2003) showed that the level of hospital environment contamination with strains of Acinetobacter pathogens during a prolonged outbreak was increased by the high number of hand touch sites near patients within the ward environment. It was also shown and documented that high standards in the cleaning regime played an integral role in the control of the outbreak The importance of cleaning in controlling an outbreak of Acinetobacter can therefore not be over-emphasised.

2.4.2. Patient susceptibility

It has been acknowledged that the patient population of hospitals and community healthcare centres today is increasingly made up mainly of older people and infants, whose lower levels of immunity often place them at risk of acquiring infections (HPA, 2013, 20008, 2000; Girard et al., 2002). Patients have differing levels of susceptibility to infections while in admission and after being exposed to pathogenic organisms (Barton, 2009). Patients with severely weakened immune systems are more vulnerable to infections in healthcare settings. Other influencing factors include underlying illnesses, age (with infants and the elderly being most at risk), and the nature of the medical interventions used in the treatment of the patient.

Immunity is defined as a state of resistance to infectious agents (Gould & Brooker, 2008). Those entering the hospital ward environment are now increasingly elderly people with weakened immunity and increased susceptibility to infections, and require treatment and an improved therapeutic environment devoid of the risk of any external infection (Gould, 2007; House of Parliament, 2005). The potential of the infected patient to recover from infection is acknowledged to be largely influenced by any underlying illnesses or diseases, depending on the age of the patient, which in turn determines their tolerance of relevant medication and care.

Within healthcare settings, it has been emphasised that minimising the risk of infections that could be acquired from exogenous sources is imperative, and that facilities management service delivery practice is paramount. Thus, the importance of good FM cleaning service delivery cannot be over-emphasised for the control of exogenous HCAIs in NHS hospitals.

2.4.3. **Environmental factors**

The design of healthcare environments where both infected persons and persons at increased risk of acquiring infections congregate is complex and challenging as a result of the interrelated issues to be addressed (WHO, 2002). These issues include the variety of users (patients, visitors and staff) and the frequent technological changes made to support diagnostics and treatment, as well as the nature of the services provided, which ultimately focus on caring for people's health and well-being (Clancy, 2013; Codinhoto et al., 2009). All these factors are considered in the design of the physical structure and surroundings, including fittings, furnishings, equipment and supplies (Ayliffe et al., 1999). Depending on their susceptibility, it has been noted that patients can develop infections due to the emergence of their own endogenous organisms, or because of cross-contamination in a healthcare setting (Ayliffe, 2009; Brooker & Gould, 2008). What is more, the surfaces of inanimate objects in patient care settings could also be predisposed to contamination from dead squamous which contains microorganisms that are shed from infected patients' skin and gowns (WHO, 2012; Collins, 2002). A body of clinical evidence derived from case reports and infection outbreak investigations has suggested an association between a dirty environment and the transmission of microorganisms which cause healthcare-associated infections in hospitals (Gillespie et al., 2012; Dancer, 2009, 2011; Department of Health, 2008b).

The surge in articles on the cleaning of the healthcare environment reflects an increasing global recognition of the interface between a clean healthcare environment in the prevention and control of healthcare-associated infections (Walter, 2013). As a result of the criticality of

healthcare environmental cleanliness in the prevention and control of exogenous healthcare-associated infections, in 2000 £30 million was allocated to the NHS Trust by the Department of Health to improve hospital cleaning as part of the NHS Plan (Department of Health, 2000). More than £68 million is acknowledged to have been invested with the aim of making improvements to hospital environments. Newer technologies for environment cleaning are now becoming available, including Ultra-microfiber cloths that remove particles by absorption (Gillespie et al., 2013).

Findings from a study of the effectiveness of cleaning the hospital environment without chemicals have suggested that 20% - 40% of healthcare-associated infections can be attributed to cross-infection via healthcare workers' direct contact with contaminated surfaces or direct contact with patients (Gillespie et al., 2013).

> *Ministers have noted that healthcare associated infections and improving cleanliness in hospitals are often linked, and rightly so…..cleanliness contributes to infection control, and a clean environment is the best platform from where to tackle HCAIs"* (DH, 2008a)

Providing a clean and safe environment for healthcare delivery is acknowledged to be one of the key priorities of the NHS, as well as a core standard in the Department of Health document "Standards for better health" (NPSA, 2009). High standards of environmental hygiene and clinical practice in healthcare facilities have thus been identified as an important consideration in minimising the risk of the transmission of infection (DoH, 2013b). It is in recognition of the relevance of the healthcare environment that the code of practice for the prevention and control of HCAIs places further obligations on NHS trusts, including a responsibility for ensuring that the cleaning service function is adequately resourced and clearly defined through a strategic cleaning plan. This includes ensuring that clear cleaning schedules are in place, specifying the frequency of cleaning, to ensure that patients and the public know what they can expect (NPSA, 2009).

> *The public must be able to trust the NHS to keep them safe from healthcare acquired infections such as MRSA and C. difficile. And the cleanliness of hospitals is a key factor in whether patients have a positive or negative experience of using the NHS* (Labour Party, 2008:20).

Findings from earlier research showed that while bacteria such as MRSA can persist in healthcare environments for months, they cannot grow or survive for a long period on clean, dry, disinfected surfaces (Gillespie et al., 2013, 2012; Walter, 2013; Scott & Stuart, 2012; Dancer, 2009). A study by Goodman et al. (2008), cited in Health Estate (2015), evaluates the

adequacy of discharge room cleaning and the impact of a cleaning intervention on the prevalence of MRSA and VRE on healthcare environmental surfaces. This study concluded that the intervention helped to reduce the frequency of MRSA and VRE contamination.

Another multi-hospital study into the prevalence of HCAIs interfaced with infections caused by multidrug-resistant pathogens transmitted in hospital settings undertaken by Carling et al., (2008) concluded that a significant improvement in cleaning was achieved through repeated performance feedback to facilities management personnel and administrative intervention. Such findings highlight the importance of continuous knowledge creation, storing, sharing and usage for the effective management of the prevalence of HCAIs.

2.5. **The economic and socio-cultural burden of HCAIs**

Today, the cost of preventing and controlling HCAIs in financial terms has grown considerably, and is borne by the government and those who are infected (Scott, 2009; Brooker & Gould, 2008). Other potential impacts of healthcare-associated infections include:

➢ Possible legal and further training costs to employers,

➢ Loss of reputation by the healthcare establishment because of the outbreak of infection leading to negative media publicity, may take years to regain,

➢ Extra remedial costs to the employer, including securing the services of infection prevention and control specialists and extra staff, as well as the additional cost of materials in combating the cause of the infection outbreak.

In summary, the economic and socio-cultural burden of healthcare-associated infections cannot be overemphasised regardless of anecdotal evidence of the exact cost to the NHS. It is acknowledged that cleaning represents a significant expenditure of hospitals' housekeeping budget (Dancer, 2013; Malick & McGrady, 2007; CDPC, 2003). Yet these costs are not all, for they lead to further costs:

➢ **To the infected individuals and their families:** Healthcare-associated infections can be viewed as a health and economic problem if the infection is resistant to life-saving medication. This could result in an individual spending more resources and losing time through being bedbound in hospital.

➢ **To the government:** Healthcare-associated infections are an enduring social (health) and economic dilemma, and finding sustainable preventative solutions is a constant concern at the top political level and for the local National Health Service (NHS)

Trust. One reason for this desire to curtail the scourge is to minimise the enormous resources channelled towards the control of this burden each year.

Table 2.2:   The social and economic burden of healthcare-associated infections (adapted from Scott, 2009)

Categories of healthcare-associated cost	Elements
Direct Hospital Costs	Fixed Costs: Buildings - Utilities Equipment/Technology Labour (Laundry, environmental control, administration) Variable Costs: Medication - Food Consultations - Treatments Procedures - Devices Testing (Laboratory & Radiographic supplies)
Indirect Costs	Lost/Wages - Short term morbidity Mortality - Income lost by family members Forgone leisure time Diminished worker productivity on the job Time spent with family/friends for hospital visits, travel costs, home care
Intangible Costs	Psychological Costs (i.e. anxiety, grief, disability, job loss) Pain and suffering Change in social functioning/daily activities

Such burdens have prompted a number of high-profile initiatives focusing on other strategies for the prevention and control of infections in healthcare settings. Yet despite these initiatives, the problem remains significant and poses enormous challenges as both developed and resource-poor countries are still faced with the burden of curtailing its prevalence (CDC, 2013; HPA, 2013; WHO, 2011, 2005).

2.6. **The management approach to healthcare-associated infections**

2.6.1. **The infection control team (ICT)**

The infection control team (ICT) comprises the infection control doctor, the hospital microbiologist and the Infection Control Nurse (Figure 2.6). The team reports directly to the hospital Chief Executive through the infection control committee (Ayliffe, 2009). However, there is an increased recognition that "specialist practice in the prevention and management of healthcare associated infection is evolving" (Ayliffe, 2009; Olesen & Hood, 2003). This is in

response to the changing nature of healthcare delivery relative to the variety of pathogens causing resistance to antibiotics, changes in statutory obligations, technological advances and demographic pressures. It is now evident that the prevention and control of healthcare-associated infections is not solely within the scope of the medical profession but requires collaboration with external, non-medical disciplines, especially service providers among which facilities management is paramount.
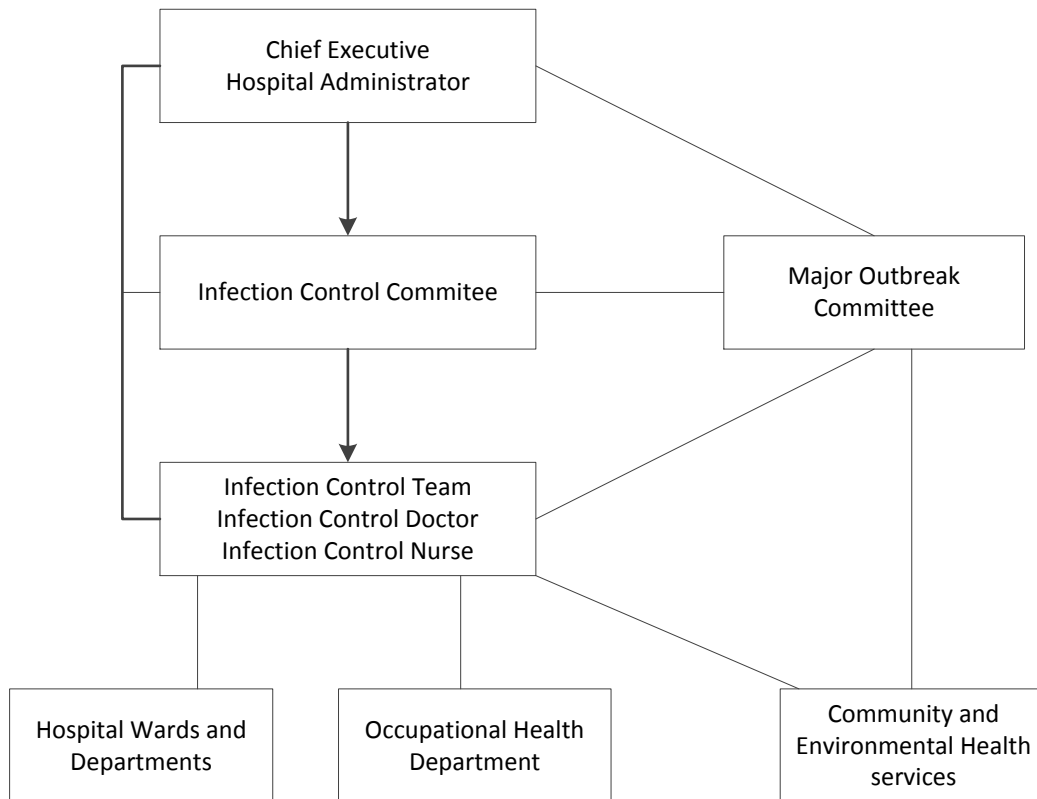
Figure 2.6:   The organisation of the control of healthcare-associated infection (Ayliffe, 2009).

The ICT is charged with the day-to-day aspects of infection control and with preparing and implementing infection control programmes and policies (Ayliffe et al., 1999). The team liaises with all hospital departments on all infection-related issues. They are responsible for designing, coordinating, implementing and undertaking an evaluation of the hospital infection prevention and control program and policies, and provide expert infection prevention direction to hospital staff. They monitor compliance with environmental cleanliness and hygiene standards in conjunction with the consultant in communicable disease control (CCDC). They also liaise with relevant international, regional, national and local regulatory bodies on behalf of the hospital to ensure compliance with standards (Ayliffe, 2009; Brooker & Gould, 2008).

As evidence of the healthcare environment contribution to healthcare-associated infection increases (Curtis, 2008; Dancer, 1999, 2011), it has been suggested that bringing facilities management know-how into hospital design, construction and environmental assessments will boost hospital facilities performance (British Institute of Facilities Management, 2015). This acknowledgment from the world-leading facilities discipline organization further supports the relevance of facilities management service delivery practice in the control of infections that are acquired from the hospital environment..

2.7. **What is Facilities Management?**

The practice of facilities management has been in existence for hundreds or even thousands of years, going back to the time of the construction of social and economic facilities such as buildings, telecommunication systems, water and sewerage systems (Atkin & Brooks, 2002; Baillie, 2009). Technological advances espoused by demographic pressure, as well as the complexity of modern-day healthcare facilities, changes in the workplace environment, changes in legislation, increased requirements for better services and better health and safety standards, and the sustainability agenda - all these mean that facilities management practice is now more important than before. The scope and definition of facilities management has thus continued to evolve to reflect its increasing strategic relevance to the built environment. Early articles on facilities management in the 1980s described the core of facility management as a practice of integrating people, process, and place (Becker, 1990). Thus, facilities management was then defined as "the practice of coordinating people and the work of the organisation in the workplace.

Barrett (1995) defined facilities management as "an integrated approach to operating, maintaining, improving and adapting the building, and infrastructure of an organisation; in order to create an environment that strongly supports the primary objectives of that organisation". This definition takes into account the entire property life-cycle management including improving and altering the built facility to adapt to changes in the business environment.

Atkin & Brooks, (2000) proposed a working definition of facilities management as "an integrated approach of operating, maintaining, improving and adapting the buildings and infrastructure of an organisation in order to create an environment that strongly supports the primary objectives of that organisation". This suggests that the FM function is an integral management process focused on optimising the functionality of the building fabric, space and related assets of people and process as a workplace environment to achieve set objectives.

Barrett and Baldry (2003) defined facilities management as "an integrated approach to operating, maintaining, improving and adapting the building and infrastructure of an organisation in order to create an environment that strongly supports the primary objectives of that organisation". Atkin & Brooks (2009) felt this was a well-focused definition of facilities management in that it demonstrates that the scopes of facilities management is not constrained by the physical characteristics of the building. Rather it is an inclusive interface of other management disciplines within and outside the built environment to optimise non-core service functions to the organisation.

As a consequence of the dynamic nature and the rapid development of facilities management, supported by sustained economic growth and market developments over the years, the scope and definition of the function now encompassed more of the services traditionally provided by other management sciences of the built environment. Following the earlier working definition of FM provided in 2003, the International Facility Management Association (IFMA) in 2009 defined Facility Management as a profession that encompasses multiple disciplines to ensure the functionality of the built environment by integrating people, place, process and technology. This definition acknowledges the multidisciplinary nature of FM and the management of the workplace environment that is effectively coordinated using information technology. Albeit, Nunnington & Haynes (2010) criticise this definition for its lack of a connection to the core business strategy.

The British Institute of Facilities Management (BIFM) defines facilities management as the integration of processes within an organisation to maintain and develop agreed services, which support and improve the effectiveness of its primary activities. In other words, facilities management encompasses multi-disciplinary activities within the built environment and the management of their impact upon people and the workplace (BIFM, 2009). This definition, like that provided by IFMA, also suggests that facilities management encompasses different professional disciplines within the built environment. However, the BIFM definition goes further to make the link between the workplace and its potential impact on the occupiers. It also stresses how well managed facilities can provide support in improving the effectiveness of the organization's core activities in order to achieve set objectives. This robust definition was provided in 2009, and when it is compared to the definition of 1999 in which FM was defined as "the practice of coordinating the physical workplace with the people and the work of the organisation" (BIFM, 1999), it clearly shows how much the profession has progressed over a decade.

The Facility Management Association of Australia (FMA) (2009) defined facility management as buildings, properties and major infrastructure with the primary function to maintain the efficient operation of this built environment. In contrast to some of the other definitions discussed here, this definition does not link the provision of FM to the needs of the organisation's core business. The emphasis of this definition is more on the physical and hard fabric maintenance of the built facilities within the built environment.

This section has reviewed a variety of definitions of facility/facilities management from the 19th through to the 21st century, and demonstrates that there is little uniformity in terms of providing a clear direction for the objectives and scope of FM. The definitions clearly illustrate the holistic nature of the discipline and the interdependence of multiple factors in its success, with each definition having its strengths and weaknesses (Atkin & Brooks, 2002).

In contrast to other management professions within the built environment, facilities management responds to context and contributes to organisational strategies, as it addresses key issues concerning the workplace. As a consequence of this, there continues to be a recognition that facilities management is a vital strategic discipline because it translates high-level strategic changes required by senior decision-makers into the day-to-day reality for people in their work and living space (BIFM, 2014; Keith, 2007). The paradigmatic characteristics of facilities management are that it:

> - Encompasses multidisciplinary professional activities;
> - Enhances and projects the organisation and its image;
> - Delivers effective management of an organisation's assets;
> - Improves the effectiveness of the core business;
> - Acknowledges the impact the workplace has on people's productivity;
> - Helps the integration processes associated with change, mergers or acquisitions;
> - Delivers business continuity and workforce protection in an era of heightened security threats.

The strategic concept behind the emergence of facilities management, in addition to the above, could also be explored by examining traditional facilities management vanguard services. This is acknowledged to be the practice that continued to improve processes by which the workplace can be managed to inspire people to give their best, and ultimately to make a positive contribution to the growth of the organisation (Atkin & Brooks, 2009; Alexander, 2005)

According to Wiggins (2010), the lack of commonality between the organisations teaching FM and those practicing and representing FM is a possible reason why there are as many definitions of facility management as there are different types of organization in the industry. These are influencing factors that have made it difficult to agree on one definition for facilities management. The acceptance of a definition is most often dependent on the viewpoint of stakeholders, so the preferred definition is that which is most acceptable and suitable to the institution. Many definitions of FM are very broad, whilst others are very precise. Notwithstanding, whichever definition is favoured, facilities management is a diverse profession. It is an umbrella term under which a wide range of properties and user-related functions from other backgrounds outside the built environment may be brought together, with the aim of taking control, adding value and supporting workplace facilities. This is to ensure that the space and working environment optimise and do not hinder the efficiency of the organisation and its stakeholders.

Healthcare facility management is not all about minimising the running costs of facilities, but also ensuring the suitability and the optimisation of support services in order to enhance the experience of patients, staff and other visiting stakeholders. As well as being driven by the aim of preventing the occurrence of exogenous healthcare-associated infections, other aims may emerge as a consequence of compromises in facilities management cleaning services. Thus the scope of healthcare facilities management is not limited.

2.8. The Facilities Management interface in the control of exogenous HCAIs

Compared to facilities management functions in other industries, the provision of healthcare facilities management services is unique, dynamic and constantly changing to support the delivery of healthcare services. Historically, the facilities management service delivery concept, in contributing to the prevention and control of healthcare-associated infections (HCAIs), has had increasing recognition since the work of Florence Nightingale at the military hospital in Scutari in present-day Turkey in 1854. Her work became the foundation for acknowledging the relevance of the soft FM services of cleaning and janitorial services as being bound up with medical interventions in the prevention and control of infections often acquired from exogenous infectious agents within the care environment (Selanders & Crane, 2012; Kudzma, 2006). It is noted that the principles that Florence Nightingale developed, upheld and promoted in terms of the vital role of hygiene and environmental cleanliness and the impact they have on patient recovery outcomes, and her insights into the spread of infection, still hold good to this day (Payne & Rees, 1999). Stichler (2011) notes that

Nightingale's ideas about the importance of clean air, adequate lighting, ventilation, sanitation and environmental cleanliness are the foundations of the concept of the "healing environment." Her work provided the basis for the recognition that infectious diseases could be transmitted from patient to patient, patient to carer and from carer to patient.

The process and focus of facilities management is often-service driven, starting from facility design through to the construction management phase, workplace management, support service management and then the change management phase in the facility life cycle (Figure 2.7). If this is viewed in terms of a Hard and Soft FM interface, hard facility management relates to services that fall within the remit of physical building fabric maintenance and responsibility for mechanical and electrical work on things such as windows, doors and boilers. On the other hand, soft FM services encompass cleaning, linen services, waste management, porterage, catering and other office and central services (British Institute of Facilities Management, 2014; NHS Estate, 2002). Hospitals are acknowledged to be amongst the largest and most complex of all modern institutions to run, requiring huge bureaucratic structures to manage them, against the background of political and financial pressures (British Institute of Facilities Management, 2014; Clancy, 2013; Codinhoto et al., 2009). According to the Centre for Facilities Management (CFM), University of Strathclyde (Alexander, 2007), healthcare facilities management is defined as the process by which a provider unit creates and sustains a caring environment and delivers support services to meet healthcare objectives at best cost. In contrast to the situation in other modern institutions, modern hospital facilities management is not seen as a soft option, as it entails keeping buildings and equipment functioning at an acceptable level despite significant budget constraints. Among other things, this is influenced by public scrutiny in the face of media which focuses on maximising value for resources in public institutions (British Institute of Facilities Management, 2014; Cameron, 2014; Haggard & Hosking, 2002; NHS Estate et al., 2002)
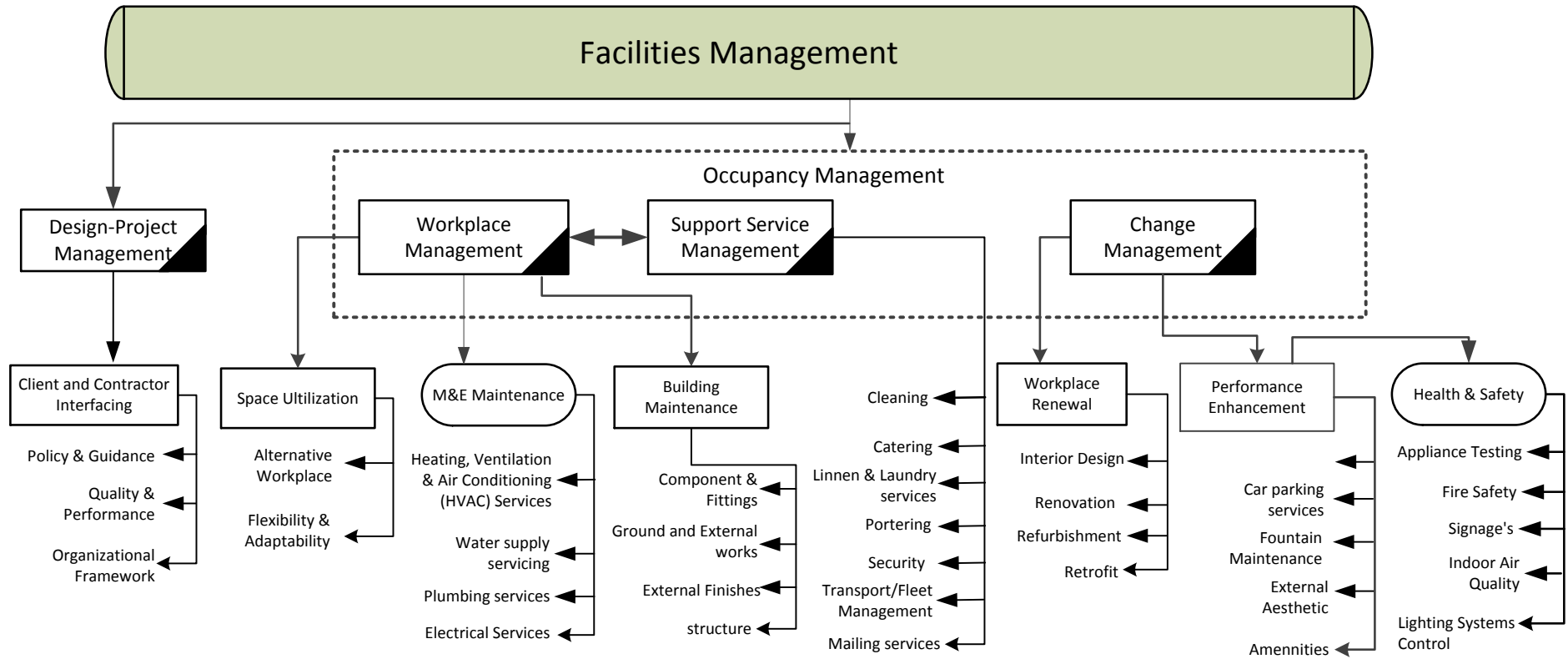
Figure 2.7: The typical Facilities Management service delivery interface

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The bespoke facilities management services typically provided to hospitals include cleaning, porterage, security, health and safety, interior design, renovation, telecommunications, mailing, energy management, space planning and mechanical and electrical maintenance. These services are either provided by a virtual organisation, made up of a group of external service providers, which is known as "outsourcing." They could also be provided using a combination of in-house resources and outsourcing (BIFM, 2014; Barrett & Baldry, 2003; NHS Estate, 2002; Payne & Rees, 2000). Within the healthcare sector, the British Institute of Facilities Management (2014) lists a typical facilities manager's activities as including:

➢ Cleaning and waste management;
➢ Catering and linen services;
➢ Maintenance services;
➢ Energy management (i.e. keeping the heating running, monitoring and regulating energy and water usage in the building);
➢ Making sure that the facilities comply with legislation;
➢ Refurbishing and adapting facilities as the organisation's business model changes;
➢ Keeping workers safe and secure;
➢ Dealing with the aftermath of major incidents such as infection outbreaks (epidemics) or fires, together with the clinician;
➢ Integrating people back into the building after a major alteration, renovation or acquisition.

Within the scope and limitations of this research, the knowledge process management interface of selected facilities management cleaning-centred services for the control of exogenous HCAIs will be extrapolated from the broad service functions of facilities management services to NHS hospitals (Figure 2.7). This will be critically explored in the next section in order to achieve the research aim and objectives.

2.8.1. The facilities manager's operations at the design project management phase of healthcare facilities in the control of HCAIs

The design, construction and operation of buildings generally requires the integration of many professions and processes as a clear understanding of the functional and physical requirements of a building is essential in ensuring its successful delivery. It has been recommended that in the design, management and construction of healthcare facilities, the

participation of the infection control team (of which the facilities manager is an integral member) is essential, considering that at the design stage steps can be taken to address infection prevention and control issues in a variety of ways that could result in substantial cost reductions during any renovations or replacement of equipment (Memarzadeh, 2011b; NHS Estate, 2002)

> *...newly identified diseases, viruses, and antibiotic-resistant, diseases-causing bacteria have changed the face of medical science and caused us to rethink the design of our healthcare facilities* (Memarzadeh, 2011b).

Because of the multifaceted effect of a healthcare facility on both the physical and mental health of patients, staff and other stakeholders, the design of healthcare facilities is governed by many regulations and technical requirements espoused by other less define laconic needs and pressure. This is attested by previous research and investigation, which has consistently found that the physical characteristics of the healthcare environment could serve as a reservoir for organisms to flourish, which can affect the healing process and have a negative impact on patient recovery (Department of Health & NHS Estate, 2013; Dancer, 2009; Douglas and Douglas, 2004). To optimise the functionality of the varying characteristics of the building systems, including ease of cleaning the building fabric, maintaining the structures and other mechanical and electrical items used in servicing the building, it is imperative to explore the professional input of the infection control team at the design phase. They will risk-assess all relevant aspects of the building and provide information and guidance from a building services infection prevention and control perspective that will reduce life-cycle costs. Their input could also help in optimising the health and environmental functionality of the building to meet user's expectations.

> *"…… The infection prevention and control team should be consulted throughout every stage of a capital project and their views taken into account….."* (NHS Estate et al., 2002)

Achieving design excellence in the provision of a fit-for-purpose, patient-centred landmark healthcare facility has been acknowledged to underpin the delivery of modern health service objectives (NHS Estate England, 2005). At the design management phase of healthcare facilities design, the facilities manager will liaise with the contractor to stress prevailing policy and guidelines, and how they could be implemented fully to enhance the functionality of the building and its constituent elements. This highlights the importance of design

solutions, including infection prevention and control protocols, so that some of the risk of infection can be eliminated or significantly reduced.

> *"Good design is not an optional extra; it has to combine*
> *fit for purpose with whole-life costs to deliver value for*
> *money. Good quality design will contribute to providing*
> *environment in which patients will be safe and secure"*
> (Barlow, O'Sullivan, & Bora Trimçev, 2011).

During the design phase, together with other clinician members of the infection control team, the facility manager is also able to carry out an assessment in order to ensure that the facility is designed to embody all operational policies and procedures that support the prevention and control of HCAIs. This is facilitated through an inclusive, sustainable design concept that enables and encourages desired cleanliness outcomes (Department of Health, 2013b; Wiggins, 2010; NHS Estate, 2002). Two prominent provisos contained in the NHS constitution that relate to the facilities in which healthcare is delivered in the UK are:

➢ Services will be provided in a clean and safe environment that is fit for purpose, based on national best practice.

➢ Continuous improvement in the quality of services - identifying and sharing best practice (Knowledge management – capture, transfer, and knowledge sharing) in quality of care and treatment.

Within the remit of facilities management service delivery to NHS hospitals, it is noted that the above provisos are central to FM service delivery functions for NHS hospitals (NHS England, 2013c). There is also a causal recognition that efficient and effective service delivery to premises and the management of such services require careful planning if they are to be delivered safely and legally (Transport for London, 2010). It is imperative that healthcare facilities are designed to facilitate sustainable infection prevention and control for a better patient experience and healthcare delivery outcomes.

Various functional and operational challenges for facilities management could result from poor design of healthcare facilities that might have the potential to impact on FM services during the occupancy phase. Some of these are:

➢ The challenges of managing available resources;

➢ The integration of processes within the facilities;

- The maintenance and development of agreed service level agreements which support and improve the effectiveness and functionality of modern healthcare facilities.

Based on liaison with architects, designers and builders in partnership with healthcare infection control teams, the Department of Health has acknowledged and continues to emphasise the need to take into consideration other wider issues beyond that of actual building performance in healthcare facility design (Department of Health, 2013b). Such considerations include a focus on infection control by designing in flexibility and adaptability to accommodate future changes to the healthcare facility (Department of Health, 2014b; NHS Estate, 2002). Healthcare facilities are nowadays expected to be designed to meet, among others, the following requirements:

- Accommodate enough hand washing basins and antimicrobial hand-rub dispensers;
- Include finishes that are impervious, smooth and seamless as far as practicable;
- Run hard flooring up the walls for a short distance to provide an easy-to-clean covering;
- Provide for the accommodation of sufficient storage for patients' possessions and for all supplies, including storage for:
  - Personal protective equipment (PPE);
  - Moveable equipment;
  - Clean linen;
  - Clean patient items;
  - Healthcare waste, including sharp bins and used linen.
- Ensure proper segregation and management of waste, including clinical waste;
- Accommodate sufficient domestic waste receptacles;
- Provide space for bedside waste disposal facilities for patient use;
- Design out unnecessary inclusion, so as not to impact on ventilation, the water supply, heating, plumbing and the air-conditioning system including the level of filtration where adequate ventilation is required;
- Consider as far as practically possible hands-free operation of other facilities (for example automatic doors, proximity-sensors, etc.);
- Provide and accommodate suitable and sufficient facilities for cleaning equipment and the preparation of cleaning equipment and materials, as it is always good practice to

maintain a visibly clean environment that is free from dust and soilage and which is acceptable to all stakeholders including patients, staff and visitors;

➢ Provide sufficient space for activities to take place and to avoid cross-contamination between adjacent beds;

➢ Establish a baseline for future staffing profiles and revenue budgets including contracts for other support services such as catering, cleaning, linen and sterile services that may be provided.

> *"………If the burden of healthcare associated infection is to be reduced, it is imperative that architects, designers and builders partners with healthcare infection control team when planning new facilities and renovating older buildings……."*(NHS Estate, 2002)

The emphasis on these paramount service functions of the facilities management discipline has further heightened the recognition of their relevance to the NHS, and the need for continual service innovation.

2.8.2. The facilities manager's operations at the occupancy phase of healthcare facilities in the control of HCAIs

The healthcare environment in which the facilities management discipline is practiced has three basic components - buildings, equipment and people (Joint Commission on Healthcare Organisation - JCHO, 2009). Each component is a potential medium for harbouring infectious organisms that could lead to healthcare-associated infections. Characteristically, facilities management soft service delivery practice is centered on these three components to ensure they are aligned to facilitate the control of exogenous HCAIs (Figure 2.8).

Components of the care
Environment
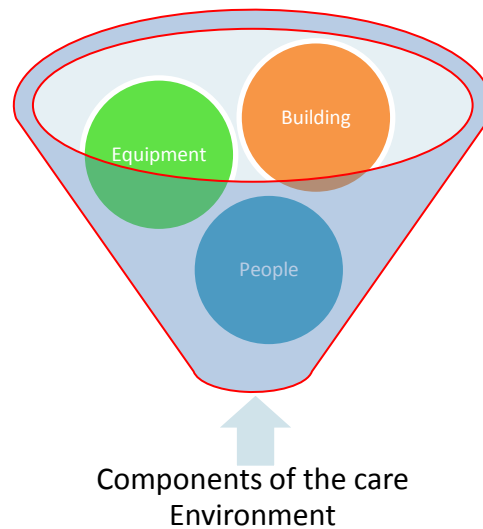
Figure 2.8: The component of the care environment – (adapted from JCHO, 2009)

The Joint Commission on Healthcare Organisation acknowledged that the effective design and management of the physical environment of healthcare facilities during the occupancy phase fundamentally aims to achieve the following goals:

- Reduce and control environmental hazards;
- Prevent accidents and injuries;
- Maintain safe conditions for patients, staff and others stakeholders visiting the facilities;
- Maintain an environment that is sensitive to patient needs for comfort, social interaction and positive distraction;
- Minimise unnecessary environmental stress for patients, staff and other stakeholders visiting the facilities.

Research has also shown that an inclusive and supportive healthcare environment not only prevents harm and injury, but also provides psychological support and aids healing processes (JCHO, 2009). Evidence-based design is understood to be the process of basing decisions about healthcare facilities design and construction on informed and credible principles in order to achieve the best possible outcomes (Edwards & Ellison, 2004). With the increasing culture of claims and compensations, exacerbated by shrinking hospital budgets and scant resources, the design dialogue is nowadays centred not only on cost-effective design but also on considerations of evidence-based design strategies in order to:

- Reduce healthcare-associated infections (HCAIs);

> ➢ Reduce falls;
> ➢ Increase savings on energy;
> ➢ Increase patient satisfaction;
> ➢ Support the mission and vision of the organisation in providing high-quality healthcare delivery.

The literature (NHS Estate, 2002; NHS Estate et al., 2002) has suggested that these desired outcomes need to be taken into account at the design phase by the design team in liaison with the infection control team (ICT). For the purpose of this research, the interface between hospital facilities management services at the occupancy phase for the sustainable prevention and control of exogenous HCAIs will be explored within the scope of this research.

The next section presents a review of facilities management service-centred literature relating to the control of exogenous HCAIs in NHS hospitals, in order to achieve the research aim and objectives.

2.8.2.1. Environmental cleanliness-centred guidance documents for the control of HCAIs in NHS hospitals

Environmental factors can play a major role in the spread of epidemics (Barton, 2009). Particles (e.g., from bioaerosols) in the healthcare environment often fall or travel some distance suspended in the air, and fall as droplet nuclei in the form of a mucous membrane on surfaces (Memarzadeh, 2011b). This has necessitated enhanced cleaning regimes in healthcare settings to target specific microorganisms or a broad spectrum of organisms that might be of concern in specific locations in order to reduce their number within the environment. The increase in healthcare environmental cleaning-related literature over the years could be attributed to concerns of about a perceived fall in standards in hospital cleanliness, and this is echoed by the Infection Control Nurses Association and the Association of Domestic Managers (Pratt et al., 2007). This has resulted in several initiatives, including publications by the Department of Health, to improve standards of hospital cleanliness. One of the key publications is the NHS Plan: a plan for investment, a plan for reform by the Department of Health (Department of Health, 2000).The NHS plan set out a 10-year programme for the modernisation of the health and social care infrastructure in England with the aim of improving the delivery of healthcare services to a level that is consistent with the NHS constitution (Department of Health, 2000). The NHS plan also led to the launch of

the clean hospital programme and Patient Environmental Action Teams (PEAT) as part of a programme to redress low cleanliness standards. The NHS Plan has been credited with bringing the conceptualisation of healthcare facilities management service delivery practice in the NHS from the purely clinical sphere (medicines) and viewing it in the context of controlling HCAIs and enhancing the patient experience in healthcare institutions. Several hospital environmental cleanliness standards have been published against the backdrop of the NHS plan to provide a comprehensive framework as a basis on which all hospitals in England can develop bespoke plans with the aim of providing enhanced cleaning services (NPSA, 2009, 2007; NHS Estate England, 2004a, 2001).

Other healthcare environmental cleanliness-focused publications further to the publication of the NHS plan include:

- Clean hospital programme (NHS Estate, 2001);
- Patient Environment Action Team (PEAT). The PEAT initiative was first established in 2000 to make independent assessments in NHS hospitals of food, catering and environmental cleanliness (National Health Service England, 2012);
- National Standard of Cleanliness – first published by the NHS in 2001. This has been replaced by "The national specifications for cleanliness in the NHS: a framework for setting and measuring performance outcomes" (National Patient Safety Agency, 2007);
- Winning ways: working together to reduce healthcare-associated infection in England (Department of Health, 2003b);
- A Matron Charter: An Action Plan for Cleaner Hospitals (Department of Health, 2004a);
- The Revised Healthcare Cleaning Manual - first published by the Department of Health in 2004 (Association of Healthcare Cleaning Professionals, 2009);
- Essential Standard for Quality and Safety (Care Quality Commission, 2010);
- The NHS Premises Assurance Model (PAM) (Department of Health, 2016);
- Patient-Led Assessments of the Care Environment (PLACE). PLACE is the new system for assessing the quality of the patient environment, and replaces Patient Environment Action Team (PEAT) inspections (NHS England, 2013a);
- The Code of Practice for the prevention and control of healthcare-associated infections
- Clean, safe care: reducing MRSA and other healthcare-associated infections.

There have been several revisions to these publications as a result of the changing phase of infection-causing bacteria that are resistant to existing antibiotics, as well as:

- The changing pattern of healthcare delivery;
- Changes in statutory regulations, including the Health Act, 2006;
- Emerging technologies;
- Demographic pressures.

Notwithstanding the plethora of policies and good practice guidance relating to healthcare environmental cleanliness for the control of healthcare-associated infections in NHS hospitals, there is wide criticism of the lack of a review of their effectiveness (NHS England, 2013a; May & Pitt, 2012). It could be argued that it was against the backdrop of this limitation that contemporary policies such as Patient-Led Assessments of the Care Environment were introduced. The key mandate of PLACE, in contrast to previous publications, was in that it focused "entirely on the care environment and does not cover clinical care provision or how well staff are doing their job" (NHS England, 2013a).

> *…..Patient-Led Assessment of the Care Environment (PLACE),will focus entirely on the care environment and does not cover clinical care provision or how well staff are doing their job* (NHS England, 2013a).

Healthcare facilities cleaning is a skilled activity undertaken by specially trained domestic staff using effective procedures, equipment and materials to maintain the appearance, structure and efficient functioning of the clinical environment and its contents (Brooker & Gould, 2008; Ayliffe et al., 1999). It is a purposeful and routine process of identifying, containing, removing and disposing of possible contaminants (e.g., dust, chemicals, droplets, etc.) from surfaces or from the healthcare environment (Memarzadeh, 2011a). Cleaning is the first necessary step in sterilization or decontamination. It involves the use of vacuum cleaners, mops, damp dust-cloths and other suitable materials and equipment with or without disinfectants (Walter, 2013; Memarzadeh, 2011). According to the Centre for Disease Control and Prevention (2003), cleaning is a form of decontamination that purifies surfaces in the healthcare environment so that they are safe to touch by removing organic matter, salts and visible soiling. The Centre for Disease Prevention and Control USA (2003) identified several influencing factors that promote the number and type of microorganisms on environmental surfaces and the prevalence of HCAIs including:

- ➢ The number of people in the environment (demographic);
- ➢ The amount of activity in the environment;
- ➢ The amount of moisture present in the environment;
- ➢ The presence of material capable of supporting microbial growth;
- ➢ The rate at which organisms suspended in the air are removed;
- ➢ The type of surfaces and their orientation (choice of material and design consideration);
- ➢ The strategies for cleaning and disinfecting surfaces in patient-care areas.

Cleaning and the quality of hospital food are core services provided by the facilities management department, and in the public consultation that preceded the publication of the NHS Plan, it was acknowledged that the public ranked them as high priority services that they want to see improved (Department of Health, 2000). In recognition of this high ranking, the NHS allocated over £30 million to hospital trusts to improve hospital cleaning, and an extra £10 million to improve hospitals' food and for other initiatives focused on cleaning and catering services (Department of Health, 2000; Pg.46-47). Upon receipt of this amount each NHS Trust set up a system for assessing current standards of cleanliness, tidiness and general decoration, plus other factors that contribute to the patient environment, including support services, car parking, furniture and food (Tyson, 2002). Hence, it could be argued that the clean hospital programme in the 21st century began in July 2000 when the Government allocated these funds to start this campaign in the NHS.

> *Clean and safe environment for healthcare is a key*
> *priority for NHS and is a core standard for better health*
> (The National Patient Safety Agency, 2007- Pg. 5).

The NHS plan encouraged non-governmental agencies to introduce initiatives and publications centred on good practice protocols that focus on collective strategies to achieve the targets set in the plan. Prominent among these non-governmental initiatives is that developed by the Infection Control Nurses Association - "the Audit Tools for Monitoring Infection Control Standard" (Infection Control Nurses Association, 2005).

The NHS plan also advocated a role of ward housekeeper, who would be "ward-based", to ensure that the basics of the care environment were right for patients (Department of Health, 2000). The role could be seen as a coordinated approach to achieving excellence in the way healthcare-associated infections are controlled, as well as achieving other objectives in the

constitution. Among other responsibilities, the ward housekeeper is mandated to ensure that cleaning, food services and maintenance are delivered to the appropriate standards, and that the care environment is suitable for patients, staff and visitors (NHS Estate, 2001). The ward housekeeper is perceived to be a "link person" between the healthcare facilities manager, the ward sister and other clinicians and non-clinicians in the ward (Figure 2.9). The introduction of the ward housekeeper was welcomed as a worthwhile strategy for reducing the potential for the tension and conflict of the "us and them" (clinicians and non-clinicians) relationship in the healthcare environment, which could hinder the achievement of the objectives outlined. It could be argued that the introduction of the ward housekeeper was an initiative in keeping with the founding principles of the National Health Service, and informed by a non-clinician services perspective of facilities management service delivery practice in the area of cleaning, catering and maintenance of the care environment.
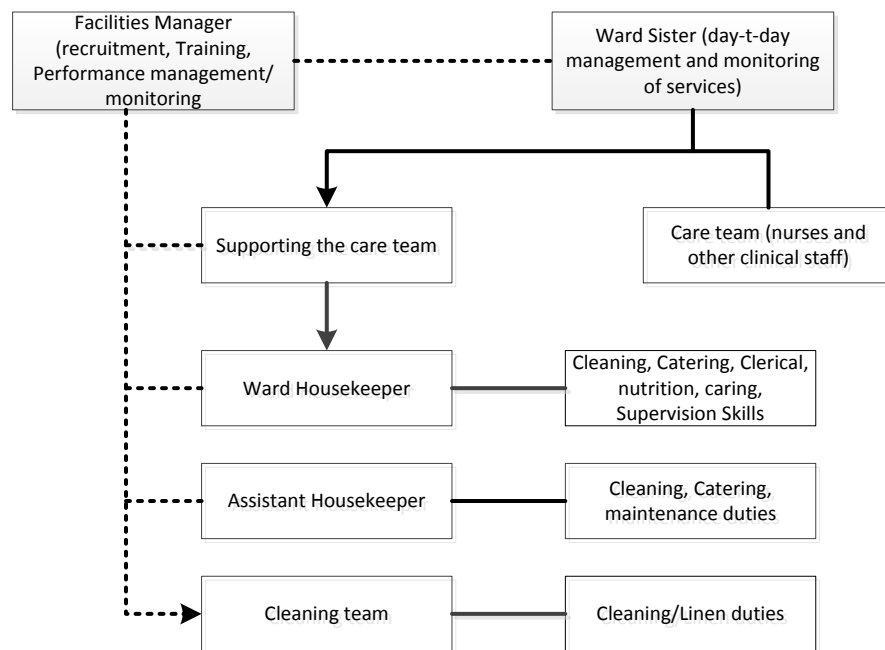
Figure 2.9: The ward housekeeper task (adapted from NHS Estate, 2001)

Previous publications focused on sensitising stakeholders to the continued burden of healthcare-associated infections, and the need for alternative management approaches to overcome the dynamism of microorganisms' resistance to existing infection prevention strategies (May & Pitt, 2012). Hence, a more targeted and robust system referred to as patient-led assessments of the care environment (PLACE) was introduced in 2013 to replace the old Patient Environment Action Team (PEAT) that was first introduced in 2000. The introduction

of PLACE and the obligation on all NHS care service providers to implement it in the assessment of non-clinical services among which facilities management services are paramount can be hypothesised to further buttress the continued recognition of the relevance of the discipline in the control of healthcare-associated infections.

In the Chief Nursing Officer for England's (Jane Cummings) letter to NHS leaders during the introduction of PLACE in 2013, the need for healthcare environmental cleanliness was emphasised (NHS England, 2013a). It was stated in the letter that "good environment matters and patient should be cared for, not only with compassion and dignity but also in a clean and safe environment"(NHS England, 2013a).

2.8.2.2. Waste Management

It is disturbing that in 2016, 16 years after the publication of the NHS Plan, the initiative to introduce patient-led assessments of the care environment still aims at providing motivation for improvement to optimise the cleanliness of the care environment.

The Royal College of Nursing (2014) defined healthcare-waste as waste produced by an organization providing health and social care, or in a person's own home where healthcare is being provided. From a similar perspective, the World Health Organisation (2014) elaborated the scope of this, and defined healthcare waste as waste generated within healthcare facilities, research centres and laboratories related to medical procedures. Healthcare waste is generally classified into two broad categories, namely domestic and clinical waste, also referred to as hazardous and non-hazardous waste (Royal College of Nursing, 2014; World Health Organisation, 2014; Auditor General of Scotland, 2001). Non-hazardous waste is waste that has not been in contact with infectious agents such as hazardous chemicals or radioactive substances and does not pose a sharps hazard (WHO, 2014). Different types of healthcare facilities are viewed and classified as major or minor sources of healthcare waste depending on the amount of waste they generate (World Health Organisation et al., 2014). Clinical waste, on the other hand, is defined as any waste which consists wholly of human and animal tissue, blood or other bodily fluids, excretions, drugs, pharmaceutical products, swabs/dressings, syringes, needles or other sharp instruments or substances containing viable microorganisms or their toxins which are known or reliably believed to cause disease in man or living organisms (RCN, 2014; Department of Health, 2013a). Thus, medical waste requires careful disposal and containment before collection and consolidation for treatment.

The World Health Organisation, (2014) recommended that waste should always be assumed to potentially contain a variety of pathogenic microorganisms. This is based on the fact that the presence or absence of pathogens cannot be determined at the time waste is produced and discarded into a container. This perception was reinforced by the research conducted by the Royal College of Nursing (2014), which showed that a large quantity of healthcare waste is classified as infectious and therefore hazardous. Hence, the effective management of healthcare waste, including its safe storage, transportation, treatment and disposal is essential for the health and safety of patients, staff and visitors, and in order to maintain environmental standards (Karagiannidis, 2012). This is a further argument for the importance of adequate facilities management practice in the control of healthcare-associated infections.

2.8.2.3. Service Level Agreements (SLAs)

Facilities management services cover an extremely wide range of activities that are dependent on the sector, organizational structure, and the business focus of the organization (Atkin & Brooks, 2002; British Institute of Facilities Management, 2004, 2014).The scope of facilities management services is therefore often tailored to meet the particular objectives of the organization. Similar to the procurement strategy of facilities management in other sectors, Payne & Rees, (2000) noted that healthcare facilities management is provided by a virtual organization made up of groups of in-house and contracted (outsourced) service providers. Outsourcing is defined as the contracting-out of services that were previously performed in-house by an organisation; while in-house service provision invariably refers to the performance of services by direct employees of an organization (Walker, Knight & Harland, 2006). The pros and cons of the two forms of procurement of FM services are unclear and debatable, and dependent on the particular objectives of the organization. In order to bridge any perceived gap in service quality (SERVQUAL), i.e. where in-house service provision stops and contract service providers are engaged, it is imperative to include detailed standards of performance for individual services, including but not limited to response times, reporting and monitoring, liaison with other suppliers and specific details of deliverables.

In relation to the National Health Service (NHS) procurement route, the origin of outsourcing goes back to the day of then British Prime Minister Margaret Thatcher, who sought to reduce expenditure and diminish the power of the trade unions (Carley, 2012). The early 1980s saw the introduction of compulsory competitive tendering (CCT), which forced public sector organisations like the NHS to put various services out to tender. Cleaning and catering

services, which were viewed as non-core, were among the first to be contracted out to external service providers (Carley, 2012; Walker et al., 2006). It is argued that the decision to outsource hospital cleaning services was the starting point for the growth of MRSA infections and subsequent concerns about hospital cleanliness. Notwithstanding, it is documented that the rationale for outsourcing services offered by most organisations was to enhance efficiency and competitive effectiveness, which could result in cost reductions (Walker et al., 2006). The plethora of policies and guidance documents focusing on cleaning services, coupled with media publicity on the increasing rate of morbidity and mortality attributed to poor compliance with existing preventative strategies for the control of HCAIs, offers further evidence of the imperative need for a useful knowledge management process to check actual performance against the contract deliverables in the areas of:

- ➢ Knowledge creation;
- ➢ Knowledge sharing;
- ➢ Knowledge transfer;
- ➢ The reuse of the captured knowledge.

A Service Level Agreement (SLA) is often expected to define detailed standards of performance for individual service deliverables that may or may not form part of the main contract (Wiggins, 2010). For example, a Service Level Agreement (SLA) in the Food Safety Act 1990 requires all healthcare establishments to comply with the food safety requirements and food hygiene regulations made under the Act (NHS Estate, 2002). An SLA is often used to verify standards and the performance of key activities or services. An SLA therefore:

- ➢ Provides an agreed quality and performance standard;
- ➢ Includes penalties for non-compliance;
- ➢ Forms part of the contractual arrangement;
- ➢ Could be internal or external to the organization; and
- ➢ Could be used in benchmarking activities.

Required service standards from external "hard" and "soft" facilities management service providers, including those described in the next section, are all anchored in the SLA.

2.8.2.4. Laundry services

Laundry in healthcare facilities includes bed sheets, blankets, towels, personal clothing, patient apparel, uniforms, scrub suits, gowns, and drapes for surgical procedures (Sehulster & Chinn, 2003). It is acknowledged that contaminated laundry and fabrics often contain high numbers of microorganisms from body substances including blood, skin, stool, urine, vomitus, and other bodily tissues and fluids (Report, 2007; Sehulster & Chinn, 2003). Contaminated laundry is defined as laundry which has been soiled with blood or other potentially infectious materials (OSHA, cited in CDPC, 2003). Disease transmission attributed to healthcare laundry has involved contaminated fabrics that were handled inappropriately (i.e. shaking soiled linen). It has been noted that Florence Nightingale, at the Crimean army hospital in 1850, succeeded in reducing the death rate resulting from cholera, typhoid and dysentery from 42% to 2% by providing new laundry and by better cleaning of equipment and the hospital environment (Dancer, 1999).

This further evidences the importance of this soft facilities management service interface and those earlier discussed in the control of exogenous HCAIs, and the need for effective good practice knowledge initiatives and management in healthcare environments. The next section provides a review of literature in this area in order to achieve the research aim and objectives.

2.9. The paradigm of knowledge and knowledge management: a literature review

Knowledge is a multifaceted concept with multi-layered meanings, and it can be argued that the history of philosophy since the classical Greek period can be regarded as a never-ending search for the meaning of knowledge (Ikujiro Nonaka, 1994). There are various definitions and taxonomies of knowledge from a variety of disciplines that have influenced and informed the field of knowledge management paradigms which have often made the concept of knowledge management that implies "development and growth" (Kakabadse, & Kouzmin, 2003). The chain of knowledge management can be seen as a sequence from data to wisdom (Figure 2.10).
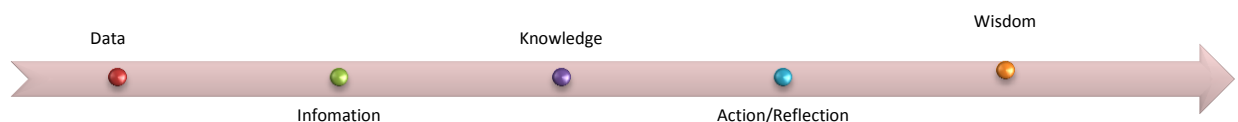
Figure 2.10:   The chain of knowledge (adapted from Kakabadse et al., 2003).

Activities are performed at each stage of the process of knowledge development in order to release the knowledge gained by the collection of data through observation of facts out of context, which may or may not be directly meaningful (Zack, 1999). Information emerges from the placing of data within some meaningful context, often in the form of messages. Through the evaluation and interpretation of information from the data gathered, one moves to a realization of knowledge that requires validation and internalisation, and a will to act and reflect in order to gain wisdom, which with experience grows towards strength, as illustrated in Figure 2.10 (Nilakanta et al., 2009; Zack, 1999). This leads to a definition of knowledge as a "justified true belief" that people value on the basis of the accumulation of meaningful and organised information (message) through experience, communication or inference (Gold et al., 2001; Ikujiro Nonaka, 1994). Knowledge is a creation of the interface of data and information. Information is seen as a flow of messages, and knowledge is said to be created and organised by the flow of information, anchored by the commitment and beliefs of its holder (Nonaka & von Krogh, 2009; Ikujiro Nonaka, 1994). Sheffield (2008) and Bergeron (2003) further suggest the metaphor of a taxonomy underlying the knowledge paradigm:

> **Data:** Raw facts and figures (numerical quantities) or other attributes derived from observation, experiment or calculation;

> **Information:** Data in context; Information is a collection of data and associated explanations, interpretations of textual materials concerning a particular object, event or process made meaningful by placing it in a context relevant to the recipient of that information.

> **Knowledge:** knowledge is information that is organised, synthesized or summarised to enhance comprehension, awareness or understanding. It is a transformation of information made meaningful

Because it is intangible, fluid, personal, elusive, invisible, immeasurable and an ever-changing concept, knowledge is acknowledged to be a difficult asset to manage (Gorelick, Milton & April, 2004). This has led to a variety of conceptual, philosophical and practical presentations of knowledge management and what it can deliver. Webb (1998) defines knowledge management as "the identification, optimization, and active management of intellectual assets to create value, increase productivity to gain and sustain competitive advantage". It is the management of intellectual capital and constitutes a systematic and organised process of identifying, capturing and transferring information in order to optimise

efficiency, ensure competitive advantage and spur innovation (Serban & Luan, 2004; Petty & Guthrie, 2000). Grayson (2012) and Dell et al. (1998) perceive knowledge management as a conscious strategy of getting the right knowledge to the right people at the right time. This includes helping people to share and put information into action in a way that strives to improve organisational performance.

Table 2.3: Varying professions perceptions of knowledge management (adapted from Kakabadse et al., 2003)

Discipline	Knowledge management descriptions
Social Science	Understanding motivation, people, interactions, culture, environment
Management Science	Optimising operations and integrating them within the enterprise
Information Science	Building knowledge-related capabilities
Knowledge Engineering	Eliciting and codifying knowledge
Artificial Intelligence	Automating routine and knowledge-intensive work
Economics	Determining priorities

Gorelick et al. (2004) see the concept of knowledge management as an activity that systematically and routinely helps individuals, groups, teams and organisations to:

➢ Learn what the individual knows;

➢ Learn what others know (e.g. individuals and teams);

➢ Learn what the organisation knows;

➢ Learn what you need to learn;

➢ Organise and disseminate this learning effectively, as well as supplying and applying the learning to new endeavours.

The National Health Service (NHS) in England has published a great deal of information in the form of policies, strategies and guidance as well as implementing structural changes across the NHS in the wake of the publication of *"The NHS Plan: a plan for investment, a plan for reform"* (Department of Health, 2000). These publications have further drawn attention to HCAIs, and encourage NHS hospitals to tackle infections, and especially those that are acquired from exogenous sources (NHS Commissioning Board, 2014; National Audit Office, 2004). Despite the perceived progress in terms of improvements and greater awareness which have resulted, there are concerns about the extent to which the good practice advocated in policies, guidance and strategies aimed at the control of HCAIs are

implemented (Health Protection Agency, 2012; National Audit Office, 2004). The acknowledgment that healthcare is a knowledge-driven sector presents a challenge and at the same time an opportunity, namely to harness the wealth of knowledge from within the different professionals in the infection control team for a targeted management approach to the control of HCAIs.

> *......Great deal has been written about the importance of knowledge management. Relative attention has been paid to how the knowledge is created, and not how the creation process can be managed* (Ikujiro Nonaka, 1994).

It is acknowledged that many knowledge management practices are in reality information management practices which are difficult to consolidate into innovative models (Judy & Ghosh, 2007; Gold, Malhotra & Segars, 2001). This has resulted in continuing efforts to progress beyond information management to the complex realm of knowledge management activities, with the development of structures that allow the organisation to recognise, create, transform and distribute knowledge (Gold et al., 2001). These activities are now vital in the healthcare sector, as there are concerns that the knowledge accumulated is greatly under-utilised (Riano, 2008). Sheffield (2008) characterised healthcare knowledge in terms of its relationship to the three conceptual domains of personal learning, communities of practice and the exercise of technical (technology) expertise. The importance of managing the wide spectrum of these constituent parts, as well as the potential benefits of their management interface in tackling the prevalence of HCAIs, could be hypothesised to have led to a cultural shift away from the traditional knowledge management paradigm. This could further be argued to have led to the increasing application of contemporary knowledge management systems and processes in healthcare facilities management with the aim of optimising opportunities for the sustainable management of the prevalence of HCAIs in hospitals (Figure 2.12).

The knowledge management paradigm is categorised into the areas of knowledge management processes (KMP) and knowledge management systems (Ghosh et al., 2006). Knowledge management processes include knowledge creation, knowledge sharing and knowledge usage (Figure 2.11); knowledge management systems include the systems, policies, processes and procedures used to manage the creation, storing, sharing and reuse of knowledge (Ghosh et al., 2006). Knowledge management systems are facilitated by the

organisation's knowledge infrastructure capabilities, which include its prevailing culture, structure and technological capabilities (Gold et al., 2001).
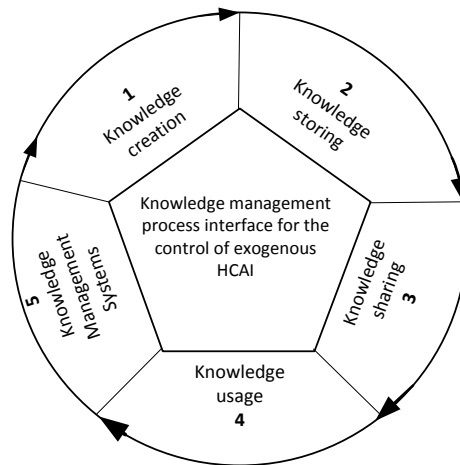
Figure 2.11:   The wheel of knowledge management (adapted from Judy & Ghosh, 2007)

Knowledge is created either tacitly or explicitly or a combination of both (Ikujiro & von Krogh, 2009; Davenport & Glaser, 2002; Gold et al., 2001; Ikujiro, 1994). These two dimensions of knowledge differ on the basis of whether the knowledge is embedded, or has been transcribed into a second or third party element. Duffy (2000) and Nonaka & Takeuchi (1995) define tacit and explicit knowledge as follows:

> ➢ Tacit knowledge is non-verbalised, intuitive, and unarticulated. It resides in human mind, behaviour and perception. It evolves from people's interactions and requires skills and practice to acquire. On the other hand, explicit knowledge is structured, expressed in writings, drawings and documents. It can also be captured and shared through information technology.

At the early stages of information creation, further to the synthesis of collated data, knowledge is created through action or continuous interaction between an interpretive framework of the individual processing the knowledge (tacit) and data (explicit), and is a support and value adding processes (Hou, 2012; Ikujiro Nonaka, 1994). Tacit knowledge is personal, hidden, undocumented and context-sensitive, and cannot easily be represented via electronic media (Ikujiro Nonaka & Takeuchi, 1995). It is dynamically created, derived, internalised and experienced-based (Duffy, 2000; Ikujiro Nonaka & Takeuchi, 1995). Explicit or codified knowledge is transmissible in formal and systematic language. The interface of

these knowledge dimensions is typified in both the knowledge management process and the knowledge management system (Figure 2.12).

It could be inferred that the chain of knowledge creation begins with the routine collection and presentation of data, and then progresses through the manipulation and codification of information to understanding. This is then viewed through a tacit or explicit lens, and is sufficiently pliable to be interfaced with knowledge management processes and organizational infrastructure capabilities, including the will to act and reflect on the protocols (one's practice). Wisdom is then achieved and continues to be nurtured (Figure 2.12). Within these contexts, wisdom is described as a dialectical integration of all aspects of the personality including will, cognition and life experience (Zack, 1999).
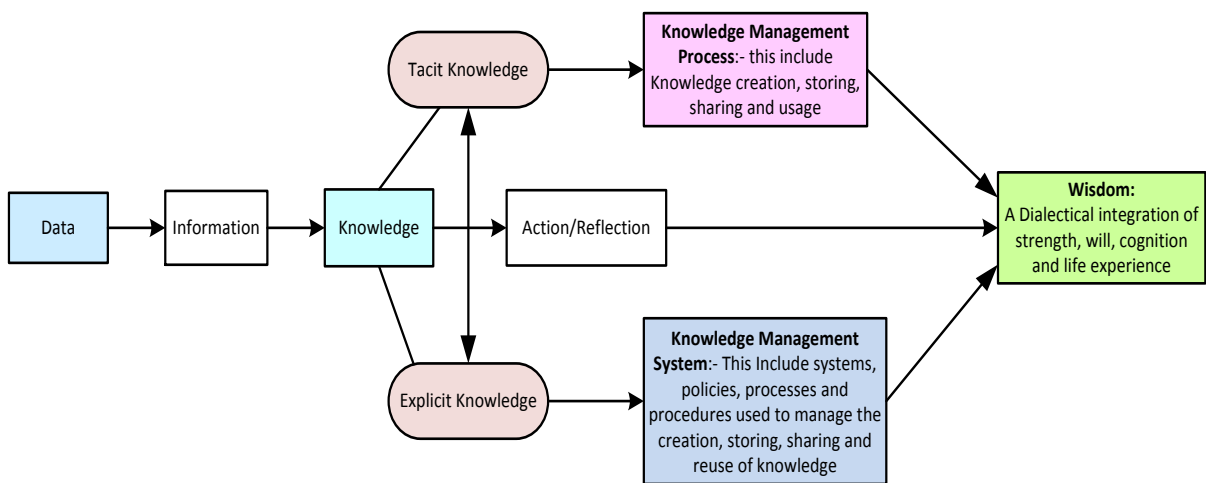
Figure 2.12:   The chain of knowledge management (adapted from Scott, & Ghosh, 2006; Kakabadse et al., 2003)

The next section explores the interface of knowledge management processes and knowledge infrastructure capabilities in the control of exogenous HCAIs in facilities management cleaning services.

2.10. The knowledge management process in facilities management services for the control of HCAIs

This discussion suggests that the quest to move beyond information management to the realm of knowledge management is a complex undertaking involving the development of structures that allow the organization to reorganize, create, transfer, and distribute knowledge (Gold et al., 2001). Efforts to drive good practice knowledge in the control of HCAIs have been

backed by a great many infection control guidelines and documents, including policies, specifications, and systems since the publication of the NHS Plan in 2000. According to Gold et al. (2001), many taxonomies are used by researchers to describe knowledge management processes oriented towards obtaining knowledge, including:

- ➢ Knowledge capture, transfer and use;
- ➢ Acquire, collaborate, integrate and experiment;
- ➢ Create, transfer, assemble, integrate and exploit;
- ➢ Create, transfer and use;
- ➢ Acquisition, conversion, application and protection.

Healthcare delivery is a complex and dynamic process involving a multidisciplinary team. It is acknowledged to be an activity in which different professional groups, broadly classified into clinicians and non-clinicians, congregate and engage in collaborative practice to achieve set objectives (Nicolini et al., 2008; Nilakanta et al., 2009; Sheffield, 2008). Each of these groups often exhibits both tacit and explicit knowledge in their contribution to contemporary issues, and in promoting the relevance of their respective professional practice. According to Scott & Ghosh (2006), the dynamic context of knowledge is a set of inherently human processes to justify personal beliefs. There are various types of healthcare knowledge and modalities from which knowledge is created and employed to support the management of healthcare facilities cleaning services for the control of exogenous HCAIs. Within the context of this research, 'types' of healthcare knowledge refer to the orientation and domain of knowledge, while 'modalities' of healthcare knowledge are the representational media in which knowledge exists (Riano, 2008). Types of healthcare knowledge that are explored and directly contribute to facilities managers' knowledge for the control of HCAIs include:

- ➢ **Patient knowledge:** this encompasses the knowledge of the patient's healthcare status that is captured by direct observations of the patient and inferences drawn by clinicians or physicians, captured, and recorded in the patient's medical record. The sources of exogenous healthcare-associated infections is acknowledged to include surfaces of inanimate objects in healthcare settings, patient contacts, and so on (Health Protection Agency, 2014). Patient knowledge provides a snapshot of the patient to the facilities management team and guides them in establishing a targeted and strategic patient surrounding cleaning care plan for the control of exogenous HCAIs.

➢ **Practitioner knowledge:** this encompasses the residual knowledge of healthcare practitioners acquired through active learning, internship, observation and experience, which they draw on while discharging patient care. This knowledge enables the facilities management team to take into consideration other stakeholders associated with the safe management of the facilities in the control of exogenous HCAIs.

➢ **Resource knowledge**: this refers to the overall knowledge of the quantified care delivery resources and infrastructures available particularly to the facilities manager within the healthcare setting. This provides both clinicians and the facilities management team with up-to-date knowledge of available resources, including support staff, hospital beds, nurses, surgical and non-surgical facilities, and medical and non-medical devices, when performing their duties. Riano (2008) emphasises the relevance of resource knowledge in the healthcare setting as a means to enhance performance and the quality of service delivery for the targeted control of exogenous HCAIs.

➢ **Process knowledge**: this relates to knowledge of the organisation's standardised way of healthcare delivery and patient care, whilst addressing pragmatic considerations such as available resources (Riano, 2008). It is the understanding of the institution-specific pathways or workflows that determine the stipulated discourse for specific condition within the healthcare setting, and how this could enhance or inhibit the control of exogenous HCAIs through FM cleaning services.

➢ **Healthcare organizational knowledge**: this refers to knowledge of the organisational structure and the policies exercised by the healthcare institution (Riano, 2008). It entails the understanding of information and knowledge flows within the organization. This includes knowledge of:

  ➢ How information flows from one source to another within the organization;
  ➢ Who is required to report to whom;
  ➢ The decision-making hierarchy;
  ➢ The composition of the care team;
  ➢ The roles and responsibilities of the different healthcare team members;
  ➢ How to make and respond to information requests.

This type of knowledge is vital for the healthcare facilities management team when deploying resources that need to be aligned to healthcare policies and procedures in the control of exogenous HCAIs.

➢ **Relationship knowledge**: this type of knowledge involves an understanding of the communication mechanisms and contacts between multiple departments and institutions for the purpose of knowledge sharing. It helps the facilities manager to know who can be approached to seek a solution for a specific problem, and who can provide critical opinions to help overcome the challenges of controlling exogenous HCAIs.

➢ **Measurement knowledge**: measurement knowledge helps the facilities manager to ascertain whether the knowledge management solution chosen is achieving the desired result. Riano (2008) notes that measurement knowledge helps to:

    ➢ Set meaningful performance, efficiency and safety benchmarks;

    ➢ Measure the things that really matter as opposed to needless indicators;

    ➢ Understand the results presented in different healthcare contexts;

    ➢ Intelligently analyse the data presented.
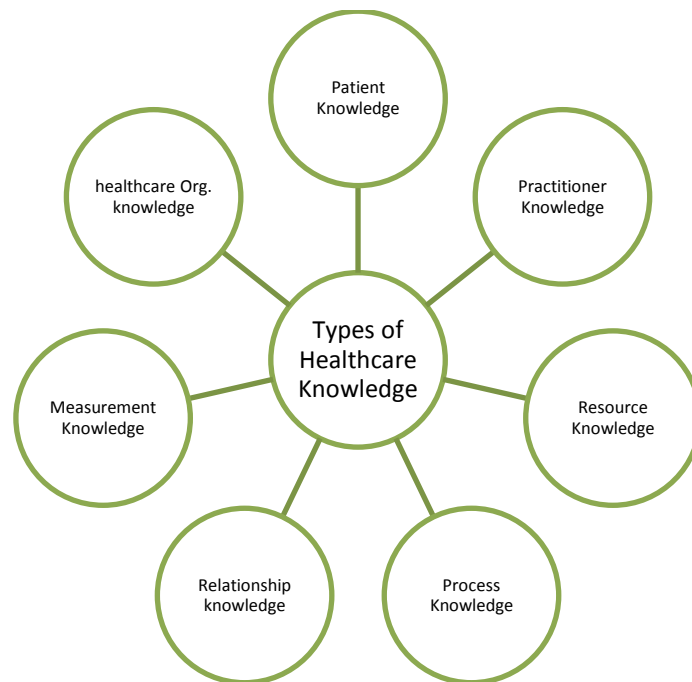
Figure 2.13:   Types of healthcare knowledge (adapted from Riano, 2008)

These types of healthcare knowledge are a representation of a range of knowledge modalities which captures knowledge types as healthcare knowledge artefacts (Riano, 2008). Healthcare knowledge artefacts are objects that allow for knowledge to be captured and communicated independently of the knowledge holder. The data captured at source are raw facts and figures which are processed into information and transformed into a meaningful context to be delivered to the recipient to store as knowledge (Riano, 2008; Sheffield, 2008). Healthcare knowledge artefacts can be structured, semi-structured or unstructured, and include documents, healthcare records, knowledge repositories, communication between peers through social media (emails, Facebook, blogs, LinkedIn, etc) as well as care workflows (Riano, 2008).

The effective management of these knowledge types provides the functionality to achieve a specified task or address the knowledge gap inherent within the healthcare delivery process, specifically in the control of exogenous HCAIs (Ghosh et al., 2006; Riano, 2008). Some healthcare knowledge modalities identified for the conveyance and sharing of healthcare knowledge include:

➢ **Tacit knowledge of practitioners or other professionals:** this is the personal knowledge of the individual that is acquired when the individual evaluates objective information against previous knowledge, then incorporates it into his or her current knowledge and manifests it through problem solving skills, judgment and intuition (Riano, 2008; Sheffield, 2008). It is rooted in action, experience and involvement in a specific context. It comprises the cognitive elements of mental model, belief, paradigm and viewpoints, and the technical element of the crafts and skills which apply to a specific context (Sheffield, 2008).

➢ **Explicit knowledge**: this is codified, articulated and communicated knowledge acquired from literature, policy documents, guidelines and case studies, etc., (Riano, 2008; Sheffield, 2008; Ikujiro, 1994).

➢ **Collaborative problem-solving discussion knowledge:** this type of knowledge is created by individuals, as an organization cannot create knowledge (Ikujiro Nonaka, 1994). It is created through continuous dialogue between practitioners and other professional staff (Riano, 2008; Ikujiro, 1994). The interaction between individuals and healthcare institutions is noted to contribute to the amplification and development of new knowledge and concepts, and could be facilities managers adapting

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management strategies to combat the emerging threat of infection-causing bacteria in healthcare settings.

➢ **Operational policies**: This is organization-created data that is stored in print and electronic systems. This knowledge modality is associated with the explicit knowledge paradigm. It is a type of knowledge that is embedded in material resources and focuses on making available potentially useful information to the targeted group, as well as facilitating the assimilation of the information to achieve the organisation's objectives in the control of exogenous HCAIs.

Figure 2.14:   Healthcare knowledge modalities (adapted from Riano, 2008)

The facilities management discipline offers a wide spectrum of inclusive services that cover needs across the entire continuum of the healthcare service delivery process (Keith, 2007; Barrett & Baldry, 2003). The inherent gaps in healthcare knowledge have been acknowledged to be an impediment to the curtailment of the prevalence of HCAIs over the years (World Health Organisation, 2011). The characterization of healthcare knowledge types and modalities provides an understanding of both the sources and the pragmatic nature of healthcare knowledge. This allows for the optimisation of the functionality of healthcare facilities in addressing the knowledge gaps inherent in the healthcare delivery process for the control of HCAIs (Riano, 2008; World Health Organisation, 2011). This draws on the healthcare infrastructure capabilities relative to the prevailing culture, structure and technological knowledge infrastructure capabilities grouped under the explicit knowledge dimension (Ghosh et al., 2006; Gold et al., 2001).

The next section explores these capabilities.

2.10.1. **Hospital healthcare knowledge infrastructure capabilities**

The management of healthcare knowledge and modalities is facilitated within healthcare knowledge infrastructure capabilities in the context of the hospital's prevailing culture, structure and technological capabilities. The overlap between these capabilities provides a platform for developing high-level services that provide for the operationalization and utilization of strategies in the control of exogenous HCAIs. According to Gold et al. (2001), it is necessary to identify and assess these capabilities for the effort to flourish. The interface of capabilities enables the maximization of social capital, which is "the sum of actual and potential resources embedded within, available through, and derived from the network of relationships possessed by social a unit" (Gold et al., 2001).
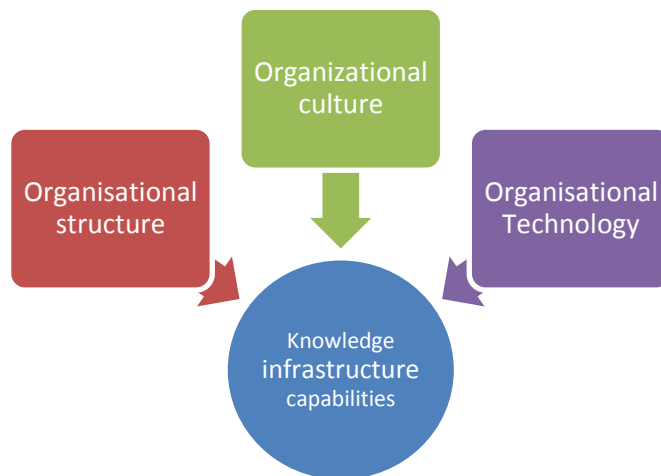
Figure 2.15:   Organizational knowledge infrastructure capabilities (adapted from Judy & Ghosh, 2007; Gold et al., 2001)

The exponential growth in the scientific understanding of diseases and the changing nature of healthcare facilities design to meet care delivery standards in the 21st century, as well as the challenges of emerging strains of infection-causing microorganisms, continue to present a challenge to healthcare facilities managers in the control of exogenous HCAIs (Cameron, 2014; Clancy, 2013). Compared to generic knowledge management in FM service delivery in other sectors, knowledge management practice in the healthcare sector is systematically more complex and challenging (Clancy, 2013; Codinhoto et al., 2009). As a consequence, the importance of good practice knowledge management in healthcare facilities for the control of exogenous HCAIs continues to be emphasised. This is against the backdrop of an

understanding that knowledge management capabilities provide opportunities for improvements in processes and performance (Nilakanta et al., 2009). Clancy (2013) acknowledges the challenge of using the knowledge gained from the infection control tools adopted to combat the prevalence of HCAIs in healthcare settings. These challenges are attributed to the complex design of the healthcare facilities environment in terms of layout and ease of access for appropriate cleaning.

Findings from the survey conducted by Mattner et al., (2006) (*"Knowledge of nosocomial infections and multi-resistant bacteria in the general population: results of a street interview"*) indicated that knowledge of the way healthcare-associated infections are transmitted is a precondition for the prevention and management of the spread of HCAIs. In another survey conducted by Miller & Farr (2006) to determine the knowledge of HCAIs among recently discharged patients, it was discovered that 62% of these patients were dissatisfied with the information they had received about HCAIs while in hospital.

With increasing demographic challenges and the emergence of new strains of infectious bacteria that are resistant to antibiotics, there is a need to adequately sensitise those accessing and working for the NHS to the prevention of risk associated with acquiring HCAIs (Cameron, 2014; Clancy, 2013). In the report of the World Health Organisation (2011),*"Report on the Burden of Endemic Health Care-Associated Infection Worldwide"*, it was acknowledged that huge gaps still exists in the knowledge accumulated over the past decades from using the various good practice and compliance monitoring strategies used in relation to HCAIs. These gaps are greater in poor resource settings, which has resulted in breaches in infection control measures that undermine advances and investment made in the management and control of HCAIs over the years.

The facilities management service discipline continues to bear the burden of the challenges associated with the management and reuse of accumulated good practice knowledge in healthcare environmental management for the control of exogenous healthcare-associated infections. This is evidenced in the continuing government publications focusing on contemporary strategies for the maintenance of hospital environmental cleanliness (Berwick, 2013; Department of Health, 2004a; Health Protection Agency, 2012a). At the vanguard of the current guidance documents since the publication of the NHS plan is the Patient Environment Action Team (PEAT) inspection (Department of Health, 2000). PEAT was established to measure standards in several areas, including environmental cleanliness,

through routine inspection of care environment tactics (National Health Service England, 2012; Jeanes, 2005). It could be hypothesised that the growing literature linking hospital environments to the prevalence of HCAIs, together with the emergence of antibiotic-resistant bacteria, led to the replacement of PEAT by the Patient-Led Assessment of the Care Environment (PLACE) (NHS England, 2013a; Bean, 2013; Gillespie et al., 2012; Dancer, 2009, 2011; Cantrell, 2010). One of the explicitly stated aims of PLACE is to "provide motivation for improvement" (NHS England, 2013a). Other Department of Health (England) publications that are particularly relevant to facilities management service delivery practices for the control of exogenous HCAIs further to the publication of the NHS Plan include those listed in Table 2.4.

> *"FM's understanding of the key values and culture of their organisation is a critical component for not only communicating effectively, but also engaging across the business".* BIFM, 2016

Table 2.4: Some FM cleaning services-focused guidance documents for the control of HCAIs
published since the NHS Plan

Document Name	Publisher/year of publication	Policies	Guidance	Strategy
Getting Ahead of the Curve - A Strategy for Infectious Diseases	Department of Health, 2002			√
Winning ways: Working Together to Reduce Healthcare-Associated Infection in England	Department of Health, 2003		√	
Improving patient care by reducing the risk of hospital acquired infection: A progress report	National Audit Office, 2004		√	
Saving Lives: A delivery programme to reduce healthcare-associated infection including MRSA	Department of Health, 2005	√		
Essential Steps to Safe, Clean Care: Reducing Healthcare-Associated infection	Department of Health, 2006		√	
The national specifications for cleanliness in the NHS: A framework for setting and measuring performance outcomes	National Patient Safety Agency, 2007		√	
Clean, Safe Care: Reducing infections and Saving Lives	Department of Health, 2008b		√	
Reducing Healthcare-Associated Infection in Hospitals in England	House of Commons Public Account Committee, 2009	√		
Essential Standards of Quality and Safety	Care Quality Commission, 2010		√	
Health Building Note 00-01 - General design Principles	Department of Health, 2010		√	
Prevention and control of healthcare-associated infections (HCAI) in secondary care setting	Department of Health, 2011b		√	
Guidelines for the management of norovirus outbreaks in acute and community health and social care settings	Health Protection Agency, 2012		√	
Patient-Led Assessments of the Care Environment (PLACE)	NHS England, 2013a		√	

As paramount support service providers to hospitals with the responsibility of maintaining environmental cleanliness, healthcare facilities managers need to understand the knowledge management interface of available infection control policies, processes and procedures (3Ps) within the context of the hospital knowledge infrastructure capabilities in order to manage HCAIs in a targeted and sustainable way (BIFM, 2015; Alexander, 2007). Additionally, the need to promote collaborative processes for identifying and accessing existing implicit and explicit knowledge among clinician and non-clinician (facilities management team) members

of the infection control team has been emphasised (Andrew & Streifel, 2007; Judy & Ghosh, 2007). This will potentially reduce fragmentation and enhance mutually supportive links between theory and practice, as well as creating a pathway for the exploration of new knowledge opportunities. It will also provide environments which enable experimentation with the acquired knowledge for the control of HCAIs, specifically those from exogenous sources. All these enabling factors will be enhanced or inhibited by the interface of the organization knowledge infrastructure capabilities (Gold et al., 2001; Ikujiro Nonaka, 1994).

The management of healthcare knowledge and modalities is facilitated within the healthcare knowledge infrastructure capabilities in the context of the prevailing culture, structure and technological capabilities of the hospital. The overlap between these capabilities provides a platform for developing high-level services that provide for the operationalisation and utilization of strategies for the control of exogenous HCAIs.

2.11. **Chapter summary**

This chapter presents findings from the review of literature pertinent to the research area in order to gain theoretical insights into the research subject domain. Findings from the literature show that facilities management cleaning service delivery has the potential to optimise the efficiency of healthcare facilities in the control of exogenous healthcare-associated infections.

In the light of themes consistently dealt with in the literature and discussed in this chapter, the following conclusions can be made:

➢ There have been a great number policies and guidance documents on the control of exogenous HCAIs in facilities management services in NHS hospitals since the publication of the NHS plan;

➢ There is a recognition of the inherent challenges to the full realisation of healthcare facilities management knowledge capabilities for the control of healthcare-associated infections, relating especially to the seamless integration of clinician and non-clinician workflows;

➢ There is a recognition of the lack of a process for reviewing process the accumulated knowledge gained from the use of good practice protocols in hospital facilities cleaning services to assess and allow for the reuse of this knowledge for the sustainable and targeted control of exogenous HCAIs;

- There is anecdotal evidence of the costs of HCAIs as a consequence of compromises in FM service delivery practice. However, the socio-economic impact is acknowledged;
- There is also increasing evidence of a link between dirty hospital environments and the prevalence of HCAIs, and of how enhanced hospital environmental cleaning regimes curtail the prevalence of HCAIs.

This chapter has also provided an overview of the UK National Health Service (NHS) as the context of this research.

The next chapter (3) presents a conceptual framework depicting the key elements of the knowledge management process and components of knowledge infrastructure capabilities. The anticipated outcome of this interface is an effective knowledge management framework to assist in the control of exogenous HCAIs through facilities management cleaning service delivery practice in NHS hospitals.

Chapter 3.   **A CONCEPTUAL FRAMEWORK**

3.1. **Introduction**

Further to the theoretical findings from the synthesis and review of the literature in the preceding chapter, this chapter offers a conceptual framework that depicts hospital infrastructure capabilities and knowledge process management prerequisites for the control of exogenous healthcare-associated infections through facilities management cleaning service delivery. The framework provides a roadmap for this research to achieve the research aim and objectives.

3.2. **Overview**

It is anticipated that the outcome of this research will assist hospital facilities managers and infection control teams to formulate local bespoke good practice protocols for infection control which target those infections acquired from the hospital environment. It is also anticipated that the framework will provide hospital infection control teams with the parameters within which informed judgments may be made in their investigation of outbreaks of infection in their hospitals.

The research examines the issues of effective knowledge management in healthcare facilities management for the control of exogenous healthcare-associated infections from the perspective of hospital capabilities. The literature suggests that such a perspective, encompassing a knowledge infrastructure consisting of culture, structure and technology capabilities, along with a knowledge management process involving the creation, storing, sharing and usage of knowledge, is an essential hospital precondition for effective knowledge management in facilities management cleaning service delivery for the control of exogenous HCAIs. This research draws on the discussion of the literature to identify the key influences in the infection control good practice guidelines, policies and systems.

3.3. **Conceptual frameworks**

A conceptual framework is defined as a network or "plan" of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena (George et al., 2011). According to Miles & Huberman (1994), a conceptual framework explains either

graphically or in narrative form the main things to be studied, the key factors, constructs or variables, and the presumed relationships among them. It includes ontological, epistemological and methodological assumptions (George et al., 2011). The ontological assumptions relate to knowledge of "the way things are," "the nature of reality," "real existence" and "real action" (Guba & Lincoln, 1994). The epistemological assumptions relate to "how things really are" and "how things really work" in an assumed reality, while the methodological assumptions relate to the process of building the conceptual framework and assessing what it can tell us about the real world (Guba & Lincoln, 1994).

According to Jabareen (2009), a conceptual framework specifies who and what will and will not be studied. It provides an interpretive approach to the understanding of social reality. The focus of this study is to develop a conceptually effective knowledge management framework for facilities management cleaning service delivery practice for the control of exogenous healthcare-associated infections in NHS hospitals. The initial conceptual framework is presented in Figure 3.1. The interface of the components of the proposed framework and how they address the research aim and objectives are discussed below.

3.3.1. The elements of the conceptual framework

Researchers and practitioners have proposed a wide variety of practices to support the creation, storage and propagation of knowledge within and across organizations. Some have proposed a single framework or model that seeks to categorise and integrate these practices on the assumption that the problem-solving process is a way of connecting knowledge and performance (Gray, 2001). Gray (2001) and Gold et al. (2001) both acknowledge that effective knowledge management can generate economic value when it is used to solve problems, explore opportunities and make decisions. Within the context of this research, it is assumed that understanding the contribution of knowledge management, and incorporating various elements of good practice knowledge management in healthcare facilities management through collaboration could lead to the development of a sustainable knowledge management framework in healthcare facilities cleaning service delivery practice for the control of exogenous HCAIs.

Bergeron (2011) and Judy & Ghosh (2007) both suggest that interrelated processes that could enhance effective knowledge management in organizations include:

- ➢ Creation

- ➢ Modification
- ➢ Use
- ➢ Archiving/storing
- ➢ Transfer/sharing
- ➢ Access
- ➢ Disposal

These processes could effectively enhance, promote and provide optimal, timely, effective and pragmatic knowledge which healthcare facilities managers require to address the good practice knowledge gaps for the control of exogenous HCAIs (Burnham, 1994; Riano, 2008).

In this research, it is assumed that effective healthcare facilities knowledge management processes for the control of exogenous HCAIs are anchored and driven by the three main components of knowledge infrastructure capabilities, which are prevailing culture, structure and technology capabilities (Figure 2.15). These components represent fundamental requirements for anchoring the management process, which comprises knowledge creation, storing, sharing and usage modalities, in facilities management cleaning service good practice knowledge for the control of exogenous healthcare-associated infections within NHS hospitals (see Section 2.2).

One core objective of the NHS constitution pledge is to "provide services from a clean and safe environment that is fit for purpose based on national best practice standard" (Department of Health, 2014; NHS England, 2013). The conceptual framework for knowledge management explains the theoretical basis of key elements deemed relevant in healthcare facilities management service delivery practice for the control of exogenous healthcare-associated infections in NHS hospitals
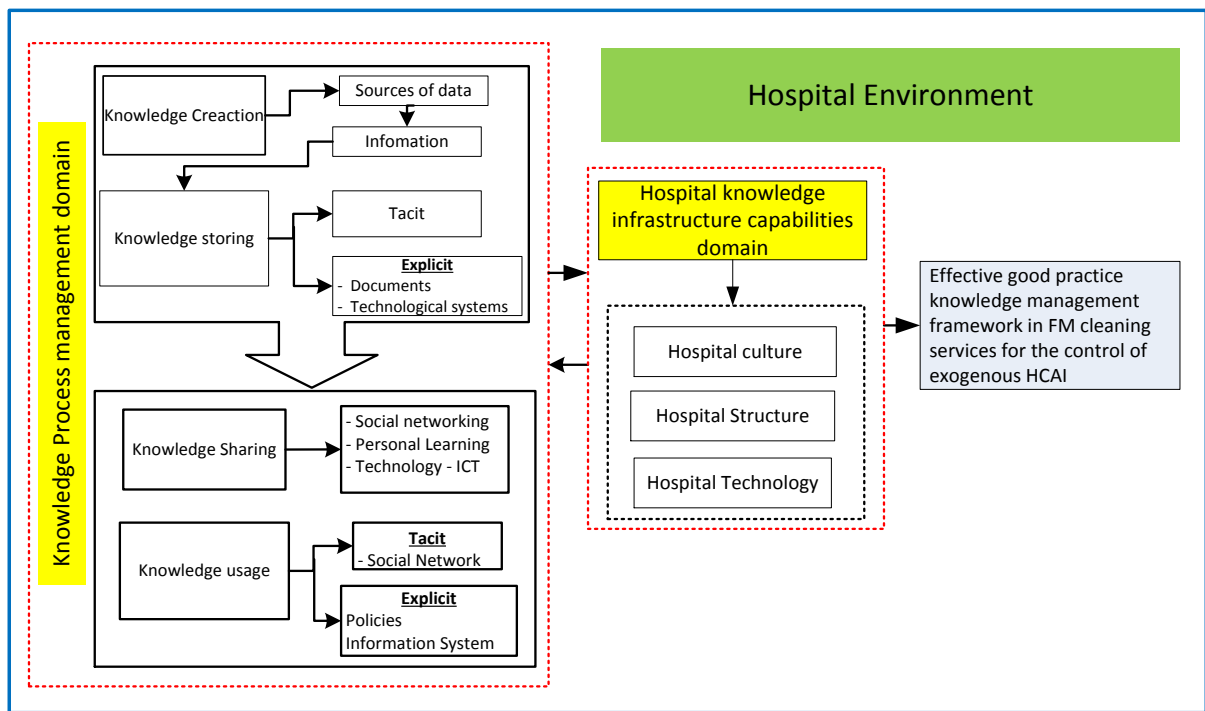
Figure 3.1: Conceptual framework for knowledge management in relation to exogenous infection control

Gold et al. (2001) acknowledge that knowledge is created through a generic process of combination and exchange, which entails the presence of social capital. Social capital refers to the sum of actual and potential resources embedded within, available through and derived from the network of relationships possessed by a social unit. In order to leverage knowledge management processes in an efficient manner and maximise this social capital, three key elements of infrastructure are needed, i.e., comprising of the prevailing cultural, structural and technological capabilities are needed to enable the maximisation of the social capital (Gold et al., 2001).

Within the context of this research, structural infrastructure capabilities refer to the presence of the norms and trust mechanisms shared within the contexts of the prevailing hospital cultural dimension. The technological dimension relates to the technological enablers that interface with the structural and cultural dimensions through the linkage of information and communication systems within the hospital in the control of exogenous HCAIs in FM cleaning services.

3.3.1.1. Knowledge Creation

> *Data are raw facts and figures…Information is processed*
> *data made meaningful by placing it in a context relevant*
> *to the recipient of that information…Knowledge is then*
> *information somehow transformed to make it more*
> *valuable than the original information* (Scotland, 2012).

The first element of the knowledge management processes in the framework is knowledge creation. Within the context of this research, this encompasses all the processes that are oriented towards the acquisition of knowledge, from the sourcing of data through to its transformation into the information that is used in the delivery of hospital cleaning services for the control of exogenous HCAIs. Gold et al. (2001) list many terms which have been used to describe this process, including acquire, seek, generate, capture and collaborate. All these terms is noted to have a common theme – the accumulation of knowledge (Gold et al., 2001).

3.3.1.2. Knowledge Storing

Healthcare knowledge phenomena are acknowledged to be inherently complex, multi-dimensional and value-laden (Scotland, 2012). Knowledge storing refer to those processes oriented towards making the created knowledge safe, and free from unauthorised interference within and outside the hospital environment. The management of explicit knowledge in hospitals, and specifically in healthcare facilities management, is facilitated by electronic record systems and other security-oriented processes designed to protect the knowledge from inappropriate or illegal use or from theft (Scotland, 2012; Gold et al., 2001). It is acknowledged that knowledge storing mechanisms are often linked, and built into technology infrastructure mechanisms to reduce heterogeneity, and allow for them to be used in different but interdependent units (Scotland, 2012; Gold et al., 2001). The tacit knowledge inherent in the individual is often governed by an employee code of conduct, which is an incentive to protect the stored knowledge (Gold et al., 2001). This research investigates the prevailing hospital knowledge storage capabilities that are essential for knowledge storing processes in the delivery of hospital cleaning services for the control of exogenous HCAIs.

3.3.1.3. Knowledge Sharing

The third aspect of the knowledge management process in the framework is knowledge sharing. This refers to those processes oriented towards making the created and stored knowledge appropriate, available and accessible to the various professionals who are likely to benefit from its use in the hospital environment (Gold et al., 2001; Gray, 2001). Because of the multi-disciplinary nature of the healthcare environment, knowledge sharing is unique in the healthcare environment, and vital to patient recovery outcomes (Scotland, 2012; Kagioglou & Tzortzopoulos, 2010). The collection and sharing of evidence-based good practice is an important and insightful step towards the control of exogenous HCAIs and the delivery of quality healthcare outcomes through facilities management cleaning services. There is a vast range of sources of information available in the healthcare environment. This often reduces the transparency of knowledge and can make good practice collaboration difficult among the multiple professions that are a feature of the healthcare environment (Scotland, 2012; Gold et al., 2001; Gray, 2001).

In the healthcare environment, patient recovery outcomes can be investigated from many clinician and non-clinician viewpoints, including psychological, biological and social perspectives. The psychological perspective relates to how people consciously and unconsciously interpret how they cope with their surroundings. On the other hand, the biological perspective has to do with how the human body reacts to different characteristics of the environment, while the social perspective focuses on how groups and individuals interact within specific settings (Lichtig, 2010). As a consequence of these influencing factors, and of the recognition of several contrasting theories which explain the same phenomenon in different ways, knowledge can often be sparse and fragmentated in healthcare environments (Scotland, 2012; Kagioglou & Tzortzopoulos, 2010; Codinhoto et al., 2009).

3.3.1.4. Knowledge Usage

The fourth element of the knowledge management processes in the framework is knowledge usage. This term is used and meant to encompass all the application and monitoring processes or systems that are oriented towards the actual use of the created, stored and shared knowledge in the most effective manner in the control of exogenous HCAIs (Gold et al., 2001; Gray, 2001). These include all the social networking or community practices, policies and technological processes that have been adopted or adapted and which reduce the redundancy of knowledge and enhance consistent use of good practice knowledge in the

delivery of facilities cleaning services for the control of exogenous healthcare-associated infections.

3.3.1.5. Hospital Culture

The fifth component of hospital knowledge infrastructure capabilities in the framework is the hospital culture. This is considered to be the most significant barrier to effective knowledge management (Gold et al., 2001). The literature suggests that the NHS is a brand that has attracted cosmopolitan specialist clinician and non-clinician professionals from across the globe (Alexander, 2007; Department of Health, 2003; NHS Commissioning Board, 2013; NHS England, 2014). As in other sectors, these specialists, as well as locally-based professionals working for the NHS, carry with them varying social (personal, religious and psychological) and economic predispositions. Harmonising these with the culture of the NHS to deliver healthcare services in line with the constitutional pledge continues to pose a challenge.

….. shaping culture is central in a firm's ability to manage
its knowledge more effectively (Gold et al., 2001).

Generally, the term culture is used to refer to the whole way of life in which people grow up or are cultivated (Pheysey, 1993). Within the context of this research, culture is taken as the hospital approach towards collaborative practice among clinician and non-clinician employees. This encompasses ensuring compliance and promoting initiatives that focus on the control of exogenous healthcare-associated infections. This component of knowledge infrastructure capabilities is relevant to both directly employed and contracted staff in relation to compliance with the infection control strategies adopted, and it is thus imperative to understand the dynamism of the hospital infection control team. This includes the human factor in complying with hospital infection control policies and procedures (National Audit Office, 2009). The report of the Controller and Auditor General states that "whilst staffs are more aware of good infection control practice, compliance is still not universal as some staffs still do not understand a clear link between their actions and healthcare associated infection." It was also recommended in the report that compliance with good infection control practice should be integrated into hospital trusts' ongoing approach to improving the quality of care and patient safety (National Audit Office, 2009).

3.3.1.6. Hospital Structure

For the purpose of this research, hospital structure relates to the departmental structures that are designed to facilitate the creation, storing, sharing and usage of good practice-centred knowledge across functional boundaries in the prevention and control of exogenous healthcare-associated infections. Departmental structure is seen as critical in leveraging functional units to achieve set objectives. Yet it can both inhibit or support collaboration, although the sharing of knowledge across internal boundaries is a practice which is noted to be vital for effective knowledge management (Gold et al., 2001; Gray, 2001).

3.3.1.7. Hospital Technological Capabilities

Within the context of this research, this term encompasses the information and communication capabilities of the hospital to leverage the knowledge management process. This includes devices used to facilitate the creation, storing, sharing and usage of good practice knowledge between clinician and non-clinician employees for the control of exogenous healthcare-associated infections in hospital settings. Technology is acknowledged to be an integral part of modern knowledge management processes (Bordoloi & Islam, 2012; Gold et al., 2001). Technology is seen as a key tool for engaging in active practices that capture and retain knowledge and making it available to employees who are seeking solutions to problems (Gold et al., 2001). This component of knowledge infrastructure capabilities is also acknowledged to determine how knowledge travels throughout an organization, including how knowledge is accessed and used in different but interdependent units in hospitals such as Accident and Emergency (A&E), and the facilities/estate and pathology departments.

Technology is considered to be the most influential component of knowledge infrastructure capabilities, as it anchors both the cultural and structural capabilities. It defines the tools and processes within the computing and web environment, leading to the development of effective knowledge management process capabilities.

3.4. Chapter summary

This chapter has presented the conceptual framework which was developed for the research on the basis of the synthesis and review of the literature. This conceptual framework contextualises the key gaps and considerations which have been identified as the research problems. The framework could be presented as **what** needs to be systematically organised to

support the fragmented tacit and explicit knowledge available in the hospital environment for the control of exogenous HCAIs in facilities management cleaning services.

The next chapter presents an in-depth discussion of the methodology adopted for this research, i.e., **how** the philosophical underpinnings are used to achieve the research aim and objectives. It provides a road-map for conducting this research in a way which achieves its aim and objectives.

Chapter 4.   **RESEARCH METHODOLOGY**

4.1. **Introduction**

The aim of this chapter is to outline the methodological process adopted to achieve the research aim and objectives. Building on preceding chapters, this chapter provides the basis for the design of the research questions used in the data collection stage. This includes the chosen research philosophy, methodology and research method. It also presents an elaboration of the techniques used to analyse the collected data, and a description of the ethical considerations an of the validation and triangulation processes to achieve the anticipated research outcome.

4.2. **Research methodology – a theoretical overview**

Research requires a systematic approach by the researcher regardless of what is being investigated and the methods adopted (Fellows & Liu, 2003). This provides the overall direction of the research including the process by which the research is constructed (Remenyi, Williams, Money & Swartz, 2005). Various terms have been used by different authors as the umbrella under which research processes are informed (Crotty, 2003; Wainwright, 1997). Sarantakos (2013) and Creswell (2009) use the term "worldview", while Blaikie (2010) refers to "broadly conceived research methodologies." Crotty (2003) prefers "epistemologies" and "ontologies", while Guba & Lincoln (1990) and Mertens (1998) both refer to "paradigms".

Saunders, Lewis & Thornhill (2012) define a paradigm as a way of examining social phenomena through which a particular understanding of a phenomenon can be gained and explanation attempted, while Guba & Lincoln (1994, p.105) define a paradigm as a basic set of beliefs (or theory). In another perspective, a research paradigm is presented as an overall conceptual framework within which research is undertaken - a theoretical framework which includes a system through which people view events (Remenyi et al., 2005; Fellows & Liu, 2003). Sarantakos (2013) presents it as a philosophical stance that informs the methodology, guides the process of research and provides an arena in which the logic and structure of the research is embedded.

Putting the above views into context, it could be inferred that research paradigms and research philosophy are an important part of the methodological process that help researchers to

achieve their aim and objectives through a structured approach (Saunders et al., 2012; Remenyi et al., 2005). They guide how the researcher makes decisions and carries out the research (Saunders et al., 2012).

The methodological process put forward by Kagioglou et al, popularly known as the "nested approach" (Kagioglou et al., 2000), is characterised by the paradigm of research philosophy, approaches and techniques grounded in the actor research philosophy of pre-understanding – understanding hermeneutic learning spiral (Figure 4.1). In this context, the research philosophy found in the outer ring energises and unifies the research approach with the research techniques found in the middle and inner rings of the model. The research process is thus said to consist of a dominant theory generation and testing method, while the research techniques comprise the data collection tools (Kagioglou et al., 2000).

RESEARCH PHILOSOPHY
Preunderstanding & Understanding

RESEARCH APPROACHES
Case study & Action research

RESEARCH TECHNIQUES:
Questionnaires, Interviews, Workshops & Literature reviews
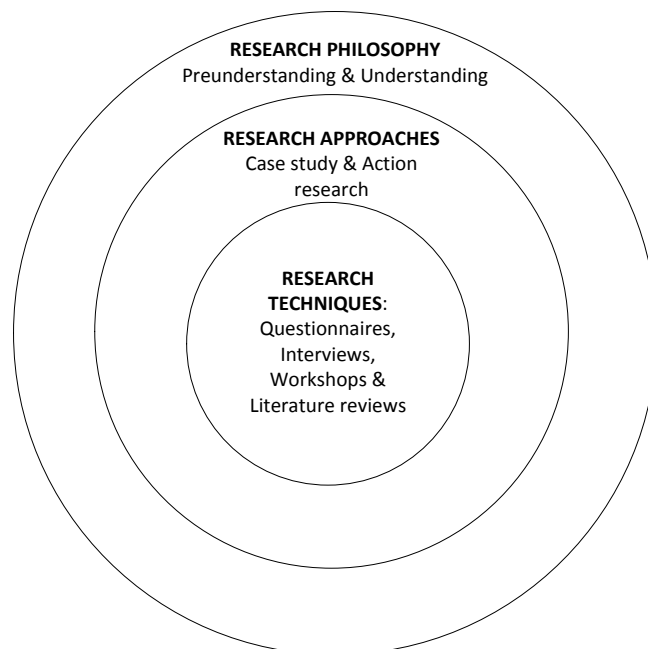
Figure 4.1:   The nested research process - adapted from Kagioglou et al., (2000)

In the research paradigm put forward by Crotty (2003), epistemology is described as a process of understanding and explaining how we know what we know. This further informs the theoretical perspectives that provide the framework for the methodology adopted from a range of methodological processes and the methods used to achieve a research outcome. In Crotty's narrative, a research paradigm from ontological perspective about the assumptions of the nature of reality was not considered prominent in the structure of the research paradigm.

Crotty argues that the interface between epistemology and ontology is wholly embodied in the epistemological paradigm.
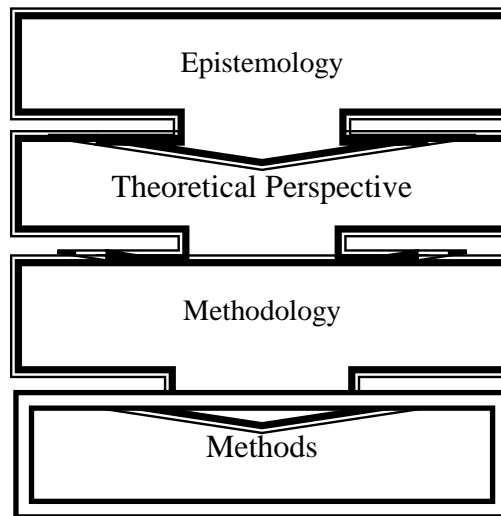
Figure 4.2: Research paradigm (Crotty, 2003)

In Crotty's view, the strategy, plan of action and design underlying the choice and the use of a particular method, as well as the interface of those methods to achieve the desired outcomes are referred to as methodology (Crotty, 2003). In this same continuum are the research methods which Crotty defines as the techniques or procedures used to gather and analyse data related to the research question or hypothesis to achieve the research outcome.

In the "research onion" methodological process put forward by Saunders et al (2012), the research philosophy was classified into four different categories namely, positivism, realism, interpretivism and pragmatism. Creswell (2009), on the other hand, classifies research philosophy from the perspective of positivism/post-positivism, interpretivism, critical inquiry, feminism, and postmodernism. These varying terms evidenced the ambiguity and inconsistency of the taxonomies used by various authors in research philosophical paradigms, as argued by Wainwright (1997).

For the purpose of this research, the term "research methodological process" will be adopted to imply the sequential, structured process that is followed to achieve the research aim and objectives. The terms "paradigm" and "methodological process" are used interchangeably in this research. It is acknowledged that a structured process in research undertaken aids the researcher to develop an understanding of the topic being researched, and of the process by

which the research is constructed (Easterby-Smith, Thorpe & Jackson, 2012; Remenyi et al., 2005).

Organizations as large as the NHS have many different priorities and pressures, making it difficult to manage the paradigm of knowledge across professional boundaries in order to achieve their objectives (NHS England, 2013, 2014; NHS Estate, 2001). The control of healthcare-associated infections is just one of the many priorities of the NHS in achieving the quality healthcare outcomes defined in the NHS constitution (NHS England, 2013). As a consequence, an understanding of the constituents of the research methodological process will assist in providing a guide towards achieving the research aim and objectives.

4.2.1. **The Adopted research methodological process**

It is acknowledged that there is no single research process or strategy that can be recommended as the 'best' in all circumstances (Easterby-Smith et al., 2012), and so the choice of research process depends on identifying the one that works best for the particular research undertaking. It is also noted that the choice of a particular research methodological process is influenced by its suitability and feasibility, and by ethical considerations relative to the research question, problem, cost and time, as well as the skills of the researcher (Easterby-Smith et al, 2012; Denscombe, 2010; Remenyi et al 2005).

The aim of this research is to "critically investigate the interface between knowledge management processes and hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management cleaning service delivery practices in NHS hospitals." Further to the synthesis and critical review of the methodological processes of Saunders et al. (2012), Crotty (2003) and the "nested research approach" of Kagioglou et al. (2000), it was decided to adapt the "research onion" methodological process put forward by Saunders et al. (2012) to guide the research process in order to achieve the research aim and objectives.
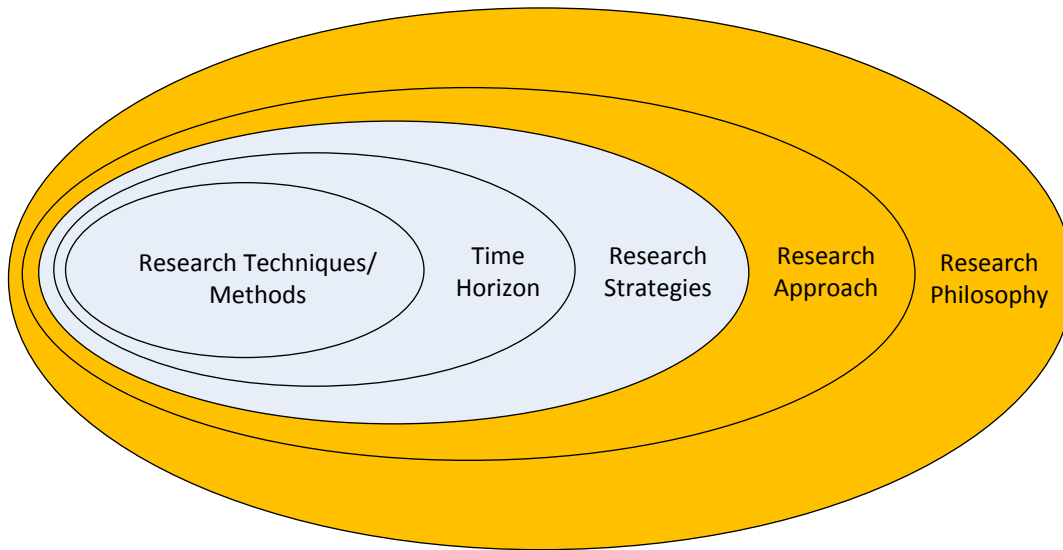
Figure 4.3:   Research methodological process (adapted from "The Research Onion", Saunders et al (2012)**)**

The "research onion" (Figure 4.3) sets out the research philosophy, research approach, research strategies, time horizon and research techniques/methods (Saunders et al., 2012) in a way which indicates a systematic direction and the cohesion of constituent elements to represent a paradigm of research methodology. Within the research onion methodological process, the research philosophy at the outer layer of the onion guides and energises the other layers of the paradigm, including the research methods and strategy which interface with the research techniques and methods to achieve a research aim and objectives.

4.3. **Research philosophy**

Research philosophy relates to the development of knowledge and the nature of that knowledge (Blaikie, 2010). It explores and tries to explain the fundamental way we think about the world, including how we know things, and what we can know (Guba & Lincoln, 1994). Philosophy consists of important assumptions that underpin the research strategy and the chosen methods to achieve a research aim and objectives. Philosophy is acknowledged to be influenced by the relationship between knowledge and the process by which knowledge is developed, and is not some distant, abstract activity. It is a practice that is "overtly" or "covertly" undertaken every day, both in practice and academia, when we explore our assumptions and knowledge (Saunders et al., 2012; Creswell, 2009; Guba & Lincoln, 1994).

Easterby-Smith et al. (2012) state that a failure to think through research philosophical issues may affect the quality of the research design. Understanding the constituent elements of the research philosophy can assist to appropriately align the research method and the study area to achieve the research aim and objectives.

> *Philosophical ideas influence the practice of research and need to be identified... I suggest that individual preparing a research proposal or plan make explicit the larger philosophical ideals they espouse... This information will help explain why they chose qualitative, quantitative, or mixed methods* (Creswell, 2014).

Easterby-Smith et al. (2012: 17-18) further identify three reasons why the exploration of philosophy is significant with particular reference to research methodology as follows:

➢ Firstly, a research philosophy helps the researcher to refine and specify the research methodology, as well as to clarify the overall research strategy to be used in the study. This includes the type of evidence gathered and its origin, the way in which such evidence is interpreted, and how it helps to answer the research questions posed. In other words, the research philosophy helps to clarify the research design.

➢ Secondly, knowledge of the research philosophy will assist the researcher to evaluate different methodologies and methods, avoiding their inappropriate use and unnecessary work by identifying the limitations of a particular approach at the early stage of the work. Research philosophy helps to identify and create designs which are outside the researcher's past experience.

➢ Thirdly, research philosophy helps the researcher to identify an even more creative design in either the selection or adaptation of methods that were previously outside the researcher's experience.

Philosophies are characterised by their ontological perception, epistemological undertaking, axiological purpose and the adopted methodology (Blaikie, 2010). Ontology refers to the perception of what reality is; it is a further inquiry into the nature of reality, while epistemology describes how we can come to know about reality - in other words, what can be known. Axiological purpose refers to the bias we bring to our understanding of the nature of reality, relative to our stance on whether reality is value-driven (value-laden) or value-free (Sarantakos, 2013; Saunders et al., 2012; Easterby-Smith et al., 2012). In value-free research,

the choice of what and how to study can be determined by objective criteria, whilst in value-laden research choice is determined by human beliefs and experience.

Methodology occupies a central position in any research process (Sarantakos, 2013). It is the strategy, plan of action, process or design that underlies the choice and use of a particular method or technique to discover reality. It is a process that translates ontological, epistemological and axiological principles into guidelines that show how research is to be conducted (Sarantakos, 2013; Easterby-Smith et al., 2012; Creswell, 2009).

Table 4.1:   Theoretical foundation of social research (adapted from Sarantakos, 2013; Easterby-Smith, 2012)

Ontology	Ontology deals with the nature of **reality**. Philosophical assumptions about the nature of reality Asks: What is the nature of reality? Is it objective (out there), constructed or subjective? OR BETTER: What does research focus on?
Epistemology	Epistemology deals with the nature of **knowledge** Asks: How do we know what we know? What is the way in which reality is known to us? OR BETTER: What kind of knowledge is research looking for?
Axiology	Assumptions about the nature of values and the foundation of value judgements
Methodology	Methodology deals with the nature of research **design and methods.** A combination of techniques used to inquire into specific situations Asks: How do we gain knowledge about the world? OR BETTER: How is research constructed and conducted?

The next sections provide an overview of the research philosophical perspectives identified here. This overview begins with epistemology, ontology and axiological assumptions. A synthesis of these research philosophies is also presented to establish how they impact the entire research process.

4.3.1. **Epistemology**

Epistemology is an approach to knowledge which looks at what constitutes acceptable knowledge in a field of study. It comprises a theory of knowledge with regards to its method, validation and the alternative ways of acquiring and communicating the knowledge (Easterby-Smith et al., 2012; Guba & Lincoln, 1994). Guba & Lincoln (1994) state that epistemology asks what the nature of the relationship is between the "would-be" (knower) and what can be

known. Scotland (2012) argues that every philosophy is based on its ontological and epistemological assumptions, which are conjectural. As a result, the philosophical assumptions underpinning each philosophy can neither be empirically proven nor disproven, as each philosophy intrinsically contains differing ontological and epistemological views. The author further states that each philosophy has different assumptions about the reality and knowledge that underpin a particular research approach, which is often reflected in the research methodology adopted. Saunders et al (2012) echo Scotland's argument by stating that "each philosophy is suited to achieving different research objectives relative to the research questions, which could rarely be answered within one philosophical domain." This indicates that no research philosophy is better than any other. Rather, it is dependent on the research question and the nature of the research inquiry.

> *Epistemology is connected with how we know things, and what we can regard as acceptable knowledge in a discipline* (Walliman, 2006)

Epistemology has two fundamental contrasting ends which various authors have used varying terms to describe. Easterby-Smith et al. (2012) refer to these contrasting ends as positivism and social constructionism or phenomenology, while Crotty (2003) uses objectivism and constructionism. Saunders et al. (2012) and Walliman (2006) both use the terms positivism and interpretivism, while Proctor (1998) has positivism and post-positivism to describe these contrasting ends. It has been noted that these varying terms are often perceived as opposing and polarised views, and are frequently used in conjunction within the context of epistemology to mean basically the same thing (Crotty, 2003;Wainwright, 1997).

Within the context of this research, the epistemological assumptions of Saunders et al's (2012) research process will be adopted, using the terms positivist and interpretivist for the two contrasting assumptions. This is to allow consistency in the terms used in this research and avoid the ambiguities acknowledged in literature (Saunders et al., 2012; Easterby-Smith et al., 2012; Creswell, 2009; Remenyi et al., 2005; Guba & Lincoln, 1994).
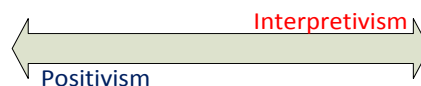
Figure 4.4:   The research terms adopted based on epistemological assumptions (Saunders et al., 2012)

4.3.1.1. The interface of positivism and interpretivism

Positivist assumptions argue that the world exists externally, and its properties should be measured through objective methods (Easterby-Smith et al., 2012). The basic reasoning behind positivism is the believe that, there is an existence of that exists an objective reality which is independent of human behaviour, and therefore not a creation of the human mind (Crossan, 2003). With the positivist school of thought, the researcher is viewed as a neutral observer and reality is not mediated by the researcher's senses, on the basis that the investigated objects have an existence independent of the knower (Saunders et al., 2012; Crotty, 2003). Consequently, the positivist approach is founded on ontological assumptions that the things we experience are things that exist. As such, its epistemology requires that experience is verified through the deductive methodological reasoning of scientific methods (Wainwright, 1997).

> *Positivism is the application of natural sciences to the study of social reality…An objective approach that can test theories and establish scientific laws…It aims to establish causes and effects* (Walliman, 2006).

While positivism assumes that reality is fixed, directly measurable and knowable with the claim that there is just one truth, one external reality, a new philosophical assumption emerges which holds the view that reality is not objective and exterior, but rather socially constructed and given meaning and interpretation by people (Easterby-Smith et al., 2012; Creswell, 2009; Guba & Lincoln, 1994). Interpretivism assumes that reality is not a rigid thing, but rather a creation of those individuals involved, as the individuals who observe reality cannot be separated from their real world (Webber, 2004). It argues that the understanding of knowledge by different people may construct meaning in different ways. Therefore, objective truth and meaning are not discovered, but constructed by social actors (people) (Saunders et al., 2012; Crotty, 2003). This stance recognises the intricate relationship between individual behaviour, attitudes, external structures and socio-cultural influencing issues.

Interpretivism also claims that reality does not exist in isolation, but is subject to various significant factors such as the culture, gender and belief from which it is constructed (Weber, 2004). It follows that objective reality as proposed by the positivist school can be seen as a one-dimensional aspect of reality.

The positivist research paradigm advocates a clear quantitative approach to investigating phenomena, in contrast to the interpretivist approach which explores and describes in depth phenomena from a qualitative perspective, and in some cases through the combination of both quantitative and qualitative perspectives (Saunders et al. 2012; Easterby-Smith et al., 2012; Creswell, 2009; Crotty, 2003). These research methods are most often seen as opposing and polarised standpoints, but are often used interchangeably (Denscombe, 2010; Creswell, 2009). It is acknowledged that the distinction between these philosophical assumptions has been overstated by some authors (Weber, 2004).

Table 4.2:   Differences between positivism and interpretivism (adapted from Weber, 2004)

Metatheoretical Assumptions about	Positivism	Interpretivism
Ontology	Person (researcher) and reality are separate	Person (researcher) and reality are inseparable (life - world)
Epistemology	Objective reality exists beyond the human mind	Knowledge of the world is intentionally constituted through a person's lived experience
Research Object	The research object has inherent qualities that exist independently of the researcher	The research object is interpreted in the light of the meaning structure of a person's (researcher's) life experience
Method	Statistics, content analysis	Hermeneutics, phenomenology, etc
Theory Truth	Correspondence theory of truth: one-to-one mapping between research statements and reality	Truth as intentional fulfilment: interpretation of research object matches life experience of object
Validity	Certainty: data truly measures reality	Defensible knowledge claims
Reliability	Replicability: research results can be reproduced	Interpretive awareness: researcher recognises and addresses implications of own subjectivity

The positivists also assume that reality is fixed, knowable and directly measurable, and as such that there is just one truth and one external reality. In contrast to this assumption, the interpretivist assumes that reality constantly changes and that reality can be known indirectly through the interpretation of the actors (people). Hence, the interpretivist champions the understanding that the knowledge of reality we seek to build and understand is influenced by culture, experience, beliefs and other factors. Therefore, reality has multiple versions.

4.3.2. **Ontology**

Ontology is another approach to philosophy that is concerned with the nature of reality, acknowledged always to be the starting point for most of the debate among philosophers (Blaikie, 2010). Ontological perception is concerned with what constitutes the nature of reality relative to how things really are and how things work (Blaikie, 2010). From an ontological perspective on research, the researcher first establishes the perspective from which the reality of the phenomenon is being investigated by stating whether the reality is objective and external to the researcher, or socially constructed and only understood by examining the perceptions of human actors (Walter, 2013; Crossan, 2003). Ontology examines the claims and assumptions that are made about the constituents of reality, and about what exists, what it looks like, what units make it up and how these units interact with each other (Sarantakos, 2013).

Different authors have used different terms to describe the two fundamental competing ontological schools of thoughts. Saunders et al. (2012) refers to them as objectivism, subjectivism or constructionism, while Easterby-Smith et al., (2012) use the terms realism and nominalism. The differences between these two contrasting ends of the continuum are mainly based on the epistemological and axiological assumptions about the phenomenon being investigated by the researcher, which the researcher needs to be explicit about (Sexton & Lu, 1990).

This research will adopt the ontological assumption of Saunders et al. (2012) and use the terms objectivist and constructionist for the two contrasting perceptions. This is to ensure consistency throughout the study.
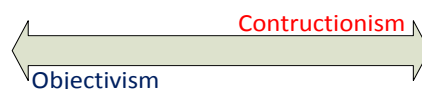
Figure 4.5:   Research terms adopted for ontological perception (adopted from Saunders et al. 2012)

Constructionism argues that all knowledge, all meaningful reality is contingent upon human practices, being constructed in, and out of interaction between human beings and their world, and developed and transmitted within an essentially social context (Crotty, 2003). It asserts that social phenomena are created from the perceptions and consequent actions of social actors (people, stakeholders). It stresses that social interaction between actors is a continual

process, considering that social phenomena are constructed by human beings who are constantly evolving (Crotty, 2003). This assumption is based on the understanding that, as social actors engage with their world, they are interpreting and providing meaning to phenomena (Crotty, 2003). This supports the stance of Saunders et al (2012), which acknowledges that individuals have different living standards, differences in social and cultural environments and different personalities that determine the nature of the individual person. This reflects the nature of the setting or sector within which the research is conducted. According to Saunders et al (2012),

> *"Under Objectivism assumptions, social realities exist in authenticity external to, and independent of the social actor, while constructionism views reality as socially constructed."*

Saunders et al (2012) add that:

> *"...Social phenomena are created through the perceptions and consequent actions of affected social actors".*

However, Crotty (2003) questions whether the two paradigms really are fundamentally opposed and suggests that the two contrasting ends of the paradigm tend to pull in the same direction in their relative meaning. As a result, there is no mention of an ontological perspective in his proposed research paradigm, which includes epistemology, theoretical perspectives (philosophies), methodology and methods. The argument for this is that realism, which is an ontological notion asserting that reality exists outside of the mind, is often taken to imply objectivism, which is an epistemological notion asserting that the meaning which exists in objects is independent of our consciousness. This stance stresses that positivism is objectivism by definition, as, without a thorough objectivist epistemology, positivism would not be positivism as we understand it today. Nevertheless, Crotty (2003) acknowledges the importance of consistency in the research process, and the relevance of an ontological stance, but without expressly anchoring research sub-processes under ontology at the starting point of the research strategy, as is often the case in other research literature (Sarantakos, 2013; Saunders et al., 2012; Easterby-Smith et al., 2012; Remenyi et al., 2005).

4.3.3. **Research reasoning - axiology**

Axiology is the science of value. It is a branch of philosophy that studies judgments about value and seeks to provide a theoretical account of the nature of values, relative morality, prudence or aesthetics (Saunders et. al., 2012). It is a philosophical assumption that is centres on the value that the researcher attaches to knowledge in relation to social enquiries in deciding whether the reality in the research is value-free or value-driven (Saunders et al., 2012). In value-free research, the choice of what to study and how to study can be determined by objective criteria, while in value-laden research, the choice is determined by human beliefs and experience (Easterby-Smith et al., 2012).

4.3.4. **Research approaches: inductive, deductive and abductive**

Reasoning is the process of using existing knowledge to draw conclusions, make predictions, or construct explanations (Blaikie, 2010). Reasoning that informs the choice of a research approach is acknowledged to enable researchers to make better-informed decisions about the research design (Sarantakos, 2013; Saunders et al., 2012). According to Blaikie (2010), there are seven types of research reasoning approach. Saunders et al. (2012) and Blaikie (2010) both acknowledge that only three of these, namely deduction, induction, and abduction, are often considered in social science research. Each of these forms of research reasoning has a philosophical and theoretical ancestry and foundation (Blaikie, 2010; Guba & Lincoln, 1994). This is in relation to ontological perceptions about the nature of reality, and an epistemological understanding of how that reality can be known.

Deductive reasoning occurs when the conclusion is derived logically from a set of premises, with the conclusion being true when all the premises are true (Saunders et al., 2012). It begins with a tentative hypothesis or set of hypotheses, that form a theory which could provide a possible answer or explanation for a particular problem, and proceeds to use observation to rigorously test the hypotheses (Blaikie, 2010).

On the other hand, inductive reasoning starts with observations that are unique and limited in scope, before proceeding to a generalised conclusion (Saunders et al., 2012; Blaikie, 2010). It begins with gathering evidence, seeking patterns and forming a hypothesis or theory to explain the findings. Compared to deductive reasoning, inductive reasoning claims that reality influences the senses (Blaikie, 2010). This approach assumes that all scientific investigation starts with an observation, which provides a secure basis from which knowledge can be

derived (Blaikie, 2010; Sarantakos, 2013). The conclusions of an inductive argument make claims that exceed what is contained in the premises, with the expected outcome aimed at extending knowledge beyond a particular phenomenon that appears to support the actual experience (Sarantakos, 2013; Saunders et al., 2012; Blaikie, 2010). This school of thought further argues that the more an observation demonstrates a relationship between phenomena, the higher the credibility of the final outcome. This entails the idea that the verification of derived generalisations comes through observations of a particular phenomenon that appears to support it.

The third form of reasoning is known as abduction (or abductive reasoning). Abductive reasoning is a combination of deductive and inductive reasoning. This has the flexibility to move from theory to data (as in deductive reasoning) or data to theory (as in inductive) (Saunders et al., 2012). It is a process that is used to generate social scientific accounts from social actors (Blaikie, 2000). This process begins with the observation of a 'surprising fact', and works out a plausible theory to account for how this could have occurred (Saunders et al., 2012). This surprising fact is then assumed to be the conclusion rather than the premises. Based on the conclusion, a set of possible premises is then determined that is considered sufficient or nearly sufficient to explain the conclusion (Saunders et al., 2012; Blaikie, 2010).

Saunders et al. (2012) assert that deductive research, when compared to the more protracted process of inductive research, can be quicker to complete. It is more of a "snapshot" research approach. It is further acknowledged that researchers lean more towards the deductive reasoning approach when there is a wealth of literature on the research topic, suggesting a design strategy to test the theory or define a theoretical framework.

In contrast, the abductive reasoning approach compared to the previous two reasoning approaches is suited for a topic where there is a wealth of information in one context of the research area but far less information in other contexts, and the research outcome is expected to enable the modification of existing theories (Saunders et al., 2012; Blaikie, 2010).

The abductive research reasoning approach will be adopted for this research undertaking. This is due to the fact that there is a plethora of literature that focuses on the clinician-centred contribution to the management and control of healthcare-associated infections when compared to the literature on the facilities management discipline. It is acknowledged that there is limited literature that discusses facilities management cleaning service delivery in

relation to the prevalence of infections in NHS hospitals when compared to the literature on the clinician's contribution (May 2013; Dancer, 2009).

4.3.5. **The research philosophy adopted**

A research philosophy is the epistemological, ontological and axiological assumptions that implicitly or explicitly guide an inquiry in a research undertaking (Easterby-Smith et al., 2012; Remenyi et al., 2005). Easterby-Smith et al. (2012, p.17) note that failure to think through philosophical issues, while not necessarily fatal, can seriously affect the quality and management of the research and is central to the notion of research design. The epistemological assumptions, ontological undertakings and axiological purpose in relation to the nature of the world complement the formulation of the research philosophy. They also influence the selection of an appropriate research approach (Amaratunga et al., 2005).

Drawing from a range of various terminologies used by different authors in the preceding discussion, the epistemological philosophical assumptions adopted for this research come under the heading of interpretivism. This states that reality does not exist in isolation but is rather a subject of a variety of other significant factors influenced by the experience, gender and cultural beliefs on which it is constructed (Weber, 2004; Guba & Lincoln, 1994). This is in keeping with the constructionist ontological perspective adopted, which also views reality as socially constructed. Hence social phenomena are created through the perceptions and consequent actions of the social actors (Saunders et al. 2012). This philosophical assumption interfaces with the axiological purpose adopted that the research is value-driven (value-laden) as the researcher cannot be separated from the research.

Interpretivist and constructionist assumptions take into account what other philosophical assumptions have ignored (Blaikie, 2010). They consider the meaning, interpretations, motives and intentions that direct people's behaviour in their everyday lives. This research aims to develop an effective knowledge management framework for the control of exogenous healthcare-associated infections in facilities management cleaning service delivery practice. To achieve this aim, it was necessary to rely on data collected from the targeted research participants, who are social actors. It is therefore imperative to acknowledge that the success of the research outcome is dependent on takeing into account these social actors' attitudes in interpreting the monitoring of compliance with good practice and other guidance documents. These have to do with the nature of the relationship between the facilities management team

and clinicians in their joint efforts to control the prevalence of exogenous HCAIs in their daily work.

Among other research philosophical considerations, the interpretivist approach also seeks to discover why people do what they do by uncovering the inner thoughts, shared knowledge, meanings, motives and rules which influence the way they act (Blaikie, 2010; Weber, 2004).

> *Interpretivism – The recognition that subjective meanings play a crucial role in social actions. It aims to reveal interpretations and meanings* (Walliman, 2006).

The interpretivist school of thought takes a very different view of social life to that held by positivism and objectivism (Weber, 2004). It is concerned with understanding the reality of people on the basis of their everyday activities in order to establish a meaning and interpretation of their actions, as well as the actions of others. The interpretivist task is focused on discovering and describing the 'insider' view, and does not impose an 'outsider' perspective, as the social world is a world interpreted as it is experienced by its members from the inside (Blaikie, 2010; Weber, 2004).

> *Constructionism… is the belief that social phenomena are in a constant state of change because they are totally reliant on social interactions as they take place* (Walliman, 2006)

The abductive research approach is a flexible process (Saunders et al., 2012). It is a combination of deductive and inductive - cognitive, and can move from theory to data (as in deductive) or from data to theory (as in inductive) (Saunders et al., 2012; Blaikie, 2010). The process begins with the observation of a 'surprising fact', and then works out a plausible theory of how this could have occurred (Suddaby, 2006, cited in Saunders et al., 2012). The abductive research approach is acknowledged to entail an ontological perspective that views social reality as constructed by social actors (people).

> *"…The acquisition of knowledge in healthcare is seen as dependent on experience, a critical aspect of medical science is the interpretation of experience in everyday understanding* (Andrew & Halcomb, 2009)

Successes achieved in any adopted infection prevention and control strategy have always been seen as the result of a collective effort that requires the input of all stakeholders (clinician and non-clinician) (Department of Health, 2003, 2004, 2011c; National Audit Office, 2000).

Given the particular aim of this research, the choice of constructionist, interpretivist and abductive philosophical assumptions was found to be the most suitable way of achieving the research aim and objectives further to the review of the relevant literature (Blaikie, 2010; Creswell, 2014; Crotty, 2003; Easterby-Smith et al., 2012; Guba & Lincoln, 1994; Saunders et al., 2012).
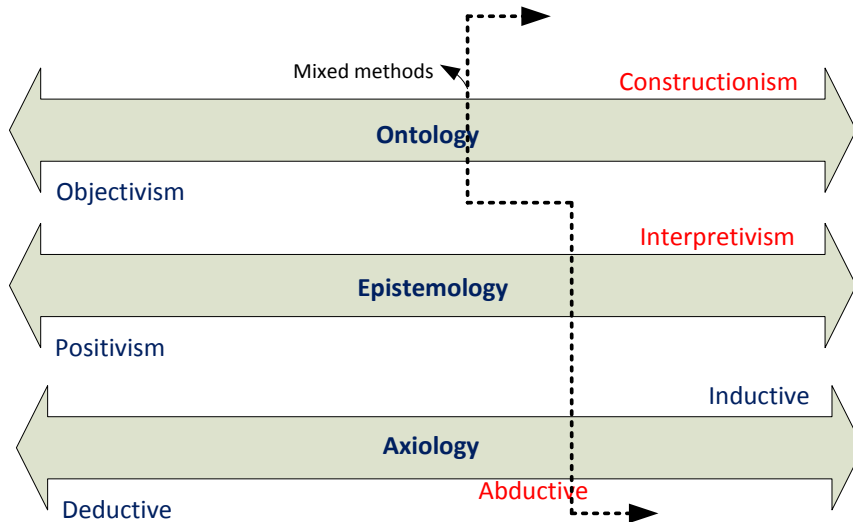
Figure 4.6:   The philosophical assumptions underpinning this research

4.3.5.1. Justification for the research philosophies adopted

Healthcare sector is acknowledged to be a knowledge-driven sector, and an environment where professionals with a variety of tacit and explicit knowledge interact to achieve set objectives. Interpretivist, constructivist and abductivist research methods involve constructing concepts that are grounded in everyday activities, and expressed in the language and meanings of social actors (Blaikie, 2010). Social reality is viewed as the product of processes that involve the collective negotiation of all stakeholders to derive meanings, understanding or explanation for actions, including circumstances that may impede or enhance the achievement of set targets (Blaikie, 2010; Flyvbjerg, 2006; Guba & Lincoln, 1994). All of this characterises the reality of NHS hospital environments.

Constructionism assumes that all knowledge construed from meaningful reality is dependent upon human practices, being deduced from interaction between human beings and their world, which is consequently developed and conveyed within an essentially social context (Blaikie, 2010). This socio-cultural interface requires a socio-cultural research approach that

allows for the development of a contextualised understanding of social phenomena based on the perspective of the social actors. Interpretivist assumptions are directed at understanding phenomena, including people's interaction, from an individual's perspective through investigation, as well as through the historical and cultural context that people inhabit (Creswell, 2009; Crotty, 2003). This combination yields insight into the understanding of behaviour and explains actions from the participant's (i.e. hospital facilities manager's) perspective and gives them a voice. In contrast, positivist philosophical assumptions tend to alienate the social actors (people) who are considered paramount within the philosophical paradigms drawn upon here, and this is crucial in this research in order to achieve the research aim and objectives.

Another consideration in the choice of the adopted philosophical assumptions has to do with the limited quantity of literature on the contribution and relevance of facilities management cleaning services delivery in combatting the prevalence and control of healthcare-associated infections. Additionally, the research approach chosen is noted to be suited for contexts in which there is a wealth of information in one part of the research area, but far less information in other parts, and in cases where the research outcome is expected to provide a basis for the modification of existing theories or perceptions (Blaikie, 2010).
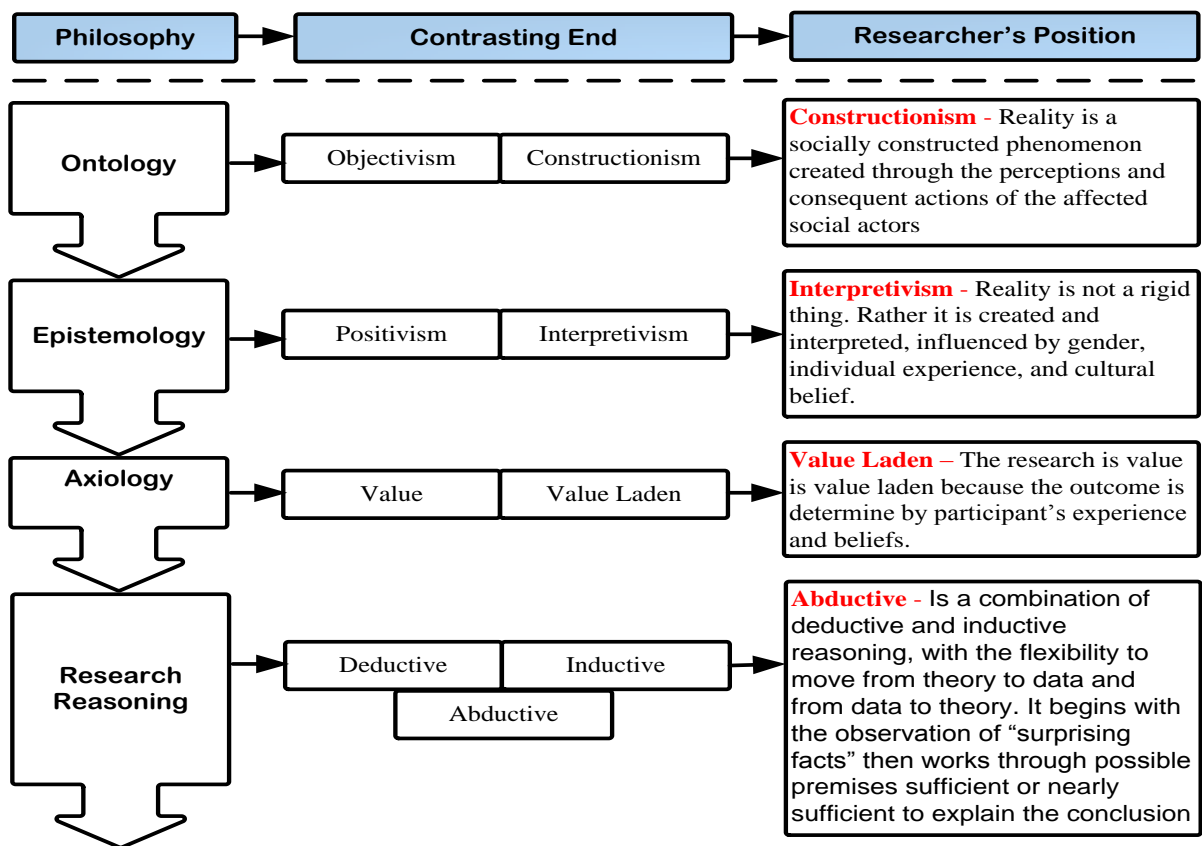
Figure 4.7:   Overview of the research philosophies adopted

In summary, the philosophical stance adopted further (Figure 4.7) provides a progressive research management protocol that takes into account relevant stakeholders' perceptions of the research phenomena (HCAIs) within the context of the scope of the study.

The description of the research method given below presents a rationale for the tools used for data collection in the context of the methodological process adopted and underpinned by the research philosophy described in order to achieve the research aim and objectives.

4.4. Research strategies

Research strategies (Blaikie, 2010), research approaches (Creswell, 2009; Remenyi et al. , 2005) or research style (Fellows & Liu, 2003) use tools such as surveys, case studies, experiments, ethnographic investigations, action research, grounded theory, as well as mixed methods as a basis for research design (Denscombe, 2010; Creswell, 2009; Fellows & Liu, 2003). It is acknowledged that the range of strategies available to modern-day researchers has increased over the years. This is predominantly influenced by advances in computer

technology which has led to faster and alternative options for analysing complex data, as well as innovations in the procedures for conducting social research. Some of the considerations in deciding on the research strategy to be adopted, as suggested by Yin (2009), include:

➢ The type of research question posed;

➢ The extent of control an investigator has over actual behavioral events;

➢ The degree of focus on contemporary as opposed to historical events.

Strategy	Form of Research Question	Requires Control of Behavioural Events	Focuses on Contemporary Events
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	Yes
Case Study	How, why?	No	Yes

Figure 4.8:   Characteristics of different research strategies (adapted from Yin, 2014)

Yin (2014) argues that the appropriateness of a particular research strategy interfaced with the available research methods to achieve the research aim is guided by the research questions (Figure 4.8). Thus there is no single research strategy or method that can be recommended as the best in all circumstances (Denscombe, 2010; Yin, 2014). Research strategies for social science researchers include:

➢ Surveys;

➢ Case studies;

➢ Experiments;

➢ Ethnography;

➢ Action research;

➢ Grounded theory;

➢ Mixed methods.

4.4.1. **Survey strategies**

A survey is a research strategy aimed at describing accurately the characteristics of a population on the basis of statistical sampling to provide a quantitative or numerical description of trends, attitudes or the opinions of a population by studying a sample of that population (Denscombe, 2010; Fellows & Liu, 2003; Polgar & Thomas, 1995). Fink (2003) describes a survey as a system for collecting information from or about people to describe, compare or explain their knowledge, attitudes, and behaviour.

Like other research strategies, a survey allows for the simultaneous measurement of multiple factors and includes the examination of possible underlying relationships to generate an answer to such questions such as 'who,' 'what,' 'where,' 'how many' and 'how and much?' (Yin, 2014; Creswell, 2009). Polgar & Thomas (1995) note that surveys have been used to describe accurately trends and the characteristics of specific phenomena as well as for other purposes within the healthcare sector, including:

➢ To establish the attitudes, opinions or beliefs of persons concerning health-related research. Data collection techniques often include questionnaires and interviews to gain insights into issues such as the prevalent causes of death or the health-related requirements of the population;

➢ To study the characteristics of populations in terms of health-related variables such as the utilization of healthcare, and to collect information about the population's demographic characteristics.

Survey strategies are broadly classified and grouped into two methods of collecting and interpreting data, commonly referred to as quantitative and qualitative research methods. Each of these methods has strengths and weaknesses, and as a result they are often combined in what is referred to as a 'mixed methods' approach (Creswell, 2014; Denscombe, 2010; Fellows & Liu, 2003).

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                    ┌─────────────────────────────────────┐
                    │       Survey Research Strategy        │
                    └─────────────────────────────────────┘
                                    ↕
                    ┌─────────────────────────────────────┐
                    │           Types of Survey             │
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Postal Surveys	Observation Surveys		Telephone Surveys	Face-to-Face Surveys
	Grouped Administered Surveys			Documents Surveys
Internet Surveys				
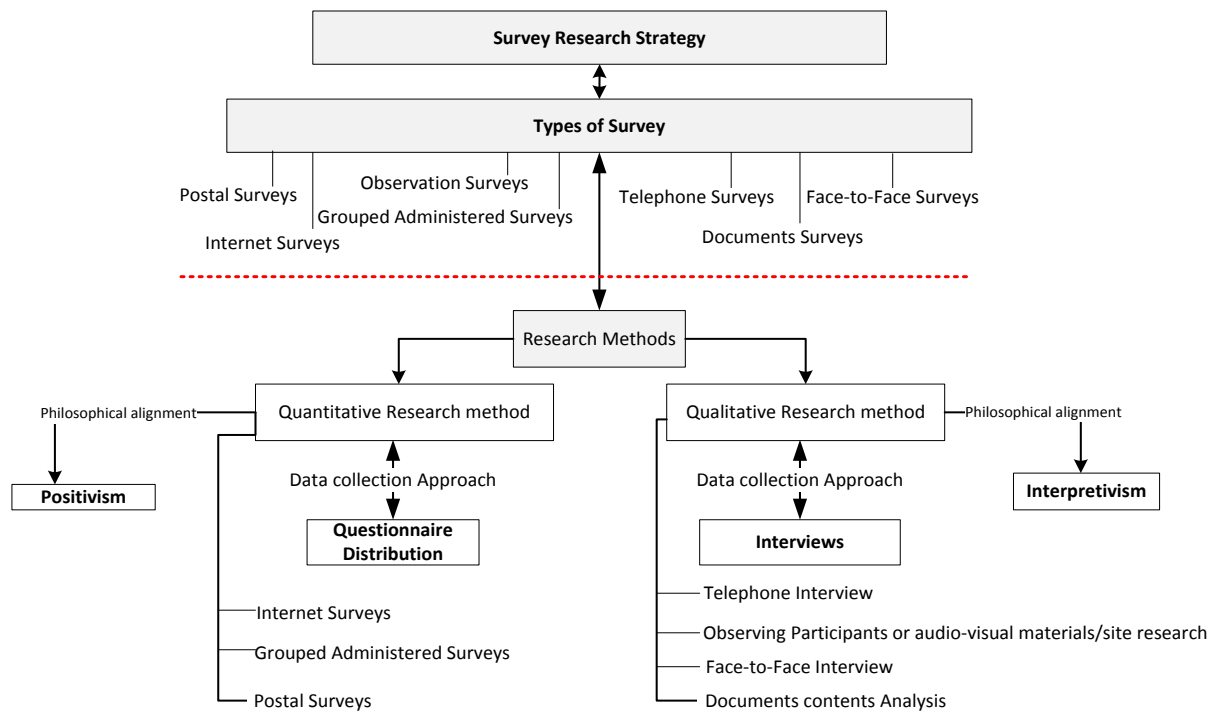
Figure 4.9:   Survey research strategy and research methods interface

4.4.2. **Case study strategies**

The case study is a research strategy which allows for in-depth exploration of processes. It is an empirical inquiry that investigate a contemporary phenomenon in its real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident (Saunders et al., 2012; Denscombe, 2010; Yin, 2014; Remenyi et al., 2005; Fellows & Liu, 2003). Information is gathered using a combination of data collection methods, including quantitative and qualitative methods, or a mix of both, to collect and analyse data in order to generate answers to the questions of 'why?' as well as 'what?' and 'how? (Yin, 2014). Saunders et al. (2012) note that compared to other methods of inquiry, the case study is most often used in exploratory and explanatory research.

As well as documentary data analysis, the case study employs interviews with key stakeholders to understand the complex relationship between factors as they operate within particular social settings. In other words, case study research uses qualitative and quantitative methods or a mix (triangulation) of methods (questionnaires, document analysis, interviews and observations) to collect data (Yin, 2014). It is thus an empirical research strategy that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident.

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4.4.3. **The experimental research strategy**

An experimental research strategy is one that uses predictions, known as hypotheses, rather than research questions, to determine if a specific variable influences other variables. In other words, it is the study of the probability of a change in an independent variable causing a change in another, dependent variable (Saunders et al., 2012; Denscombe, 2010; Creswell, 2009; Fellows & Liu, 2003). That is, it observes one factor to identify the way it influences another (Saunders et al.,2012; Denscombe, 2010). The two contrasting ends of the experimental research strategy used in testing the relationship between variables are the null hypothesis and the alternative hypothesis. The null hypothesis predicts that there will not be a significant difference or relationship between the variables, while the alternative hypothesis predicts that there might be a significant difference or relationship between them (Saunders et al., 2012)

4.4.4. **The ethnographic research strategy**

Ethnography is a research strategy used to study races, cultures or groups in a natural setting over a prolonged period of time. The researcher often becomes part of the group under study and observes their behaviour (participant observation), using multiple stages of data collection (Denscombe, 2010; Fellows & Liu, 2003; Saunders et al., 2012). The aim of ethnographic research is to describe cultural practices and traditions as well as to interpret social interaction within a culture. It is a strategy that often requires the researcher to become part of the 'tribe' and fully participate in its society (Remenyi et al., 2005). Compared to other research strategies, ethnographic research is primarily an interpretivist approach (Remenyi et al., 2005).

4.4.5. **The action research strategy**

Action research involves active participation by the researcher in the process under study in order to identify, promote and evaluate problems and potential solutions (Fellows & Liu, 2003). Action research is most often used to promote real organizational learning through a participatory and collaborative approach to produce practical outcomes through the identification of issues, and through planning, taking and evaluating action (Saunders et al., 2012). In other words, action research is used to solve a practical problem and produce a guideline for best practice (Denscombe, 2010). It is noted to be particularly useful in the area of managing change.

Like other strategies, action research provides the researcher with good quality access to data, while also constituting a potentially challenging process for the collection of data. This is because it is carried out 'live' within the context/situation/phenomenon being studied. The co-operation of staff or company personnel involved is crucial to the success of this research strategy.

4.4.6. **The grounded theory research strategy**

Grounded theory is a research strategy in which the researcher develops a general, abstract theory of a process, action or interaction grounded in the view of participants (Denscombe, 2010; Creswell, 2009). It is a strategy that involves the discovery of theory through the analysis of data by constantly comparing the data with emerging categories and theoretical samples of information from different groups. This is to highlight the similarities and differences in the information in order to clarify concepts or produce new theories, as well as to explore a new topic and provide new insights. Grounded theory was developed by Glasser and Strauss in 1967 in response to the 'extreme positivism' paradigm, which views reality as existing independently and external to human cognitive processes (Saunders et al., 2012). It involves a process to analyse, interpret and explain the meaning that social actors construct to make sense of their everyday experiences in a given situation. The grounded theory research strategy is used to develop a theoretical explanation of social interactions and processes in a wide range of contexts.

4.4.7. **The mixed methods research strategy**

The literature has acknowledged the ambiguity of the different terms used by different writers for research paradigms as the background to the choice of the umbrella term "mixed methods" (Creswell, 2014; Crotty, 2003; Wainwright, 1997). Writers variously refer to the mixed methods strategy as 'mixed methodology', 'multi-strategy research', 'integrated methods', 'hybrid method', 'multi-methods research', 'quantitative and qualitative methods' and 'combined research methods' (Denscombe, 2010; Creswell, 2009). One characteristic of these terms is the consistent implication that a mixed methods strategy involves a combination of "quantitative and qualitative methods". There is thus a consensus that a mixed methods research strategy is a blend of qualitative and quantitative research methods used to solicit information and generate data in order to achieve the research aim and objectives. This is based on the belief that the interface of the two approaches provides a better understanding of

the research problems than either approach used by itself (Creswell, 2009; Clark, 2005; Johnson & Onwuegbuzie, 2004). It is for this reason that researchers in the healthcare sector have used mixed methods to help explain complex phenomena that influence human health (Andrew & Halcomb, 2009)

> *"...Mixed methods research is a systematic approach to addressing research questions that involve collecting, analysing and synthesising both quantitative and qualitative data in a single research project* (Andrew & Halcomb, 2009)

From a broader perspective, Denscombe (2010) notes that the mixed methods approach is fundamentally a research strategy that combines different research traditions with various underlying assumptions within a single research project. At the same time, Creswell (2014) describes mixed methods as a research strategy which has both philosophical assumptions as well as a method. He further claims that, in terms of philosophical assumptions, it provides direction for the collection and analysis of data in the research process, while from a methodological perspective it focuses on collecting, analysing, and mixing both quantitative and qualitative data in a single study or series of studies. The mixed method approach is thus a research strategy that involves a set of underlying philosophical assumptions through the combination of both qualitative and quantitative forms of research.

In contrast to quantitative research, the qualitative method focuses on the in-depth understanding of specific individuals or groups rather than studying the general characteristics of a large population across specific variables to generate numerical data that support or refute clear-cut hypotheses (Polgar & Thomas, 1995). Table 3.3 details some of the perceived advantages and disadvantages of the quantitative and qualitative research methods.

Table 4.3: The advantages and disadvantages of the quantitative and qualitative methods (adopted from Sarantakos, 2013)

Quantitative Research	Qualitative Research
Does not set researcher close to reality	Sets researcher close to reality
Studies reality from the outside	Studies reality from the inside
Uses closed methods data collection	Uses open methods data collection
Employs a fixed research design	Employs a flexible research design
Captures a still picture of the world	Captures the world in action
Employs scientific/statistical methods	Employs naturalistic methods
Analyses data only after collection	Analyses data also during collection
Choose methods of the study	Chooses methods before/during the study
Produces most useful quantitative data	Produces most useful qualitative data

The qualitative paradigm is also acknowledged to be based on the rationale that human behaviour can only be understood by getting to know the perspective and interpretation of the person or people being studied. It enables the researcher to see things through the eyes of the person or people being studied rather than by reliance on the measurement of concrete facts.

It can be concluded that mixed method research is the interface of the quantitative and qualitative research paradigms within a single research project.

4.4.7.1. Types of mixed method research design

Creswell & Plano Clark (2008) suggest the classification of mixed method research design from six perspectives, which include sequential explanatory, sequential exploratory, sequential transformative, concurrent triangulation, concurrent nested and concurrent transformative. However, Creswell (2014) criticises this broad classification of mixed method design which is based on a review of nursing, public health, education policy and social and behavioural research as characterised by overlapping terms. These authors argue that other mixed method research designs such as embedded mixed methods, transformative mixed methods and multiple mixed methods all incorporate sequential explanatory, sequential exploratory and convergent mixed method research designs. They therefore use . Thus, the author identified and classified mixed method research design into three categories namely:

- ➢ Convergent Parallel mixed methods,
- ➢ Sequential Explanatory Mixed methods and,

➢ Sequential Exploratory mixed methods.

Both authors acknowledged that the adaptation of any of these designs is dependent on priorities, on the way the design is implemented and integrated, as well as on the theoretical perspective that underpins the researcher's stance (Creswell, 2014; Creswell & Plano Clark, 2008). The authors also state that the analysis and merging of collated quantitative and qualitative data using any of the above methods could be carried out using "side-by-side comparison," "data transformation," or "a joint display of data".

Table 4.4:   The data analysis and merging interface - adapted from Creswell (2014)

Data presentation techniques	Description
Side-by-side comparison	The researcher first reports the quantitative statistical results, and then discusses the qualitative findings (e.g., themes). Alternatively, the researcher discusses the qualitative findings and then compares the quantitative results
Data transformation	The researcher takes the qualitative themes or codes and counts them (and possibly groups them) to form quantitative measures.
Joint display of data	The researcher merges the two sets of data and presents them in a table or graph.

The next sections provide a review of the three most important types of mixed methods research design suggested by Creswell (2014) within the context of their respective design, methods of data collection and analysis, interpretation and validity.

4.4.7.2. Convergent mixed methods design

Using the convergent mixed methods research design put forward by Creswell (2014), both qualitative and quantitative data are collected and analysed separately, after which the results are compared to ascertain if the findings agree or disagree with each other (Figure 4.10).
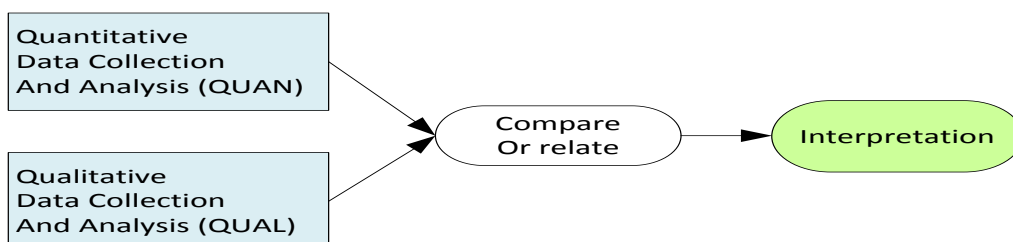
Figure 4.10: The convergent parallel mixed method – adopted from Creswell, 2014

Convergent parallel mixed method design is informed by the assumption that qualitative and quantitative data provide different types of information, and thus necessitates a detailed

review of the collated data to check if they both yield the same result. According to Creswell (2014), this mixed methods research design developed from the concept of the multimethod, multi-trait idea first suggested by Campbell and Fiske (1959), who felt that psychological traits could best be understood by gathering different forms of data.

Qualitative data collected by the convergent mixed method research design could be from interviews, observations or documents and records (Creswell, 2014). The key idea informing the convergent mixed method research design is to collect both the qualitative and quantitative data using the same concept, or parallel variables, constructs or concepts..

It is acknowledged that the challenge of using the "side-by-side" data analysis/merging technique associated with the convergent mixed method is how to converge or merge the data, given that the results are analysed separately and then brought together.

The interpretation of findings from the analysis of data using convergent mixed method design is typically written up as the discussion section of the study. This section includes a report comparing collated data from the qualitative and quantitative results, and a summary of these results noting whether there is convergence or divergence between the two sources of information. Regardless of the outcome of the amalgamation of the two results, the researcher can either return to the analysis to further explore the databases, collect additional information to resolve the differences, or discuss the results from one of the databases (Creswell, 2014). This will enable the researcher to suggest reasons for the convergence or divergence of the two sets of data so that an informed inference can be made.

Compared to other mixed method research designs, it is acknowledged that there are potential threats to validity in the convergent approach (Creswell, 2014). The author suggests that some of these challenges include:

➢ **The use of different concepts or variables:** the use of different concepts or variables in quantitative and qualitative measurements might yield findings which are difficult to compare and merge;

➢ **Lack of follow-up:** a lack of follow-up conclusions when the scores and themes diverge represents an invalid strategy of inquiry;

➢ **Unequal sample sizes:** the sample size for the qualitative data may be less than the N on the quantitative side and provide a less complete picture.

To meet the validity challenges associated with the convergent mixed method design, Creswell (2014) suggests the use of a construct validity protocol to validate the quantitative data, and the use of triangulation to validate the qualitative data (see section 4.10 and 4.10.1).

4.4.7.3. Explanatory sequential mixed methods design

Compared to the convergent mixed methods design, sequential explanatory mixed methods design is a process that is carried out in two phases (Creswell, 2014; Creswell & Plano Clark, 2008). It is characterised by the collection and analysis of quantitative data in the first phase, followed by the collection and analysis of qualitative data in the second phase (Creswell, 2014; Creswell & Plano Clark, 2008). The first phases involves:

➢ The collection of quantitative (survey) data, followed by the analysis of the results and findings which are then used to plan (or are built into) the second (qualitative) phase. Findings from this phase also inform the type of participants to be purposefully selected for the qualitative phase, as well as the type of questions that will be asked of the participants (Creswell, 2014; Creswell & Plano Clark, 2008).

The second phase (Phase 2) of the research design involves:

➢ The collection of qualitative data (typically interviews) which is used to help explain findings from the quantitative phase (typically questionnaire survey responses). The purpose of the sequential explanatory mixed methods design is typically to use the qualitative results to assist in explaining and interpreting the primary quantitative (survey) result findings in more detail (Creswell, 2014; Creswell & Plano Clark, 2008).
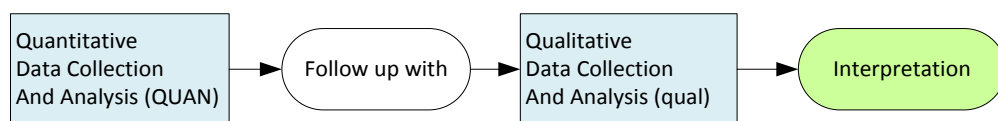
Figure 4.11: The sequential explanatory mixed method – adopted from Creswell, 2014

Some of the acknowledged data collection challenges associated with mixed methods research design include is the risk that the quantitative results that informed the qualitative data collection process may be insignificant result, extreme or outlier cases (Creswell, 2014). Another challenge is 'the length of time involved in the collection of data to complete the two

separate phases', especially if the two phases are given the same priority (Creswell & Plano Clark, 2008).

> *"..After the researcher presents the general quantitative, and then qualitative results, a discussion should follow that specifies how the quantitative results help to expand or explain the quantitative results"* (Creswell, 2014).

According to Creswell & Plano Clark (2008), the strength of this research design is its straightforward nature, which makes it easy to implement. Also, the clear separation between the phases of the design makes it easy to interpret the results in two distinct phases, with the interface of the quantitative and qualitative results merged and interpreted in the discussion section of the study. Because one database builds on the other, and analysis proceeds independently for each phase, this research design is seen to be the 'best bet' option to accomplished this research compared to the convergent mixed methods research design.

4.4.7.4. Exploratory sequential mixed methods design:

Exploratory sequential mixed methods design is the reverse of the explanatory sequential mixed method research design (Creswell, 2014). It is a research design that is characterised by the exploration and analysis of qualitative data in the first phase, followed by the second phase which comprises the collection and analysis of quantitative data (Creswell, 2014; Creswell & Plano Clark, 2008). The purpose of this design is 'to develop better measurements with specific samples of populations and to see if data from a few individuals (in qualitative phase) can be generalised to a large sample of a population (in quantitative phase)' of the research protocol (Creswell, 2014). Unlike the sequential explanatory mixed method, this method gives priority to the qualitative aspect of the study, while results from the quantitative data analysis are used to assist in the interpretation of the qualitative findings.
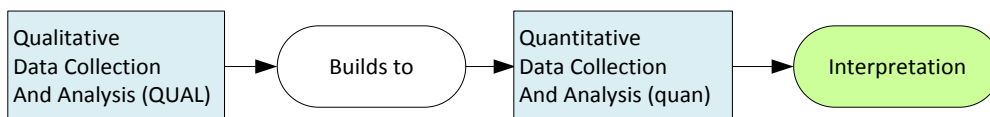
Figure 4.12:   The sequential exploratory mixed method – adopted from Creswell, 2014

Compared to explanatory mixed methods research design, which is better suited to explaining and interpreting relationships, the primary focus of exploratory mixed methods research is to explore a phenomenon. Morgan (1998), cited in Creswell (2014) suggests that this design is

appropriate for use when testing elements of an emergent theory resulting from the qualitative phase. The author further states that some of the purposes for selecting exploratory design are:

> To determine the distribution of a phenomenon within a chosen population;
> To develop and test the instrument;
> To generalise qualitative findings to different samples.

Some of the challenges or difficulties associated with the collated data in this design are, firstly, how to manage the information which is categorised into quotes, codes and themes from the initial phase (first phase) in the second phase of the data collection protocol (Creswell, 2014; Creswell & Plano Clark, 2008). Also, its sequential nature means that it requires a substantial length of time to complete both data collection phases.

4.5. **The research strategy adopted** - **mixed methods**

A research strategy or approach is a way of describing how a researcher goes about the task of doing research, using a particular style and employing different methods. No single research strategy could be considered the 'best' in all circumstance (Denscombe, 2010; Fellows & Liu, 2003). The appropriateness of research strategy is dependent on its suitability and feasibility, and on ethical considerations, which are informed by:

> The extent of the researcher's control over the actual behavioural events,
> The degree of focus on contemporary events,
> The nature of the enquiry and the question being posed,
> The researcher's personal experience and knowledge,
> The aim of finding answers to 'who?' an 'what?' questions,
> The need to gather detailed data from across key stakeholders to allow for an in-depth understanding of the phenomenon under investigation relative to the sensitivity of the nature of the industry within which the research is to be conducted.

Taking such influencing factors into consideration within the context of the phenomenon under investigation has informed the selection of both quantitative and qualitative surveys in a sequential explanatory mixed methods research design for this study. It is anticipated that the adopted research strategy will assist in capturing indicators that will inform the development of an effective knowledge management framework in facilities management cleaning service delivery practice for the control of exogenous HCAIs.

4.5.1. **Justification for the research strategy adopted**

The aim of this research is to critically investigate the interface between the hospital knowledge management process and knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management service delivery practices in NHS hospitals (see section 1.7). Compared to other healthcare organisations, the NHS hospital environment is characterised by a cosmopolitan work force made up of both clinicians and non-clinicians. This diverse workforce has a variety of religious, cultural and economic backgrounds as they continue to deliver healthcare services in line with the NHS objectives which are presumably integral to their service level agreement (SLA) with their respective local NHS Trust. These challenges are part of the considerations that informed the justification of the adopted interpretivist and constructionist research approaches selected in the first instance. Both of these approaches assume that reality is constructed and interpreted by the persons involved. As a consequence, one person's reality, derived from observations and modified by socialisation (in terms of upbringing, education and training) is likely to be different from another's, and this is because truth and reality are socially constructed rather than existing independently (Easterby-Smith et al., 2012; Saunders et al., 2012). The sequential quantitative and qualitative mixed methods approach was therefore adopted for this research.

> *"Mixed method approach offers flexibility and depth of insight that is not possible to achieve through the use of either qualitative or quantitative methods alone"* (Andrew & Halcomb, 2009)

According to Andrew & Halcombe (2009), mixed methods research offers a way of conducting research that meets the needs of healthcare professionals. Given the complexity of holistic healthcare delivery in NHS hospitals, mixing research methods where appropriate can provide the sophisticated range of evidence on which to base practice. A mixed methods approach clearly has significant potential to facilitate the development of knowledge in the healthcare sciences (Andrew & Halcombe, 2009).

Where there are significant differences in the cultural backgrounds and experience of professionals, as is the case in the NHS hospital environment, the understanding of meanings becomes problematic. As a consequence, it is imperative to systematically study the different cultures represented to accurately interpret the actions and traditions of the participants

(Polgar & Thomas, 1995). Therefore, quantitative methods were used to quantify the problem by using appropriate instruments which measure variables, while qualitative research methods were used to further address the meaning of the problem from the personal perspective of the research participants in order to uncover conflicting values that could enhance or impede the achievement of the research aim and objectives. Both quantitative and qualitative research methods were adopted to enable interaction with healthcare practitioners in multiple and mutually productive ways.

> *…….Critical to understanding the human behaviour is knowing how opinions and behaviour vary across different categories of people* (Nardi, 2006)

The qualitative method of enquiry is acknowledged to be the most appropriate method for obtaining detailed contextualised information. It is often adopted to offset the disadvantages of quantitative surveys by providing insights not available through general quantitative surveys (Creswell, 2009). Oppenheim (2003) and Polgar & Thomas (1995) both suggest that compared to other methods of research enquiry, survey methods (questionnaires and interviews) are generally the most common form of data collection tools adopted in healthcare research to:

➢ Establish the attitudes and opinions or beliefs of persons concerning healthcare-related issues, including processes;

➢ Study the characteristics of populations in terms of health-related variables such as the utilization of healthcare and drug use patterns as well as the prevalence of healthcare-associated infections.

There are numerous areas of healthcare where research involving the interpretation of personal meanings is essential for ensuring effective practices (Polgar & Thomas, 1995). Given the complexity and dynamism of infection-causing micro-organisms' resistance to antibiotics, it is a vitally important challenge to develop an effective knowledge management process in order (among other things) to harmonize the socio-cultural backgrounds of the cosmopolitan staff working for the NHS to set objectives in areas such as infection control. A constant challenge that cannot be ignored. Qualitative research methods have been adopted to clarify personal meanings in situations where a shared perspective on healthcare issues cannot be taken for granted (Polgar & Thomas, 1995). Qualitative research attempts to elicit in-depth opinions from participants; it explores attitudes, behaviour and experience (Dawson, 2007).

Mixed methods research offers a way of conducting research that will meet the needs of healthcare professionals. Healthcare researchers have increasingly embraced mixed methods to guide their exploration of the complex phenomena that influence human health (Andrew & Halcomb, 2009)

Despite some perceived disadvantages associated with mixed methods, including the argument that the researcher needs to be skilled in the use of this approach, it has a number of benefits. Some of the advantages suggested by Easterby-Smith et al. (2012) which make it appropriate for this research include the fact that:

1. It increases the credibility of results, and allows the researcher to be more confident in them;
2. It increase validity and uncovers deviant dimensions of the phenomena investigated;
3. It enables generalizations to be made, as it offers new perspectives on research questions;
4. It provides deeper insights that explain why things take place;
5. It presents a greater diversity of views and provides better (stronger) inferences.

It was acknowledged in the recommendations of the Department of Health report "*Prevention and Control of Healthcare Associated Infections in Secondary care settings*" that the production and reproduction of the plethora of performance management tools in the control of HCAIs was triggered by several factors. Foremost among these was the lack of non-compliance attitude of healthcare workers with infection control procedures (Department of Health, 2011). Other factors mentioned include:

➢ Aging healthcare facilities,
➢ Technological advancement,
➢ Demographic pressures,
➢ The dynamic nature of infection-causing organisms.

Given the cosmopolitan make-up of the National Health Service (NHS) workforce, and in order to gain a better understanding of the phenomenon under investigation, the most appropriate strategy for this study was considered to be a method which combined the numerical strength of quantitative tools with the level of detail obtainable through qualitative research.

A further consideration was the fact that a fuller exploration of the quantitative results by means of face-to-face interviews would better be able to capture participants' views in order to achieve the research aim and objectives. According to Creswell, (2014), this research method best reveals trends and the voices of minority groups or individuals.

Domain 1	Domain 2	Domain 3	
Preventing people from dying prematurely	Enhancing Quality of life for people with long-term conditions	Helping people to recover from episodes of ill health or following injury	Effectiveness

Domain 4 Ensuring people have a positive experience of care	Experience

Domain 5 Treating and Caring for people in a safe environment and protecting them from avoidable harm	Safety

Figure 4.13:   The Improving Outcomes Framework, NHS Commissioning Board (2014)

It is anticipated that the effective knowledge management framework will be used (where adopted) to improve the creation, sharing, storing and usage of good practice knowledge captured from the infection control strategies adopted/adapted in facilities management cleaning service delivery for the targeted and sustainable curtailment of the prevalence of exogenous HCAIs. It is also anticipated that the outcomes of this research will assist in delivering services to "domain 5" of the NHS service delivery outcomes framework (Figure 4.13), which guarantees the safety of patients receiving care in NHS hospitals (NHS Commissioning Board, 2014).

4.6. Time horizon – longitudinal vs cross-sectional studies

Research design has been classified into three groups, namely longitudinal, cross-sectional and before-and-after studies/research (Kumar, 2011; Nardi, 2006; Remenyi et al., 2005). Remenyi et al. (2005) describe a longitudinal study as one that extends over a substantial period of time and involves studying changes over time. On the other hand, a cross-sectional study provides a snapshot of the phenomena studied (Nardi, 2006; Remenyi et al., 2005). It is a piece of research undertaken to examine how something is done at the time of the study and seeks to identify and understand differences between the various members of the study population (Remenyi et al., 2005). The third form of research design is the "before-and-after study" suggested by Kumar (2011). It is described as the observation of two cross-sectional variable or sets of variables in a population to determine any changes in the phenomenon of variable(s) between two points in time (Kumar, 2011). The process of "before-and-after" study design is similar to "cross-sectional" study design, except that it comprises two cross-sectional observations. The second observation is undertaken after a period to measure changes and compare differences in the phenomenon or variable(s).

> *"Cross-sectional study seek to identify and understand differences between the various members of the study population* (Remenyi et al., 2005)

The aim of this research is to critically investigate the interface between the knowledge management process and hospital knowledge infrastructure capabilities, to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management service delivery practices in NHS hospitals. This research is therefore considered as a "cross-sectional" study, as among other objectives (see section 1.7.1). it seeks to investigate how healthcare facilities managers effectively create, store, share and reuse good practice knowledge within the context of their current knowledge infrastructure capabilities in the control of exogenous HCAIs.

4.7. Research methods/data collection techniques

A research method is a technique for collecting and/or analysing primary and secondary data (Collis & Hussey, 2014). These technques include the use of such tools as questionnaires, interviews, focus groups, document analysis, internet records, observations and others to enable researchers to gather facts and evidence about the subject matter, in order to gain an

accurate measurement, as well as a clearer picture, of things under investigation (Collis & Hussey, 2014; Denscombe, 2010; Fellows & Liu, 2003).

> *"... method is a technique for collecting and/or analysing*
> *data"* (Collis & Hussey, 2014).

Within the context of this research, the terms methods and techniques are used interchangeably to mean the same thing.

Contemporary healthcare service delivery is increasingly seeking to implement evidence-based practice across disciplines in the light of rapid social change, an aging population and the increasing resistance to antibiotics of infection-causing microorganisms (Andrew & Halcomb, 2009). According to Kumar (2011), the "choice of a method depend upon the purpose of the study, the resources available and the skills of the researcher." Hence, before decisions can be made about how to collect the data required to answer the research questions, consideration needs to be given to the kind of data to be collected, where they will come from, and how they will be selected (Blaikie, 2010). Research data could be collected from primary or secondary sources, depending on the available resources, the research questions and the socio-economic and demographic characteristics of the study population (Collis & Hussey, 2014; Yin, 2014; Remenyi et al., 2005). Methods of data collection include interviews, questionnaire surveys and the examination of documents, physical artifacts, audio and video recordings, emails, archival records and observations (Collis & Hussey, 2014; Denscombe, 2010; Yin, 2009; Fellows & Liu, 2003). Figure 4.11 depicts the sequential explanatory mixed methods technique for the collection of data to achieve the research aim and objectives (Creswell & Plano Clark, 2008). According to Andrew & Halcomb (2009), the multifaceted nature of the phenomena that contemporary healthcare professionals are concerned with investigating frequently demands the use of a similarly multifaceted approach to develop understanding and insights. The authors argue that compared to other methods, the mixed methods approach offers a way of conducting research that will meet the needs of healthcare professionals.

> *Mixed methods designs clearly have significant potential*
> *in healthcare science (Andrew & Halcomb, 2009)*
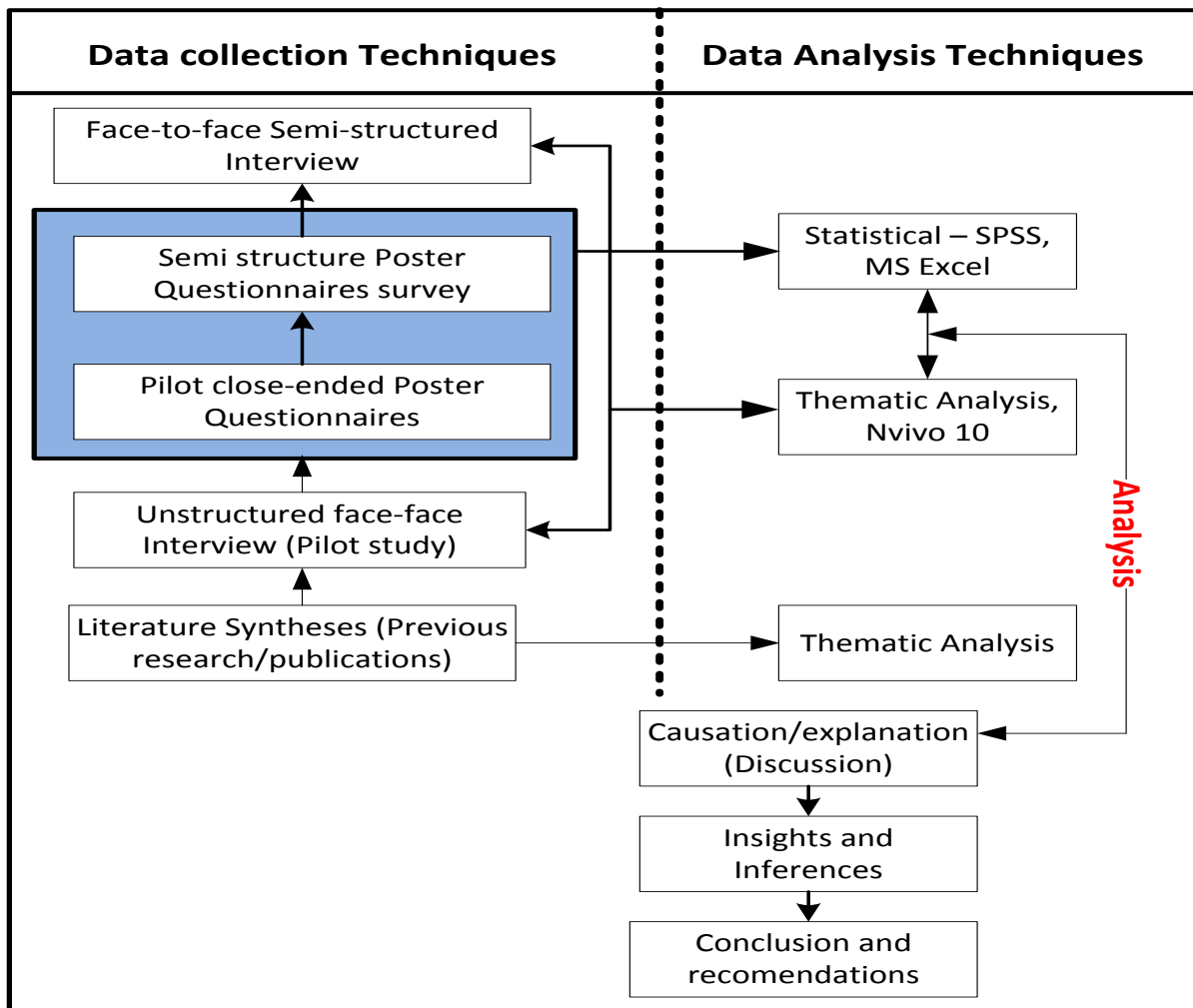
Figure 4.14:   Research data collection and analysis techniques

Two data collection techniques, i.e. a sequential interface of quantitative and qualitative methods were employed in this research (see Figure 4.14). The following sections describe the data collection methods presented above.

4.7.1. **Document synthesis and review**

To justify any research endeavour, it is necessary to carry out a literature review (Blaikie, 2010). Literature refers to the existing body of knowledge. A literature review is a critical evaluation of the existing body of knowledge on a topic which guides the research (Collis & Hussey, 2014). According to Jankowicz (2005), a literature review provides a description and critical analysis of the current state of knowledge in the subject area at the outset of and throughout the work, and during the systematic development of a conceptual framework.

Kumar (1999) describes a literature review as an essential preliminary task in any research undertaken. A literature review is further acknowledged to:

- ➢ Bring clarity and focus to the research problem,
- ➢ Improve the research methodology, and
- ➢ Broaden the knowledge base in the research area

This research commenced with the synthesis and review of literature pertinent to the research subject area. Knowledge is disseminated through various types of publication, which can be in hard copy or digital form, and the data can be qualitative (as in text or illustrations) or quantitative (as in tables or statistics) (Collis & Hussey, 2014). According to Mauch and Birch (1998), mixed methods research relies on a range of sources including less conventional 'literature' such as letters, documents, newspaper reports and works of art to set the scene for the work. A broad review of primary and secondary sources of data covering the areas of infection control, knowledge management and the knowledge management process in healthcare facilities management that is focused on the control of exogenous healthcare-associated infections was undertaken in this research (see Table 2.4). This was aimed at exploring healthcare facilities management service delivery functions and their interface with the prevalence of HCAIs in hospitals in order to enable the identification of knowledge gaps in the area of knowledge management processes in hospital facilities cleaning services for the control of exogenous healthcare-associated infections within the hospital knowledge infrastructure capabilities.

Good research frames its aim in the context of earlier work (Silverman, 2011)

Following the literature review, further insights were identified into the factors influencing the prevalence HCAIs and the management of HCAIs from the facilities management perspective, and these were used to guide the causal patterns in the design of the semi-structure interview questions used to further explore the research subject matter. This also provided a contextual and conceptual background to form a basis for identifying the contributions made by the research to the existing body of knowledge. Within the context of this research, the literature reviewed on healthcare-associated infections and healthcare facilities management was limited to items published after the publication of the NHS Plan (Department of Health, 2000). The overall aims of the literature review, in relation to this period, were to:

- ➢ Gain an overview of the knowledge of the research subject area
- ➢ Discover whether research on the same topic had been conducted
- ➢ Identify any aspects of the research topic not considered in previous work
- ➢ Gather valuable knowledge that could serve as the foundation of the research
- ➢ Search for any information that could enable the researcher to take an appropriate philosophical stance and select a suitable methodological research framework that could guide the research process.

4.7.2. Interviews

As part of the qualitative data collection techniques employed for this research to achieve the research aim and objectives, interviews were conducted among facilities managers within NHS hospitals in England. Parahoo (2014) describes 'qualitative interview' as a broad term used to denote a family of interviews with the common purpose of studying phenomena from the perspective of the respondent. Research interviews are one example of qualitative research methods. Others include questionnaire, document review, and observation (Hannabus, 1996). An interview is a purposeful conversation between two or more people that requires the interviewer to ask concise and unambiguous questions, and carefully listen to the answers in order to be able to further explore the phenomenon under investigation (Saunders et al., 2012). An interview provides a means of finding out from people what they do, and their thoughts on the phenomenon under investigation.

Interviews can be conducted with individuals or groups of individuals face-to-face, or by telephone or video-conferencing methods. According to Britten (1995), an interview is a flexible and powerful tool often used in the health sector for investigating research questions of immediate relevance to everyday work which would otherwise be difficult to investigate. It is a widely used tool to access people's experiences and their intuitive perceptions, attitudes and feelings of reality (Zhang & Wildemuth, 2006). Compared to other qualitative data collection techniques; interviews are concerned with exploring 'data' about understandings, opinions, what people remember doing, attitudes, feelings and the like that people have in common (Arksey & Knight, 1999).

A number of terms have been used to described qualitative interviews, including 'unstructured,' 'depth,' 'informal,' 'non-directive,' 'focused,' and 'open' (Parahoo, 2014).

Based on the degree of structure and flexibility, interviews can be divided into structured, unstructured and semi-structured (Walliman, 2006; Zhang & Wildemuth, 2006).

4.7.2.1. Structured interviews

A structured interview is an interview that has a set of predefined and standardised questions (Walliman, 2006; Zhang & Wildemuth, 2006). Using this technique, the researcher asks pre-determined questions from a written list in a person-to-person interaction which may be face-to-face or by telephone or electronic social media. The researcher often uses closed-ended questions in a structured interview (Collis & Hussey, 2014). Compared to other forms of interview, structured interviews are easy to construct and require fewer interviewing skills. They provide consistent information which ensures the comparability of data (Kumar, 2011). According to Fellows & Liu, (2003), structured interviews give little scope for the researcher to probe responses by asking supplementary questions to obtain more details or to pursue new and exciting aspects.

4.7.2.2. Unstructured interviews

Compared to structured interviews, unstructured interviews are more flexible. Depending on the responses received, the questions can be changed and adapted as the interview progresses. In this method of data collection, none of the questions are prepared in advance but evolve during the course of the interview (Collis & Hussey, 2014). These authors further note that in unstructured interviews the researcher uses open-ended questions which cannot be answered with a simple 'yes' or 'no' or a short factual answer. Unstructured interviews generate qualitative data through the use of open-ended questions which require longer, more developed answers (Collis & Hussey, 2014; McLeod, 2014).

4.7.2.3. Semi-structured interviews

Semi-structured interview questions are acknowledged to get a more considered response than closed questions, and therefore provide better access to the interviewee's views, interpretation of events, understandings, experience and opinions (Silverman, 2011). This form of interview occupies the middle part of the spectrum between structured and unstructured interviews, and contains both closed and open-ended questions (Collis & Hussey, 2014; Arksey & Knight, 1999). Semi-structure interviews also give interviewers the opportunity to add questions based on the participant's responses. Denscombe (2010) argues that semi-structured and

unstructured interviews are a continuum and, in practice, they move back and forth along the scale. He further argues that what separates them from structured interviews is the fact that they allow interviewees to use their own words and develop their thoughts. McLeod (2014) supports this view, pointing out that semi-structured interviews allow respondents to talk in some depth and choose their own words, which help the researcher to develop a real sense of the respondent's understanding of a situation. Both techniques have as their aim 'discovery' rather than 'checking' (Denscombe, 2010).

4.7.2.4. The interview technique adopted in this study

The above synthesis and review of the literature on pertinent to interviews and the sequence of interviews highlights the usefulness and prominence of interviews in qualitative research. Within the healthcare sector, interviews are acknowledged to offer a powerful means of uncovering the complex experience of patients, carers and clinicians during treatment and decision-making processes. They allow the subjective analysis of complex human experience, making them a powerful tool for increasing our knowledge of important processes (Broom, 2005; Riesman, 2001).

Because this research was conducted on the basis of the explanatory sequential mixed methods protocol, the semi-structured face-to-face interview technique was considered the most appropriate within the time available to complete the research. Furthermore, it gives the targeted participants the opportunity to express their opinions based on their experience in the NHS and healthcare facilities management interface in the control of exogenous healthcare-associated infections.

The researcher chose a face-to-face technique rather telephone or web-based (Skype or video conferencing) interviews because this method is more personal and makes it easier to explore participants' experiences face-to-face. Furthermore, it gives the researcher the opportunity to ask complex and sensitive questions in order to collect comprehensive data (Collis & Hussey, 2014; Rebar & Macnee, 2010). This rationale is also supported by Easterby-Smith et al., (2012), who claim that semi-structured interviews give the researcher an opportunity to probe deeply, uncover new clues, open up new dimensions of a problem and secure vivid, accurate, inclusive accounts that are based on personal experience.

4.7.3. **Questionnaire surveys**

A questionnaire is a document designed for the purpose of seeking specific information from respondents (Polgar & Thomas, 1995). It is a method that seeks written or verbal responses from people to a written set of questions or statements. Questionnaires are broadly classified as based on 'open' or 'closed' questions (Parahoo, 2014; Denscombe, 2010; Polgar & Thomas, 1995). Open-ended questions are those that allow respondents to decide the wording of the answer, the length of the answer and the kind of matter to be raised in the answer (Denscombe, 2010). This type of questionnaire allows the respondent to provide answer in their own words. In closed-ended questionnaires, the researcher designs questions which allow only answers that fit into categories that have been established in advance (McLeod, 2014; Denscombe, 2010).

Both open and closed-ended questionnaires have advantages and disadvantages in different circumstances. According to Denscombe (2010), the advantages and disadvantages of closed-ended questionnaire design are a mirror image of open-ended design. The author further suggests that the main advantage of a closed-ended questionnaire is the structure it imposes on the respondent's answers, which gives the researcher information of uniform length, and in a form that lends itself nicely to being quantified and compared. One of the main disadvantages of this design is the lack of an in-depth response from respondents. According to Denscombe (2010), there is less scope for respondents to supply answers which reflect the exact facts or their true feelings.

A further advantage of open-ended questionnaire design is that the information gathered in the responses is more likely to reflect the full richness and complexity of the view held by the respondents (Denscombe, 2010). Open-ended questionnaires elicit more detailed responses. Questions in this type of questionnaire tend to be short, and the answers tend to be as long as the space given to respondents to express themselves in their own words. Yet one of the disadvantages of this type of questionnaire design is the time it takes the researcher to analyse the data, as the 'researcher have to read the answers and try to put them into categories by coding which is often subjective and difficult' (McLeod, 2014; Denscombe, 2010).

Questionnaires are frequently used, and they are by far the most common method of data collection in social and health research, and furthermore are perceived to offer relatively high validity of the results (Parahoo, 2014; Polgar & Thomas, 1995). According to Parahoo

(2014), questionnaires have been used in healthcare research undertaken to collect information from clients and staff on facts, attitudes, knowledge, beliefs, opinions, perceptions, expectations, experiences and behaviour. They have been used in healthcare research to gather information which forms the basis for subsequent diagnosis and treatment. According to the Parahoo (2014), other uses of questionnaires in healthcare research include:

➢ To routinely gather other general information for administrative, accounting and planning purposes

➢ To gather information which provides indicators of admission, discharge, morbidity, mortality, resource allocation, uptake of services and deployment of personnel

Because this research aims to propose a good practice knowledge management framework that would assist healthcare facilities managers in the control of exogenous healthcare-associated infections in hospitals, a questionnaire survey was first conducted among healthcare facilities managers (see Appendix C). The Questionnaire survey was employed to solicit data on knowledge, experience, opinions, perceptions, attitudes and behaviour in the control of exogenous healthcare-associated infections from healthcare facilities managers in NHS hospitals in order to achieve the research aim and objectives.

Research Aim:	To critically investigate the interface between knowledge management process and hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare associated infections (HCAI) through facilities management service delivery practices in NHS hospitals.		
	Outcome	**Objectives (See section 1.7.1)**	**Questionnaire-Question No. (See section 1.7.2)**
Knowledge	To ascertain the knowledge management process adopted/adapted in hospital facilities management cleaning service, and their inherent challenges in the control of exogenous healthcare associated infections	Objective 4	Q11, 12, 13
	To ascertain the adopted/adapted guidance documents in hospital facilities management cleaning services in the control of exogenous healthcare associated infections	Objective 1	Q6,7,8,9, & 10
Experience	To ascertain the level of the working relationship experienced by facilities managers among the clinicians members of the infection control team in the control of exogenous HCAI	Objective 3	Q14
Opinions & Perceptions	To seek the opinion and perception of healthcare facilities managers on the level of effectiveness of current hospital facilities management cleaning service delivery practices in the control of exogenous HCAI, and how this could be enhanced	Objective 1 & 5	Q7
Attitude and behaviour	To ascertain the level of attitude, and behaviour of the hospital management and staffs, relative to the structure and prevailing culture in complying with infection control guidance documents. Also, to know the level of importance accorded to technological capabilities as a facilitator, and a repository of good practice knowledge resources	Objective 4 & 5	Q10, 12 & 13

Figure 4.15:   Rationale for the use of the questionnaire survey

4.7.4. **Population and sample**

According to Parahoo (2014), one vital question to be considered in designing a questionnaire is what data to collect and from whom. Thus, before looking at the approaches to sampling that a researcher can use, it is important to be clear about the terms 'population' and 'sample' in order to choose a sampling technique (Blaikie, 2010; Denscombe, 2010).

> *The target population is the group which a researcher*
> *aims to draw a sample from* (Parahoo, 2014)

The term population refers to all the items in a category of things that are being researched (Denscombe, 2010). It is a group of individuals identified by the researcher from whom data can potentially be collected (Parahoo, 2014; Polgar & Thomas, 1995). On the other hand, sample refers to the selected individuals within the populations from whom data is collected (Parahoo, 2014; Polgar & Thomas, 1995). In the context and scope of this research, the population is the Infection Control Team (ICT) in NHS hospitals in England (Figure 2.6), while the sample population is facilities managers within the ICT. These professionals were purposely selected.
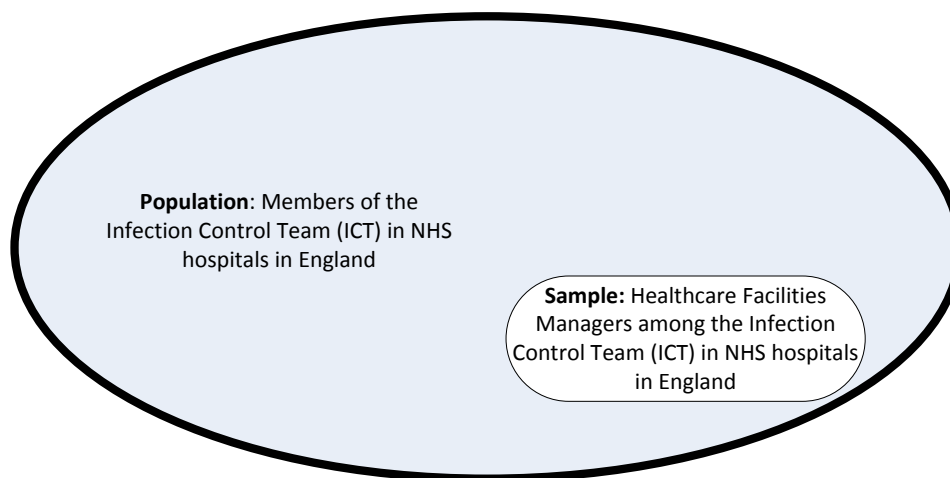
Figure 4.16:   Population and sample (adopted from Denscombe, 2010)

Purposive or judgmental sampling is a non-probability sampling approach where the researcher uses his/her judgment to select research cases or participants that will best facilitate answers to the research questions to achieve the research aim and objectives (Saunders et al., 2012; Blaikie, 2000, 2010; Denscombe, 2010). The five types of non-probability sample are accidental, purposive, volunteer, snowball and quota (Parahoo, 2014). Purposive sampling is

further classified into two overlapping categories known as purposive or judgmental and convenience sampling. In the convenience sample, the researcher chooses the targeted respondents according to who or what is available. This involves selecting samples that are both easily accessible and willing to participate in the study (Teddlie & Yu, 2007).

Non-probability sampling techniques are often used in quantitative research as 'the purpose of quantitative research is to contribute to an understanding of phenomena,' as the chosen sample has to provide the required data (Parahoo, 2014; Teddlie & Yu, 2007).

> *It is essential that all participants have experience of the phenomenon being studied* (Creswell, 2013).

This research chose purposive rather than convenience or random sampling to obtain data from facilities managers within NHS hospitals in England with experience in cleaning services and in the control of healthcare-associated infections. The reason for choosing purposive sampling for this research was that those selected are best placed to provide the requisite information for the research. According to Maxwell (2009), purposive sampling is a sampling technique in which "particular settings, persons, or events are deliberately selected for the important information they can provide that cannot be gotten as well from other choices." This is self-funded research, so it is important that the sampling technique selected should allow easy access and be cost-effective.

Gaining access to the research participants and relevant data, records and documents can be a very daunting task in health and social care research. According to Moule & Hek (2011), sources of healthcare data are sometimes protected, and the researcher may need to negotiate carefully with people in powerful positions to improve the response rate and gain access to interviewees. To facilitate access to research participants, snowball sampling was used to complement the purposive sampling method. Snowball sampling involves the process of approaching an expert, who in turn recommends other prospective participants. It is based on the assumption that people with like characteristics, behaviours or interests form associations which a researcher could exploit to increase response rates and access to a sample population (W. J. Creswell, 2014; Parahoo, 2014). This method was employed in order to increase the response rate. Participants who completed the questionnaire were asked to introduce other colleagues outside their hospital.

4.7.4.1. The unit of analysis

According to Nardi (2006), the unit of analysis is the element which the researcher observes and from which data is collected, such as person responding to a questionnaire, a school, an editorial or a local business. Within the context and scope of this research, the unit of analysis is made up of healthcare facilities managers. The rationale for the selection of this unit of analysis was the role of the healthcare facilities manager in the hospital environment, which is core to the research aim.

Exogenous healthcare-associated infections are infections that could be acquired from the healthcare environment (Rutala & Weber, 2008). Compared to other management service providers to the health service, the facilities management discipline has emerged in response to the challenges of the effective management of healthcare facilities (Alexander, 2007). This author further notes that healthcare facilities management is the process by which the facilities manager creates and sustains a caring environment by providing support services in order to meet healthcare objectives at a better cost. The services administered by facilities managers in hospitals are detailed in Figure 2.7. In order get the right information, the researcher ensured that the participants targeted within the sample population were those whose remit included 'cleaning services' (Figure 4.16).

4.8. Overview of the research questionnaire survey

4.8.1. Questionnaire design and structure

The increasing emphasis on evidence-based healthcare delivery outcomes has led to an increase in the use of questionnaires as a method of data collection in healthcare research in recent years (Andrew & Halcomb, 2009; Rattray & Jones, 2007). According to Burgess (2001), a crucial part of good research design concerns making sure that the questions asked in the questionnaire are designed to address the needs of the research. The questionnaire was first designed and structured to cover emerging issues identified from the literature. It covers relevant areas of infection control, NHS facilities management procurement methods, compliance monitoring protocols, and good practice knowledge management processes in the control of healthcare-associated infections in NHS hospitals in England. A number of concerns were taken into consideration while designing the research questionnaire. Paramount among them were the respondents targeted, the research questions; the problems of accessing information in the NHS bureaucracy, the objectives of the research and the method of

administering the questionnaire. It was imperative to design the questionnaire in a way that adequately addressed these concerns. The questions formulated were therefore centred on the overall aim and objectives of the research and its philosophical stance (see Figure 4.6).

The majority of the questions in the questionnaire are ordinal in nature, and for these a five-point Likert scale was used. According to Albaum (1997), the Likert scale is a way of measuring attitudes in social sciences research. To explore these factors from the facilities managers' perspective, an attitudinal Likert scale instrument was used for all the ordinal questions. According to Kumar (2011), this method 'measures the intensity of respondents attitudes towards the various aspect of a situation or issues'.

The Likert attitudinal scale instrument also provided a way of combining attitudes towards different issues into one overall indicator (Kumar, 2011). It was also used on the assumption that each statement/item on the scale has equal 'attitudinal value', 'importance' or 'weight.' The Likert scale is an instrument used to measure attitudes, beliefs, opinions, values and views (Parahoo, 2014). It shows the strength of one respondent's view in relation to another.

Different Likert Scales label type "A"; 'B'; 'C','D' and type 'E' were used to analyse the collected data, and express findings (see Table 4.5). The five scales were chosen based on the nature of the questionnaire survey questions. The scale ranges from 1 to 5, where 1= 'don't know'; 'not involved' (been the lowest) to 5 = 'Strongly agree'; 'Very effective'; 'Most influential' and 'very high level' (been the highest).

Table 4.5:   Questionnaire Likert scale types

Type 'A'					
Scale Range	1	2	3	4	5
Rating	Don't Know	Not Effective	Less Effective	Effective	Very Effective
Type 'B'					
Scale Range	1	2	3	4	5
Rating	Don't Know	Not influential	Less influential	Moderately Influential	Most influential
Type 'C'					
Scale Range	1	2	3	4	5
Rating	Don't Know	Strongly disagree	Disagree	Agree	Strongly disagree
Type 'D'					
Scale Range	1	2	3	4	5
Rating	Don't Know	Very low	Low	High	Very High
Type 'E'					
Scale Range	1	2	3	4	5
Rating	Not involved	Very low	Low	High	Very High

Before the main research questionnaire was distributed to the targeted respondents, a pilot study was carried out among a few of the targeted respondents to check if the questionnaire was likely to produce the information required to achieve the research aim and objectives. A pilot study enables the researcher to obtain some assessment of the questions' validity and of the likely reliability of the data that will be collected (Saunders et al., 2012; Hannagan, 1997). According to Burgess, (2001), a pilot study enables the researcher to detect any flaws in the questioning and correct them prior to the main survey. The pilot study is an important part of the research to ensure that the survey tool is effective, reliable and valid in terms of its intended purpose (Sarantakos, 2013).

Following feedback on the pilot study, the researcher was able to spot some errors, upon which modification was subsequently made to the questionnaire "to maximise the response rate and minimise error rate on answers" (Bryman, 2012; Burgess, 2001). The modifications included:

- ➢ The wording of the questionnaire was modified for clarity and understandability. Perceived ambiguities were removed.
- ➢ The questionnaire was redrafted to include a covering letter. This provides the recipient with an overview of the research, its importance, and what the responses will be used for. The covering letter includes a statement of confidentiality that guarantees anonymity to respondents. According to Remenyi et al., (2005), 'a good covering letter can contribute significantly to increasing the response rate.'

For ease of data reduction, analysis, and the understanding of the questions by the targeted participants, the questionnaire was grouped into five main sections, namely:

- ➢ Section 1 -   General information
- ➢ Section 2 -   In-use infection control good practice compliance protocol
- ➢ Section 3 -   Facilities management procurement strategy
- ➢ Section 4 -   Knowledge management process & infrastructure capabilities protocol
- ➢ Section 5 -   Infection Control Team collaborative practice

General Information: the general information section of the questionnaire focuses on the characteristics of the respondents and their organizations. The aim of this section is to elicit background information on the population from which the researcher collected date. There are four questions (Q1 to Q4 – see Appendix C) in this section.

In-use infection control good practice compliance protocol: This section of the questionnaire (Q6 to Q10) seeks to gather information relating to the guidance documents or tools used in ensuring compliance with good practice in the control of exogenous HCAIs. The information solicited includes the strategy used in managing compliance with good practice guidance documents in the control of exogenous HCAIs, the tools used to monitor compliance, the frequency with which these tools are used, the highest level HCAI risks identified are reported, and the key consideration that influence the monitoring of compliance.

Facilities management cleaning service procurement strategy: this section of the questionnaire (Q5) seeks to identify the types of facilities management cleaning service contract/procurement strategies in NHS hospitals in England. Findings from this section of the research will enable the researcher to ascertain how contracts for the delivery of facilities management cleaning services promote or inhibit effective knowledge management in the control of exogenous HCAIs.

Knowledge management process & knowledge infrastructure capabilities: This section of the questionnaire (Q11 to Q13) seeks to gather information on factors that may enhance or constrain the effectiveness of the knowledge management process (knowledge creation, storing, sharing and usage) in FM cleaning service delivery practice in the control of exogenous HCAIs within the hospital knowledge infrastructure capabilities in the control of exogenous HCAIs.

Infection Control Team collaborative practice: This section of the questionnaire (Q14) seeks to gather information on the level of involvement (i.e. the input) of facilities managers as members of the hospital infection control team (ICT) in the control of exogenous HCAIs.

The researcher reviewed the modified questionnaire and passed it to the research supervisor for final review and approval before it was distributed to the targeted respondents.

The following section discusses the technique adopted for the distribution of the main research questionnaire to the targeted respondents.

4.8.2. Questionnaire distribution

The questionnaires were first distributed by post to facilities managers in NHS hospitals in England using contact details obtained from "Binleysonline", which is an NHS database/repository of key contacts (www.binleysonline.com). This was used because it is the only online subscription-based website holding relatively up-to-date contact details for key professionals working for the NHS, including facilities managers, nurses and other professionals. Where the facilities manager's contact detail were not available on this website, the hospital main reception was contacted to obtain them.

A total of 209 questionnaires were administered to healthcare facilities managers across NHS hospitals in England using a combination of postal survey, Survey Monkey, and email of which 98 questionnaires were returned. The questionnaires were first sent to the hospital facilities manager's contact obtained from the database by post. The postal questionnaire failed to produce a significant response rate. Further investigation by the researcher found that in many cases the key contact person recorded as the facilities manager in the Binley database had either left the hospital or retired from active service. This resulted in the questionnaire not being delivered to the addressee. Further to this discovery, the researcher decided to use both the Survey Monkey internet survey link and email to administer the questionnaire. Telephone follow-up calls introducing the research and reminding respondents to complete the

questionnaire were made after sending the questionnaire link through Survey Monkey and email. This tactic significantly improved the response rate, and an additional 41 responses were received (see Figure 4.17).
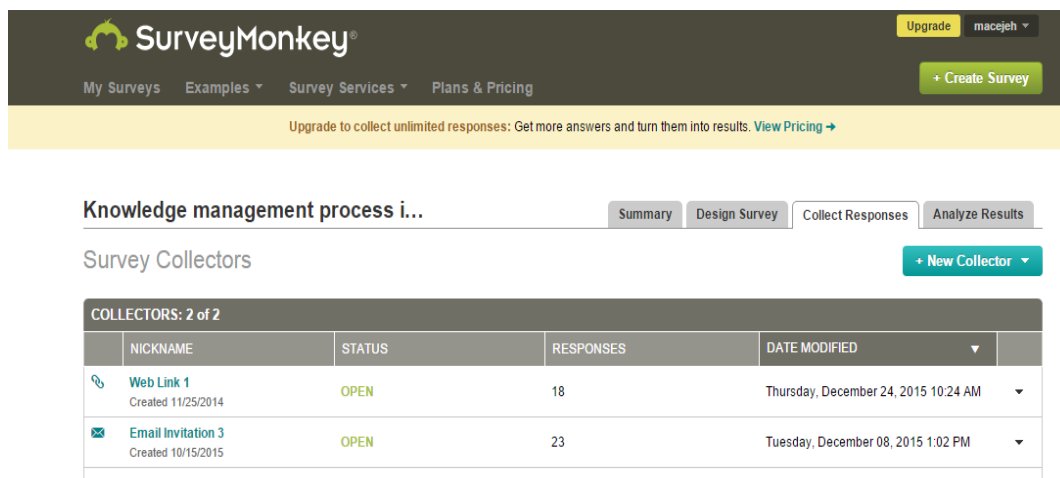
Figure 4.17:   Online questionnaire responses

Out of the 98 originally returned, 13 were incompletely filled out and considered not suitable for use in the analysis. 85 questionnaires which, represents 41%, were fully completed, hence considered useful for the data analysis (Table 4.6). This response rate is considered adequate, and valid for research within the healthcare sector "considering the difficulty in questionnaire survey response from healthcare professionals" (Parahoo, 2014). According to Parahoo (2014), the reasons for low response rates in healthcare research are that 'healthcare professionals are prone to question fatigue' as increasing demands on their time make it difficult for them to find time to reply to questionnaires. The excuses given during the telephone follow-up calls by some of the targeted research participants (facilities managers) for not having been able to complete the questionnaire include:

> High demands on their time because of keeping up with the demands of the community affected by the prevailing flood across the UK, which overlapped with this phase of the research data collection. Many NHS hospitals in England, and across other parts of the UK, were affected in one form or the other by this flood (see https://www.gov.uk/government/topical-events/winter-flooding-2015).

> High demands on their time because of preparing for either Care Quality Commission (CQC) or PLACE annual visits/inspections.

> High demands on their time from other pressing issues, of which they did not provide further details

Parahoo (2014) and Nardi (2006) both suggest various strategies which can be used to increase response rates. According to Parahoo (2014), making respondents feel that their responses are valuable, and ensuring that the questionnaire is well structured, easy to respond to, and not too lengthy, could increase response rates. This research questionnaire has the characteristics advocated by Parahoo (2014), as shown in the format of the questionnaire. Nardi (2006) also advocates follow-up phone calls, e-mail messages, and so on. These tactics were employed in this research and achieved a high response rate.

Table 4.6: Total questionnaires distributed and percentage of valid responses

Total Distributed Questionnaires: = **209**
Total Returned: = **98**
Questionnaires returned fully completed: **85**
Response Rate (%): = **41**

Job role	Valid Questionnaires	Percent (%)	Valid Percent (%)
Facilities manager	56	66	65.9
Head of facilities/Director of facilities	16	19	18.8
Domestic service manager	4	5	4.7
Works manager	5	6	5.9
Others	4	5	4.7
Total	**85**	**100**	**100**

Some of the reasons for achieving this satisfactory response rate could be:

> The interest of healthcare facilities managers in the research topic, which has had little or no focused attention in recent years. This is strengthened by the prevailing "target culture" in NHS hospitals - a situation where hospitals are required to demonstrate efficiency within their allotted resources without compromising quality healthcare outcomes.

> Follow-up phone calls to the targeted respondents reminding them of the invaluable difference their contribution (by completing the questionnaire) would make in achieving the research aim and objectives.

- Targeting only non-clinician members (facilities managers) of the infection control team.

- Focusing on a topical issue in the public eye (healthcare-associated infections). This is more interesting because of the research emphasis on 'exogenous' sources of HCAIs which has being gaining momentum in the recent literature.

- The explanation given in the covering letter of the importance of taking part in the research, and the assurance that the findings of the research will be made available to the research participants on request.

- The inclusion of self-addressed return envelopes in the postal questionnaire.

- Ensuring that the questions in the questionnaire were well structured, well presented, easy to understand and not too lengthy.

The next section presents the data analysis techniques used for the questionnaire.

4.8.2.1. Questionnaire data preparation and analysis

According to Pallant (2010), one of the most difficult (and potentially fear-inducing) parts of the research process for most students is choosing the appropriate statistical technique to analyse the data. It is acknowledged that the collated data from interviews, questionnaires or observation are 'raw' or 'crude', as these data themselves do not answer research questions or support or reject hypotheses until the researcher makes sense of them in a way that also makes sense to the reader. According to Moule & Hek (2011), data analysis involves the processing, summarising and interpretation of raw data into meaningful information. It is a process of making sense of the collected information, and searching for what lies below the surface content. The general purpose of analysing something, according to Denscombe (2010), is to gain an understanding of it. The raw data generated through quantitative approaches tends to be numerical, and therefore statistical tests are applied to generate statistical results.

Compared to other professional environments, there is an increasing emphasis on inter-professional interaction in the healthcare environment (Andrew & Halcomb, 2009). Knowledge of patients, diseases, processes, or the functioning of healthcare institutions is expressed numerically through the use of descriptive and inferential statistics (Polgar & Thomas, 1995). As a result, the importance of understanding statistical concepts continues to

be emphasised. According to Polgar & Thomas (1995), research evaluation (data analysis) techniques are typically used by the health professional at two levels:

- ➢ To evaluate the effectiveness of particular treatment techniques in order to improve the quality of therapy available to the client
- ➢ To evaluate the relative effectiveness of healthcare programmes in order to determine the allocation of resources in health settings.

To avoid potential error, misinterpretation and wrong conclusions from the research findings, the analysis of the questionnaire data was carried out in a logical and systematic sequence as suggested by Sarantakos (2013). According to Sarantakos (2013) and Denscombe (2010), the analytical process takes place in a number of stages:

- ➢ **Data preparation:** This involves checking the collated data for possible errors, editing and categorising the data.
- ➢ **Exploring the data:** This involves reviewing the edited data over and over for trends or correlations between variables.
- ➢ **Data analysis:** This involves applying descriptive and inferential statistical analysis to the data
- ➢ **Presentation and display of the data:** This involves presenting the data using figures and tables, and explaining the findings, as well as drawing conclusions and validating the data/findings.

Table 4.7:   The five main stages in the analysis and presentation of research data (adapted from Sarantakos, 2013 and Denscombe, 2010

The Five Stages of the Research Qualitative & Quantitative data analysis		
	Quantitative	**Qualitative**
Data Presentation	**Coding:** categorising and checking the collated data	Presentation of the data, and loading it into/transcribed within Nvivo 10 software
Initial Exploration of data	Searched for obvious trends or correlations Use of Descriptive Statistics	Looked for obvious recurrent themes or issues, write notes to capture the themes, issues or ideas
Analysis of the data	(descriptive analysis), Relative Importance Index (RII), Correlation (relational analysis) and significant/ reliability testing. These are linked to	Code the data, group the code into themes and categories; compare the themes that encapsulate the categories.
Presentation and display of the data	Tables, Figures, Written interpretation of the statistical findings	Written interpretation of the findings, illustration of points by quotes, use of tables and figures
Validation of the data	Internal and external validity, member validation	Data and method triangulation, member validation

4.8.2.2. Data analysis

It is acknowledged that there is no universally accepted definition of the importance of a variable, and the proper interpretation of the most commonly used measures (those provided automatically by popular statistical software programs) is often difficult, awkward, or subject to misinterpretation and misuse (Azen & Budescu, 2003). The purpose of methods such as multiple regression is to predict or explain criterion (response) values from several well-selected predictors (Azen & Budescu, 2003). However, Relative Importance Index techniques are a useful supplement to multiple regression because they provide information not readily available from the indices typically produced from a multiple regression analysis (Tonidandel & LeBreton, 2011).

> *The summary and interpretation of data from quantitative research entail the use of statistics* (Polgar & Thomas, 1995).

The research questionnaire data was analysed sequentially using descriptive statistics and Relative Importance Index (RII) techniques.

Descriptive statistics techniques were first employed to analyse and describe the basic and specific characteristics of the collated data (Pallant, 2013; Polgar & Thomas, 1995). According to Collis & Hussey (2014) and Polgar & Thomas (1995), one of the most

important uses of descriptive statistics is to 'crunch' or condense data into typical values to represent the distribution of scores, allowing patterns to be discerned that are not apparent in the raw data. Descriptive statistics was first employed to provide a clear understanding of the prevalent trend in healthcare-associated infections and in the knowledge management processes within the prevailing culture, structure and technological capabilities in NHS hospitals in England. Further to the descriptive analysis of the collated data, having identified patterns that were not apparent in the raw data identified, Relative Importance Index (RII) techniques were used to evaluate the relative importance of the variables within the context of each Likert scale question from the respondents' point of view.

The Relative Importance Index (RII) shows the contribution a variable makes to the prediction of criterion variables by itself, and in comparison with other predictor variables (Johnson & LeBreton, 2004). This technique considers only the relative contribution of a variable to total predictable variance and makes no assumptions about either the statistical significance or the partial significance associated with a particular predictor (Gosling, Naim, Fearne & Fowler, 2007; Johnson & LeBreton, 2004). This technique is also referred to as the weighted criteria model (Wysocki, 2004). According to Wysocki (2004), this approach is.

> *"...the most robust of the quantitative approaches one might select...it allows the reviewer to select the specific criteria and to weight the criteria by importance to one another".*

The Relative Importance Index has been used by several authors to evaluate the importance of questions in a Likert Scale from the respondents' point of view in both built environment and healthcare research (Muhwezi, Acai & Ottim, 2014; Gündüz, Nielsen & Özdemir, 2013; Doloi, Sawhney Iyer & Rentala, 2012; Fugar & Agyakwah-Baah, 2010). The method is used by Adzroe (2015) to analyse Likert scale questions in his thesis "A Study of E-Business Technology Transfer Via Foreign Direct Investment in The Ghanian Construction Industry", submitted to the School of the Built Environment, The University of Salford, in the summer of 2015.

RII is calculated for each variable using the RII equation below:

$$Relative\ Importance\ Index\ (RII) = \frac{\sum w}{A * N}\ \ (0 \leq index \leq 1)$$

Figure 4.18:   The RII data analysis technique

Where:

- ➤ RII =   Relative Importance Index

- ➤ W =   the weighting given by the respondents to each variable on the five-point Likert scale (where 1 represents "don't know" and 5 "strongly agree" or "very effective")

- ➤ **A** =   the highest weight (which is "5" in this instance); and

- ➤ **N** =   the total number of respondents, which is the 85 valid responses.

After the RII had been computed from the data obtained from the questionnaires, some variables were shown to have an equal rank. In these cases, the ranking of the variables was reviewed taking into account the respondents' highest ranking. Where it was not possible to differentiate between the variables using this approach, a joint ranking was applied.

4.8.2.3. Reliability and internal consistency tests of the questionnaire data

Tests of reliability are significant in research. They are employed when the researcher wants to know about the significance of the findings relative to the extent to which the results of the study reflect, or are consistent with, on-going activities in the targeted population (Sarantakos, 2013; Nardi, 2006). The majority of the questions in the research questionnaire were ordinal in nature. One of the concerns about ordinal scale questions in quantitative research is 'the scale's internal consistency.' This refers to the degree to which the items that make up the scale 'hang together' and measure the same construct (Pallant, 2013). Considering the nature of the questions in the questionnaire, and in order to check the internal reliability of the data to determine whether the questionnaire was reliable in measuring what is was intended to measure, further analysis was carried out. According to Sarantakos (2013), tests of significance/reliability are dependent on three factors which it is important to ascertain:

- ➤ Whether the distribution is scaled on a nominal, ordinal or interval/ratio level;
- ➤ Whether the study includes one or more samples (one-sample tests, two-test, k-sample tests);
- ➤ Whether the samples are related (matched) or independent.

After the variables under investigation were examined and the level of their perceived importance established using the Relative Importance Index (Figure 4.18), the results were input into Statistical Package for Social Science (SPSS) and subjected to statistical analysis for further insight, using:

- ➢ the Cronbach alpha test for internal consistency and inter-item reliability and,
- ➢ Correlation - Spearman's rho test to measure the strength of the relationship between variables (correlation)

Cronbach alpha:

High quality tests are important to evaluate the reliability of questionnaire data in a research study. According to Bland & Altman (1997), when items are used to form a scale, they need to have internal consistency to ensure that they all measure the same thing. The most commonly used method for measuring the internal consistency and inter-item reliability of a questionnaire is Cronbach alpha (Tavakol & Dennick, 2011; Pallant, 2010). Compare to other methods of establishing questionnaire reliability; Cronbach alpha determines the internal consistency or average correlation of multiple variables summated in dichotomous or multi-point questionnaires to gauge their reliability (Santos & Reynaldo, 2013; Tavakol & Dennick, 2011). The measure of reliability and internal consistency using Cronbach alpha is expressed as an alpha coefficient with a value of between 0 and 1. This value is used to describe the reliability of factors extracted from dichotomous (i.e., questions with two possible answers) and/or multi-point questionnaire or scales (Santos & Reynaldo, 2013). The higher the score, the more reliable the scale is. It is felt that alpha values of over 0.8 are preferable. However, an alpha value of 0.7 is considered to be an acceptable coefficient value (Santos & Reynaldo, 2013; Tavakol & Dennick, 2011; Pallant, 2010).

Internal consistency is concerned with the inter-relatedness of a sample of test items, and tests ascertain or describe the extent to which all the items are inter-related and are measuring the same concept or construct (Santos & Reynaldo, 2013; Tavakol & Dennick, 2011). According to (Tavakol & Dennick, 2011), the alpha coefficient should be calculated for each of the item rather than for the entire test or scale. Table 4.8 shows the results of the Cronbach alpha test for the internal consistency and reliability of the Likert scale questions in the questionnaire.

Table 4.8: Internal consistency of the questionnaire data as measured by the Cronbach alpha test

Question No.	Variables	Reliability Statistics			
		Cronbach Alpha	No of Items	Valid Responses	%
3&4	Respondents' experience in the control of HCAIs	0.769	2	85	100
9	Frequency of compliance monitoring in the control of drivers of exogenous HCAIs	0.687	7	85	100
11	Factors inhibiting effective knowledge management	0.815	6	85	100
12	Prevailing hospital knowledge infrastructure capabilities	0.815	5	85	100
13	In-place knowledge management processes in hospitals	0.943	9	85	100
10	Factors driving compliance with the good practice knowledge management process	0.819	7	85	100
14	Level of facilities management involvement in ICT in the control of exogenous HCAIs	0.658	1	85	100

The closer the number is to 1, the higher the reliability, while the closer the number to 0, the less reliable the result. It should be noted that high alpha values (say greater than 0.9) may suggest that some item are redundant, which means that they may be measuring same the thing. A low alpha value could be due to a low number of questions, poor inter-relatedness between items or a heterogeneous construct (Tavakol & Dennick, 2011). It is recommended that the Alpha coefficient value should be between 0.7 to 0.95 (Tavakol & Dennick, 2011).

Correlation

A correlation is the relationship between two variables (Sarantakos, 2013; Pallant, 2010). There are different types of correlation test, and the choice of which test to use depends on the level of measurement, the nature of the data (nominal, ordinal or interval), the distribution of the data (continuous or discrete) and the structure or characteristics of the distribution (Sarantakos, 2013; Pallant, 2010).

Table 4.9: Association (correlation) tests by level of measurement (adopted from Sarantakos, 2013).

Level	Association (Correlation) Test
Nominal	ϕ coefficient, Cramer's V, contingency coefficient (C), Tschurprow's T, and Lambda test
Ordinal	Spearman's rank correlation, Tau-a, Gamma coefficient, Sommer's d, and Tau-b
Interval - ratio	Pearson's product-moment correlation

According to Sarantakos, (2013), a correlation specifically relates to three major aspects of a relationship. These are:

➢ **The presence or absence of a correlation,** i.e. whether or not there is a correlation between the variables in question

➢ **The direction of the correlation**, i.e. whether an existing correlation is positive or negative

➢ **The strength of the correlation**, i.e, whether an existing correlation is strong or weak

Spearman's Rank Order Correlation (rho) and Pearson's product-moment correlation coefficient (r) tests both explore the data and provide an indication of both the direction (positive or negative) and the strength of the relationship between two continuous variables in terms of a coefficient ranging from -1 to +1. +1 denotes a positive or strong relationship, -1 indicates a negative or weak relationship, while a zero correlation indicates no relationship between the variables (Sarantakos, 2013).

Pearson's product-moment correlation coefficient (r) is a parametric test employed to measure the strength of the relationship between normally distributed data measured on an interval or ratio level (Sarantakos, 2013; Pallant, 2010). On the other hand, Spearman's Rank Order Correlation (rho) is a non-parametric test employed when ordinal data are tested (Sarantakos, 2013). According to Moule & Hek (2011), Spearman's rho is used either when both variables are ordinal, or when one is ordinal and the other is interval/ratio. This is the most common measure used for testing the reliability of ordinal data (Sarantakos, 2013; Moule & Hek, 2011).

The majority of the questions in the questionnaire are not normally distributed, and are ordinal in nature. Hence, Spearman's ranked correlation rho test was employed to determine the level of significance and the strength of association between the variables.

The aim of this research is to develop a knowledge management framework that will assist in the control of exogenous healthcare-associated infections in facilities management cleaning service delivery practice in NHS hospitals. Most hospitals develop a bespoke version of good practice compliance key performance indicators (KPI) from existing guidance policies and specifications for assessing how far their delivery of FM cleaning services meets the required standard. It is therefore imperative that indicators which might not be rated high on the Likert scale by respondents are tested to ascertain the extent of their correlation with other, more highly rated variables.

Designing Likert scale questions involves assembling interrelated items in a summated scale to measure underlying constructs. Thus it is imperative to examine the variables further by interlacing them to identify any underlying factor that may further contribute to the research results. This is a further reason for using Spearman's rho to determine whether there are any statistically significant relationships between the variables as ranked by the respondents. This will enable the researcher to ascertain the level and strength of the relationships and lead to a clearer and informed interpretation of the findings (Naoum, 2013; Sarantakos, 2013; Nardi, 2006).

4.9. Qualitative interview data analysis

Compared to questionnaire surveys, interviews have the capacity to discover new knowledge and capture detailed explanations of phenomena from experts in the field in a more open, consistent and systematic manner (Petty, Thomson & Stew, 2012; Qu & Dumay, 2011). Considering the dynamic nature of infection-causing microorganisms' resistance to antibiotics, it was imperative to explore contemporary management approaches by questioning the experts in the field (i.e. hospital facilities managers) as a basis for proposing a sustainable knowledge management framework. According to Parahoo (2014), the aim of qualitative interviews is to identify all the possible ways in which respondents experience phenomena.

Bearing in mind the varied strategies used across NHS hospitals for the control of exogenous HCAIs, a semi-structured interview technique was employed for face-to-face interview data collection. This technique was chosen because it was considered to be more suitable for exploring the perceptions and opinions of the targeted research participants regarding the phenomena under investigation (see section 1.7.2). McLeod (2014) refers to this technique as

'discovery interviews', which often contain open-ended questions. Healthcare-associated infections are a typical issue. It is a technique which enables the researcher to explore facilities managers' experiences, behaviours and practice, allowing the "respondent to talk in some depth by choosing their own word" (McLeod, 2014; Parahoo, 2014).

One of the key findings from the initial study was the lack of clinicians' in-depth awareness of the knowledge management processes used by the facilities management team in the control of exogenous healthcare-associated infections. This finding led to a change in the initial research participants targeted, which included clinician members of the infection control team, to focus instead on the non-clinician members who are charged with the management of the hospital environment. At the start of one of the interviews with a senior clinician (General Manager, Infection Prevention and Control) it was stated that:

> *"To be honest, answers to your questions rest with those that manages the hospital environments, say the facilities managers or the estate guys."*

The research interviews were conducted in 16 NHS hospitals across England using the semi-structured interview technique. However, six of the interviews were deemed invalid as a result of the interviewee's reluctance to provide complete answers to some of the questions. This reduced the valid number of interviews for this research to 10 (see Table 4.10).

Table 4.10:   Professionals involved in the main research interviews

Present Job Role	Type of NHS organization	No. of interviews
Facilities Manager	Acute hospital	5
Head of Facilities	Acute hospital	3
Senior Facilities Manager	Acute hospital	1
Domestic Service Manager	Acute hospital	1
Total No. of interviews conducted		10

The interviewees had different job titles, ranging from Facilities Manager (5), Domestic Service Manager (1), Head of Facilities (3) to Senior Facilities Manager (1). Notwithstanding this disparity in the interviewees' job titles; there is homogeneity in the scope of their responsibilities, which include ensuring the cleanliness of the hospital surroundings and care environment.

To gain access to the participants, the researcher politely introduced himself and his research through phone calls and emails to seek their initial consent to participating in the interview. Once they had agreed, a formal invitation to participate in the interview together with a research participant consent form was emailed to them (see Appendix E). In some cases, these were sent by post, with an enclosed self-addressed and stamped return envelope. This process is part of the research ethics requirements of the College of Science and Technology of the University of Salford (see Appendix A). An appointment for the interview was made as soon as they had confirmed participation either by email or by returning the signed research participant consent form.

According to Parahoo (2014), the real-life experiences of interviewers show that interviewer - interviewee interaction in qualitative interviews differs from situation to situation, and this suggests that researchers have to be flexible in their approaches. With this in mind, the participant consent form was read out once again before commencing the interview.

All the interviews were conducted in English, and were audio recorded and notes were taken. The audio recordings were reviewed and contextualized against the notes and findings from the literature, and from this themes were developed and subsequently used to confirm or disprove findings from the questionnaire survey conducted in the first phase of the research.

Each interview was conducted in an interactive and open manner, following the pattern set out in the interview schedule guide, and lasted between 30 and 45 minutes. The interviews were broadly focused to encourage respondents to share their personal experiences in relation to the prevalence of healthcare-associated infections and the knowledge management process employed to curtail their prevalence within the culture, structure and technological capabilities of their hospitals.

Analysis of the data was carried out in three stages using NVivo 10, which is one of many types of computer-assisted qualitative data analysis software (CAQDAS) available. Like other similar packages, NVivo allows for basic searches for coded categories and the retrieval of coded segments (Moule & Hek, 2011). It allows data to be analysed using qualitative analysis procedures in order to identify emerging patterns/themes (concepts, ideas, topics and phrases) from a macro-perspective. According to Creswell (2013), computer-assisted qualitative data analysis software (CAQDAS) helps:

> To store and organise qualitative data. The program provides a convenient way to store and retrieve qualitative data

> To locate segments of text or images associated with a code or theme

> To locate common passages or segments that relate to two or more labels

> To make comparisons among code labels

> The researcher to conceptualise different levels of abstraction in the analysis of qualitative data

> To provide a visual picture of codes and themes

> To provide the capability to write memos and store them as codes.

A theme is something relevant to the research question which can be seen in "some level of patterned response or meaning within a data set" (Flick, 2014). According to Saldana (2009), a theme is an outcome of coding, categorization and analytic reflection. Gibson & Brown (2009) note that a significant aim of thematised analysis is to establish the relationship between code categories, and the significance of such relationships for the development of theoretical conceptions and statements. The relevance of themes in the analytical process used in qualitative research is therefore of paramount important. According to Bazeley (2013), themes identified in the data provide a useful starting point for developing a report of the findings from a study. Themes are best used to describe an integrating, relational statement derived from the data that identifies both contents and meaning (Bazeley, 2013).

The content of each interview was first transcribed verbatim into NVivo 10, thus maintaining the originality of the shared experience and ideas as expressed by the respondents. This was in order to identify emerging themes recorded as semantic (major) themes within NVivo (see Figure 4.19). The semantic themes were further developed (where pertinent) into latent themes. According to Flick (2014), semantic themes focus on the 'explicit or surface meaning of data', whereas latent themes aim to 'identify or examine the underlying ideas, assumptions, and conceptualizations - ideologies.'

2.2. The benefits of the adopted FM contract attributes

Name	Sources	References
Greater control	0	0
Feel part of the hospital team	3	4
High level of responsibilities	4	6
Job security	1	1
Development opportunity	0	0
Training opportunity	4	4
Increased Productivity	0	0
Scope to develop service	3	4
Flexibility to response to various needs	4	4
Control of new ways of working	4	4
Direct link with staffs	3	3
Staff understand the hospital process	5	5
Outsource Contract	0	0
Knowledge transfer	2	2
Turnaround or response time	1	1
Contract management only	1	1
Budget Control	0	0
Cost control	5	6

2.1 The adopted FM contract attributes

Name	Sources	References
Inhouse	7	7
Outsource	3	3

2.3. Areas that could be improve in the Inhouse adopted FM contract

Name	Sources	References	Created On
Collaboration	0	0	06/01/2016 13:15
Better working relationship	5	5	06/01/2016 13:15
Avoiding cross management of servic	1	1	06/01/2016 13:15
Improve communication	2	2	07/01/2016 14:11
Increase staffing level	0	0	06/01/2016 13:16
employment of skillful staffs	2	3	06/01/2016 13:16
Increase routine monitoring and supe	4	4	06/01/2016 13:16
Productivity	2	3	06/01/2016 13:17
Motivation of staffs	2	4	06/01/2016 13:17
Cost Control	0	0	06/01/2016 13:18
Budget control	2	2	06/01/2016 13:18
Outsourced contract	0	0	07/01/2016 14:13
Getting the Service Levele agreemen	1	1	07/01/2016 14:14
Training	1	2	07/01/2016 14:15

4.1. Culture of good practice knowledge collaboration in the control of HCAI attributes

Name	Sources	References	Created On	Created By
Collaboration	0	0	06/01/2016 13:43	CE
Learn from problems	1	1	06/01/2016 13:43	CE
Identify problem and deals with it c	5	5	06/01/2016 13:44	CE
Routine Inspection	3	3	06/01/2016 13:44	CE
Regular meetings and discussion	5	6	06/01/2016 13:44	CE
Improvement model	0	0	06/01/2016 13:45	CE
PLAN, DO, STUDY, ACT	1	1	06/01/2016 13:45	CE
Communication	0	0	06/01/2016 13:45	CE
Sharing information	7	7	06/01/2016 13:47	CE
Communicate good practice appro	3	4	06/01/2016 13:47	CE

4.5. How does the hospital ensure that employees have adequate knowledge of the adopted technological system

Name	Sources	References	Created On	Created By	Modified On
Action Plan	0	0	06/01/2016 14:27	CE	06/01/2016 14:27
50 point auditing chart check list in front of every ward	1	2	06/01/2016 14:27	CE	07/01/2016 18:57
Immediate action plan for failings	1	1	06/01/2016 14:27	CE	07/01/2016 18:59
Meetings	0	0	06/01/2016 14:23	CE	06/01/2016 14:23
Regular meeting with HICC	2	2	06/01/2016 14:24	CE	07/01/2016 19:14
Periodic review of competence	0	0	06/01/2016 14:24	CE	06/01/2016 14:24
Annual appraisal	1	1	06/01/2016 14:24	CE	07/01/2016 19:12
Observation and supervision	1	1	06/01/2016 14:24	CE	07/01/2016 19:09
Supervisor communicate with the domestic staffs	2	2	06/01/2016 14:25	CE	07/01/2016 19:12
Training	0	0	06/01/2016 14:22	CE	06/01/2016 14:22
Face to face training	5	5	07/01/2016 18:49	CE	07/01/2016 19:14
Mandatory E-Learning	4	5	06/01/2016 14:22	CE	07/01/2016 19:13
Refresher training	2	2	06/01/2016 14:23	CE	07/01/2016 19:01
Updating good practice documents	1	1	07/01/2016 19:19	CE	07/01/2016 19:20

4a.1. Process for the creation of new knowledge from existing knowledge in FM attributes

Name	Sources	References	Created On	Created By
Collaboration	0	0	06/01/2016 14:36	CE
Collaborate with other Trust to se	2	2	06/01/2016 14:37	CE
ICT review of policies & Procedur	7	9	06/01/2016 14:37	CE
Routine Inspection	0	0	06/01/2016 14:38	CE
Checklist	2	2	06/01/2016 14:39	CE
Routine Observations	3	4	06/01/2016 14:38	CE
Survey	0	0	06/01/2016 14:39	CE
Feedback	1	1	06/01/2016 14:39	CE
Patient survey	1	1	06/01/2016 14:40	CE
Training	0	0	06/01/2016 14:37	CE
E-Training	4	4	06/01/2016 14:37	CE
face to face trainings	5	5	06/01/2016 14:38	CE
Training sign-offs	1	2	06/01/2016 14:38	CE

Figure 4.19:   Screenshot of some semantic themes in the research

The second stage of the data analysis was the coding and analysis of the semantic themes in order to derive the latent themes, and for this qualitative data analysis techniques such as thematic analysis were used with the assistance of NVivo 10. According to Flick (2014), thematic analysis is a method of identifying, analysing and reporting patterns (themes) within data. It is a popular method for analysing qualitative data by identifying patterns of meaning (Whittaker, 2009). Other authors describe it as a versatile and flexible approach that can be used to minimally organise, describe and interpret various aspects of the research data (Flick, 2014; Whittaker, 2009). This method was used to carry out an in-depth analysis of the semantic themes and "key issues identified the semi-structured interviews stage and document review stage" (Ahmad & Ali, 2003), and was adopted to gain an in-depth understanding of the management and control of exogenous HCAIs from facilities managers within NHS hospitals in England. The findings were reviewed to determine how far they supported or disproved the findings from the questionnaire survey to achieve the research aim and objectives.

The third and final stage of the data analysis was the weighting of the subthemes to ascertain the cumulative weighted score of both the sub- and major themes in order to draw an informed conclusion about the dominance of the variable in relation to the targeted objective.

The latent themes generated in this analysis will be discussed in the context of the findings from the questionnaire and the literature in the qualitative data analysis and discussion chapters.

4.9.1. **Interview sample size**

Compared to probability sampling techniques, there is "no strict rule of sample size" in non-probability sampling, and the selection of the sample focuses on the research questions and objectives (Saunders et al., 2012). According to Creswell (2009), the sample size for qualitative research should be small and be able to inform the development of variables. It is acknowledged that non-probability sampling techniques are the dominant factor in selecting appropriate research participants in qualitative studies (Schultz, Essiet, Souza, Kapogiannis, & Ruddock, 2013; Saunders et al., 2012). Table 4.11 gives the minimum sample sizes for non-probability qualitative research suggested by Saunders et al. (2012).

Table 4.11: Minimum non-probability sample size

Nature of studies	Minimum sample size
Semi-structured/in-depth interviews	5 - 25
Ethnographic	35 - 36
Grounded theory	20 - 35
For a homogenous population	4 - 12
For a heterogeneous population	12 - 30

The 10 participants in the qualitative interview phase of this research constitute the valid sampling size for non-probability research given by (Saunders et al., 2012).

4.10. Validity and reliability of the research process

Validity and reliability are two of the most important concepts used by researchers to evaluate the rigour with which a study is carried out (Parahoo, 2014). These concepts have to do with the tools used for data collection and analysis and the objectivity with which they are administered, as well as the extent to which sources of bias can be controlled (Parahoo, 2014; Easterby-Smith et al., 2012). Validity has to do with the relevance, precision and accuracy of a research instrument. It tells the researcher whether an instrument measures what it is supposed to measure and whether the measurement is accurate and precise (Sarantakos, 2013).

According to Parahoo (2014), validity refers to the degree to which a questionnaire, interview or observation schedule or other method of data collection measures the phenomenon under investigation. It is about accuracy, and about whether the measure actually measures the concept it is supposed to measure correctly (Tavakol & Dennick, 2011; Nardi, 2006; Fellows & Liu, 2003).

Reliability refers to the consistency of a particular instrument in measuring or observing the same phenomenon across multiple occurrences of its use (Parahoo, 2014; Tavakol & Dennick, 2011; Denscombe, 2010). According to Tavakol & Dennick (2011), the reliability of an instrument is closely associated with its validity. An instrument cannot be valid unless it is reliable.

Various methods have been used in the validation of research instruments in both qualitative and quantitative research. Sarantakos (2013) groups those used for checking the validity of research instruments into:

Face and content validity: a measure is considered to have content validity if its covers all possible dimension of the research topic (Sarantakos, 2013). According to Kumar (2011), to achieve content validity each question or item must have a logical link with the research objective, and the items and questions used must cover the full range of the issue or attitude being measured. This research is in line with Kumar's (2011) definition of content validity (see Table 7.1).

Construct validity: construct validity refers to how far the operational measures for the concepts, ideas and relationships being studied are correct (Remenyi et al., 2005). According to Sarantakos (2013), a measure can claim construct validity if its theoretical construct is valid. Construct validity was achieved in this research through the use of a mixed method strategy, which involved the use of multiple sources of data collection, including a questionnaire survey, interviews and a literature review (see Figure 4.14).

Internal Validity: internal validity refers to the extent to which the research design impacts the research outcomes, and is established by ensuring that the findings of the research are the results of the independent variables and have not been affected by the instruments or procedures used (Sarantakos, 2013). Internal validity is concerned with seeking causal relationships between different events in explanatory studies (Yin, 2014; Remenyi et al., 2005). The interviews and survey used in this research were explanatory in nature. Thus the test for internal validity does not apply to this research, as it is an explanatory study.

External validity: external validity is concerned with knowing the extent to which the research findings can be generalized to a wider universe beyond the immediate research environment (Sarantakos, 2013; Remenyi et al., 2005). In this research, external validity was achieved through the use of a mixed method strategy. Additionally, the use of several sources of data (triangulation) to investigate the research phenomena at different stages of the research undertaken indicates that the research meets the criteria for external validity criteria (see section 4.10.1. .

4.10.1. **Triangulation**

Triangulation is also known as multiple methods, and is the most frequently cited reason for using mixed methods in research (Greene, Caracelli, & Graham, 1989). Triangulation refers to the use of more than one method or source of data in a research study with the aim of corroborating particular findings (Bryman, 2012; Creswell, 2009; Yin, 2009). It offers the prospect of enhanced confidence in the results of research and the possibility of capturing a more holistic and contextual portrayal of the phenomena under study (Creswell & Plano Clark, 2008). The use of one single form of evidence in research means it is not possible to address the research question from a broader perspective. The use of multiple methods can uncover variances which otherwise may remain hidden in a research approach which relies on one method or source of evidence (Creswell & Plano Clark, 2008; Yin, 2014). Yin (2014). and Creswell (2009) recommend the use of multiple sources of data in order to provide more convincing and accurate findings in any research undertaken.

Triangulation explores the phenomena under investigation in a way that may neutralise weakensses and potentially enriches the researcher's understanding by allowing new or deeper dimensions to emerge (Creswell & Plano Clark, 2008). It therefore has a number of advantages, including the fact that:

➢ It allows researchers to be more confident in their work;
➢ In contrast to conventional forms of data collection, it can stimulate the creation of inventive methods and new ways of capturing problems;
➢ It allows for the emergence of different viewpoints that may lead to findings which do not fit existing theories or models, which in turn may be a basis for modifying old theories or developing new ones.

Some of the perceived drawbacks of triangulation are the challenge of replicating methods and the associated cost and time, which may discourage its use (Creswell & Plano Clark, 2008). Notwithstanding, triangulation has important strengths and can lead to more productive research. It takes full advantage of qualitative methods and at the same time demonstrates that they can and should be utilized in a complementary fashion (Creswell & Plano Clark, 2008).

In order to achieve its aim and objectives, this research used data triangulation, theoretical triangulation, and methodological triangulation (Guba & Lincoln, 1994; Greene et al., 1989) as follows:

> ➢ **Data triangulation:** the researcher reviewed and synthesised the theoretical literature in the research subject domain, and conducted semi-structured interviews and an empirical questionnaire survey (Figure 4.9).
> ➢ **Theoretical Triangulation:** the literature which was reviewed and synthesised included literature on infection, healthcare-associated infections, facilities management, knowledge management and healthcare facilities management within and outside the UK.
> ➢ **Methodological triangulation:** the researcher also reviewed and synthesised available literature on research methods, and provided a justification for the design of this research within the context of the methodological assumptions underpinning interpretivism, constructionism and abductive research approaches.

Considering the dynamic nature of HCAIs and the different management approaches within NHS hospitals, it was imperative to use a variety of sources to capture information that would lead to the achievement of the research aim and objectives.

4.11. **Ethical considerations**

The principal ethical consideration in data collection is that no harm should come to the respondents as a result of their participation in the research (Oppenheim, 2003). Ethics involves considerations of right and wrong (Remenyi et al., 2005). The healthcare sector is a sensitive sector in which confidentiality is a prominent consideration when compared to other sectors of any economy. According to Saunders et al. (2012), some ethical considerations to be taken into account in research include:

> ➢ The privacy of potential research participants,
> ➢ The fact that participation in a research project should be voluntary, and that participants should have the right to withdraw partially or wholly from the research,
> ➢ The fact that the consent of participants should be obtained, and that their responses may not be completely open and honest,
> ➢ The fact that data obtained from the research participants should be confidential and anonymised.

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These issues were acknowledged and taken into consideration in this research. The University of Salford's research ethics policy stipulates that ethical approval must be obtained by all postgraduate research students (PGRs) prior to the commencement of research involving human subjects, animals or human tissue. Following the provisions in the ethical approval application guidelines, the researcher submitted the proposed research data collection process to the research ethics panel of the College of Science and Technology (CST) of the University for their consideration and approval. After a thorough scrutiny of the application, approval was granted (see Memorandum reference number CST13/111 in Appendix A).

4.12. **Chapter Summary**

This chapter presented and discussed the methodology adopted for this research. The methodological process is adapted from the 'research onion' described by Saunders et al. (2012). The elements discussed in this chapter include the research philosophy, research approach, research methods, research strategies and research techniques. This provides the context within which the research was conducted using the sequential explanatory mixed methodological research strategy rooted in an interpretivist philosophy.

The next chapter presents the initial findings and discussion from the questionnaire survey as part of the first phase of the sequential explanatory mixed methodological research strategy.

Chapter 5.   ANALYSIS OF FINDINGS FROM QUESTIONNAIRE SURVEY

5.1. Introductions

This chapter presents the findings from the research questionnaire survey that was conducted among healthcare facilities managers across NHS hospitals in England as part of the research explanatory sequential mixed methodological strategy set out in Figure 4.11. The questionnaire survey was conducted with the aim of gathering objective information on day-to-day occurrences associated with knowledge creation, i.e. the storing, sharing and usage. in healthcare facilities management cleaning services in the control of exogenous HCAIs. This was investigated within the context of the prevailing hospital culture, structure and technological capabilities. The findings from the questionnaire survey are analysed and presented below. The results will be substantiated in the second phase of the research methodological protocol, which involved qualitative face-to-face interviews, to help explain the questionnaire findings. According to Creswell (2014),

> *"...Sequential explanatory mixed method design begins with the collection of quantitative (survey) data, followed by the analysis of the result and the finding which is then used to plan (or built onto) the second (qualitative) phase".*

The author further adds that

> *"....Findings from this phase also inform the type of participants to be purposefully selected for the qualitative phase, and the type of question that will be asked of the participants."*

The analysis and discussion presented in this chapter are based on the structure and sequence of the research questionnaire (see Appendix C). This chapter partly addresses objectives 1-5 and research questions 1 to 5 towards achieving the overall research aim.

According to Parahoo (2014), questionnaires have been used in healthcare research to collect information on the attitudes, knowledge, beliefs, opinions, perceptions, expectations, experiences and behaviour of clients and staff to achieve the research objectives. In this study, the questionnaire survey was employed to solicit data on knowledge, experience, opinions,

perceptions and attitudes relating to the control of exogenous healthcare-associated infections from healthcare facilities managers. These will be investigated within the context of the knowledge management process within the prevailing knowledge infrastructure capabilities in their NHS hospitals (see Section 2.10).

5.2. Data analysis and presentation of findings

5.2.1. Questionnaire structure

The research questionnaire was designed and structured to cover emerging issues identified from the literature and the pilot study. It covers pertinent areas of infection control, procurement, and good practice knowledge management processes within the knowledge infrastructure capabilities for the control of healthcare-associated infections in NHS hospitals in England. For ease of data analysis, and to facilitate participants' understanding of the participants, the questionnaire was grouped into five main sections namely:

- ➢ Section 1 -   General information
- ➢ Section 2 -   Infection control good practice guidance documents/tools used
- ➢ Section 3 -   Facilities management procurement strategy
- ➢ Section 4 -   Knowledge management processes and infrastructure capabilities
- ➢ Section 5 -   Collaborative practice within the Infection Control Team

The questionnaire was designed in accordance with the philosophical stance underpinning the research (see Figure 4.6), and contained multiple-choice questions. It consisted of both open and closed-ended questions, thus giving the respondents the opportunity to provide additional relevant information that was not captured in the questions.

The methods used in the analysis of the questions vary, depending on the nature of the data. According to Flick (2014), the method for analysing survey data will always be dependent on the type of data (nominal, ordinal, and numerical) and on the number of dependent and independent variables involved.

The data from the questionnaire were first inputted into Microsoft Excel Spreadsheet and checked for possible errors and omissions (data cleaning), before been transferred to SPSS for analysis. The data generated from SPSS were tabulated and presented in graphs and tables using Microsoft Excel. The following sections provide a detailed analysis of the questionnaire survey findings.

5.3. Section 1 - General information

This first section of the questionnaire sought information about the respondents and their organisations. The aim of this section was to provide a background overview of the population from which the researcher collected information. There are four questions (Q1 to Q4) in this section. Descriptive analysis was used to analyse the findings, and the data was presented in both graphical and tabular form for ease of understanding and interpretation. According to Kumar (2011), one of the objectives of graphs is to present data in a way that is easy to understand and interpret, more-so, it is interesting to look at.

5.3.1. Present job role

Eighty-five (85) valid, fully completed questionnaires were analysed, representing 41% of the 209 questionnaires distributed. Fifty-six (56) of the responses (66%) were from hospital facilities managers, sixteen (16) respondents (19%) identified themselves as heads of facilities management, four (5%) identified themselves as domestic managers, with another 5 (6%) who were works managers. Four of the respondents simply identified themselves as 'others' (see Figure 5.1).

	Domestic Service Manager	Facilities Manager	Head of Facilities	Others	Work Manager
■ Sum of Frequency	4	56	16	4	5
■ Sum of Percent	5	66	19	5	6
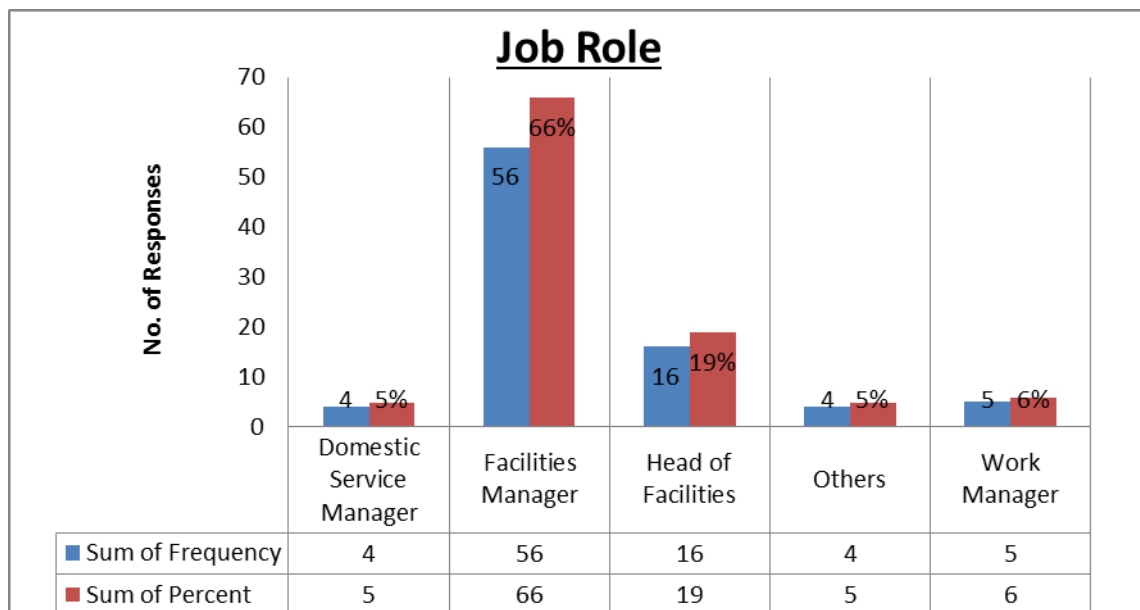
Figure 5.1: Questionnaire respondents and job roles

The job titles of the sample population are representative of those of the general population who have responsibility for the management of NHS hospital facilities found in the literature (Alexander, 2007; Champika Liyanage, 2006). One intriguing job title not prominent in the literature but which was given by four of the respondents is "works manager". This term was not seen in the literature reviewed. Further enquiry found that "works manager" is the old title used for facilities or domestic service managers in the NHS until the early 1980s. This was confirmed in a meeting with the researcher by the research supervisor, who has several years of experience working with NHS hospitals. He stated that:

> *"Works manager was the old job title for facilities and domestics manager in NHS hospitals."*

The aim of this research is to develop an effective knowledge management framework for the control of exogenous healthcare-associated infections in facilities management. The maintenance of the exogenous environment which lies at the heart of this research is paramount among the services rendered by the 85 respondents to the questionnaire. According to Ayliffe (2009), routine cleaning of the environment, including floors, toilets, baths, washbasins, beds, locker tops and other furniture, is the responsibility of the domestic services manager in all hospital wards and departments. It could be argued that all the respondents have this responsibility, which could add further rigour and reliability to this research.

5.3.2. Types of NHS hospital

The research was conducted across acute and non-acute NHS hospitals in England (see Figure 5.2). Acute hospitals are those hospitals which provide acute beds linked to medical and surgical interventions (National Audit Office, 2009). An acute hospital provides beds and operates wards for intensive and terminally ill/palliative care. According to Smyth et al. (2008), acute hospitals' core specialisms include medicine, surgery, maternity, and Accident & Emergency services. They also provide acute beds for elderly, young, physically disabled, surgical, medical, paediatric and acute maternity patients. On the other hand, non-acute hospitals are those that do not provide acute beds linked to medical and surgical interventions. The highest number (66) of responses was from staff in acute NHS hospitals, representing 77% of the 209 questionnaires distributed. The other 19 respondents were from non-acute NHS hospitals (see Figure 5.2).

It could be argued that the high level of responses from acute hospitals enhances the richness of the research data, as previous research has shown that HCAIs are more prevalent in acute hospitals in England (Smyth et al., 2008).

Type of NHS hospital

Series1	Mental health hospital	Acute hospital	Mental Health and None Acute hospital	Acute and None acute hospital	Nursing homes
	7	66	5	6	1
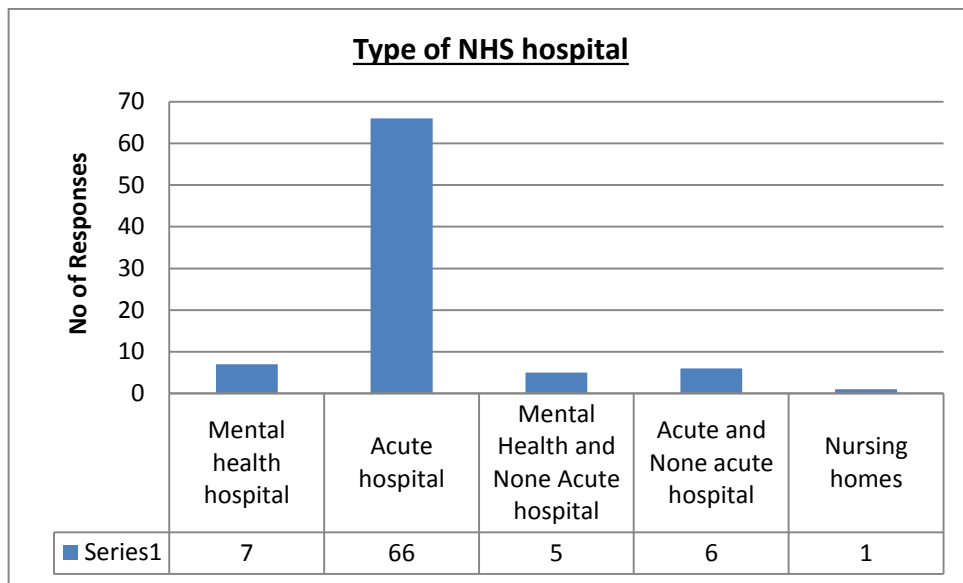
Figure 5.2:   Respondents according to NHS organisation

5.3.3. **Years of experience in healthcare and in the control of HCAIs**

Table 5.1   presents an overview of respondents' years of experience in healthcare and the control of HCAIs. 46 of the respondents (54% of the total) have over 20 years' experience in the healthcare sector, while 21 (25%) have over 20 years' experience in the control of HCAIs. Four respondents (5%) have less than five years in the healthcare sector, while 13 (15%) have between 16 and 20 years in the control of HCAIs.

Table 5.1:   Respondents' years of experience in healthcare and the control of HCAIs

Years of experience	Years of experience in healthcare		Years of experience in the control of HCAIs	
	No. of respondents	Percentage (%)	No. of respondents	Percentage (%)
Up to 5 years	4	5	14	16
6 - 10 years	10	12	23	27
11 - 15 years	15	18	14	16
16 - 20 years	10	12	13	15
Over 20 years	46	54	21	25
Total	85	100	85	100
Mean		3.99	3.05	
Std. Deviation		1.28	1.45	

The mean value of respondents' years of experience in the healthcare sector is 3.99, with a Standard Deviation (SD) of 1.28, while the average years of respondents' experience in the healthcare sector is over 20 years. The mean years of experience in the control of HCAIs is 3.05, with an SD of 1.45, and the average years of experience in the control of HCAIs is between 16 and 20years.

It is imperative that the research should be based on respondents with sufficient experience in the healthcare sector and in the control of HCAI to achieve the research aim and objectives, as this gives rigour and validity to the research. It can be argued that the more experience the respondents have in the research area, the more rigorous and valid the research will be.

5.4. Section one interpretation

This section has presented an overview of the characteristics of the research participants and the types of NHS hospital in which the research was conducted.

The following section presents the findings from the questionnaire survey on the good practice guidance documents (policies/guidelines/specifications/systems) currently used in the control of exogenous healthcare-associated infections in FM cleaning services in NHS hospitals

5.5. Section 2 - Documents/tools used in infection control good practice compliance management

This section of the questionnaire aims to identify what good practice guidance documents are used from the plethora of guidance documents in the delivery of facilities management

cleaning services in the control of exogenous healthcare-associated infections in NHS hospitals. What is presented in this section are findings on the effectiveness of the guidance documents and compliance monitoring tools which are used, and the highest level at which identified HCAI risks are reported. One aim of this is to obtain answers to research question 1 and to fulfil research objective 1 (see section 1.7.1).

Section 3 of the questionnaire begins with questions on the following topic:

5.5.1. Adopted good practice guidance document/tools used in monitoring compliance to good practice in FM cleaning service delivery practice in the control of exogenous HCAI in each hospital

Opinions were sought from healthcare facilities managers within NHS acute and non-acute hospitals in England on the usefulness of good practice guidance documents in terms of their adaptability, understandability usability. Findings will be set in the context of individual factors that might enhance or inhibit effective knowledge management processes within the hospital knowledge infrastructure capabilities. Figure 5.3 presents the findings from the questionnaire in response to this question.
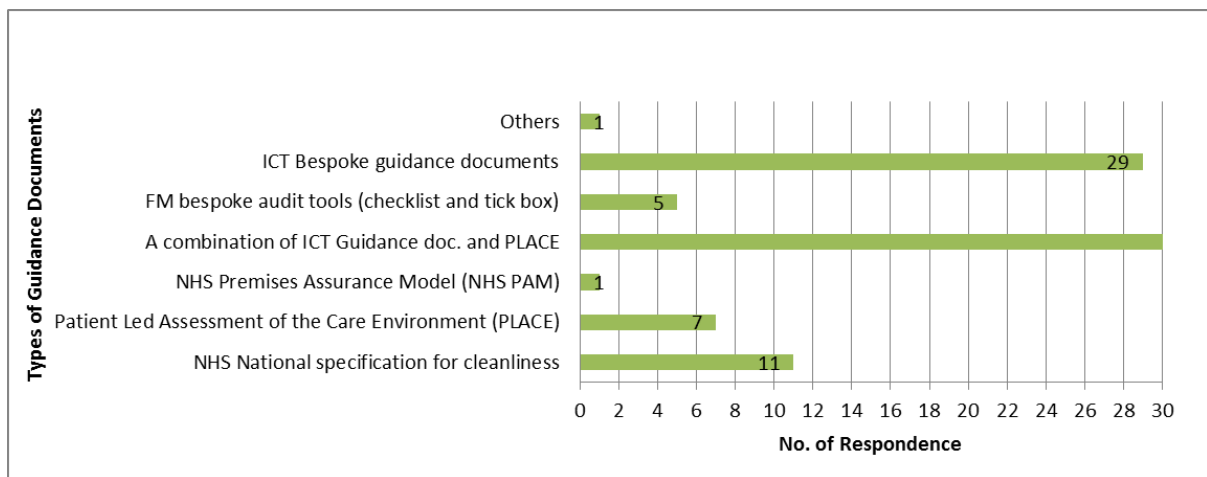
Figure 5.3:   Good practice guidance documents for the control of HCAIs in FM services

Figure 5.3 presents the results of the 85 questionnaires completed, and seeks to ascertain if there are other guidance documents apart from those sampled that are being used in monitoring compliance with good practice in hospital cleaning services for the control of exogenous HCAIs in NHS hospitals in England. The findings show the frequency of use of

these documents, and no other document was mentioned in the open-ended question section of the questionnaire.

Twenty-nine (29) of the respondents, or 34% of the total, reported using ICT bespoke guidance documents in monitoring compliance with good practice in the control of exogenous HCAIs. Thirty-one (31) respondents, representing (37%) indicated that they used a combination of ICT bespoke guidance documents and PLACE, while Eleven respondents (13%) used the National Specification for Cleanliness. Nine of the respondents (11%) use their hospital's bespoke audit tools developed by the ICT, and seven of the respondents (8%) said that they used only PLACE. Five of the respondents (6%) used FM bespoke audit tools (checklist and tick box). Only one of the 85 respondents acknowledged using the NHS Premises Assurance Model (NHS PAM).

Findings from this question showed that all the current guidance documents used in the delivery of hospital facilities cleaning services for the control of exogenous HCAIs have been covered in this research. This provides further evidence of the rigour and validity of this research.

To further explore this issue, respondents were asked to rate the effectiveness of the adopted guidance documents used. Responses will enable the researcher to fully capture the context within which decisions are made in order to achieve the targeted objective. The next question sought opinions on this.

5.5.2. Indication of the level of effectiveness of the adopted guidance document/tools used in the monitoring of compliance with good practice in FM cleaning service delivery in the control of exogenous HCAI in each hospital

After respondents had identified the guidance documents/tools used in the delivery of FM cleaning services, they were asked to rate the efficacy of the documents to achieve target standards. A Type "A" Likert scale of 1 - 5, with 5 being the highest rating, was used for this question. Relative Importance Index (RII) scores (see Figure 4.18) were then calculated for all the guidance documents in Figure 5.3 and arranged in ascending order of effectiveness. The guidance document with the highest RII score (i.e. closest to 1) indicates the most effective, while the lowest scores (those closest to 0) indicate the least effective guidance documents for the control of exogenous HCAIs.

The parameters used in the ranking had to do with the documents' adaptability understandability and usability, i.e., how far they might enhance or inhibit effective knowledge management processes within the hospital knowledge infrastructure capabilities.

Table 5.2: RIIs and rankings of guidance documents used in the control of HCAIs

| Guidance Documents | Respondent Scores | | | | | RII | Rank |
	1 Don't know	2 Not effective	3 Less effective	4 Effective	5 Very effective		
ICT bespoke guidance doc. + PLACE	4	0	21	36	24	0.779	1
NHS National specification for cleanliness	6	0	28	36	15	0.727	2
Patient Led Assessment of the Care Environment (PLACE)	2	2	34	34	13	0.727	2
ICT Bespoke guidance documents	9	2	24	39	11	0.696	3
Others	13	2	52	11	7	0.593	4
FM bespoke audit tools (checklist and tick box)	7	34	35	9	0	0.508	5
NHS Premises Assurance Model (NHS PAM)	52	3	21	8	1	0.372	6

The findings presented in Table 5.2 show that Infection Control Team (ICT) bespoke guidance documents in combination with PLACE are considered the most effective of the seven documents, with an RII of 0.779 and a ranking of 1. There was a tie between the National Specification and PLACE when used independently, with a joint RII of 0.727 and a joint ranking of 2. Infection Control Team bespoke guidance documents when used independently ranked third with an RII of 0.696. In fourth place in terms of effectiveness was "Others", with an RII of 0.593. It could be argued that what respondents are saying here is that these documents are all good, but they have to be "mixed and matched" in order to achieve the desired outcome. The facilities management 'checklist & tick box' audit tool was ranked fifth, with an RII of 0.508. This tool could be viewed as a 'spot-check' measure used for a 'snapshot' overview during routine inspections. It was noted that the NHS Premises Assurance Model (NHS PAM), which was ranked sixth with an RII of 0.372, is not a popular guidance document. It should be recalled that PAM was launched with the aim of raising

awareness of the impact that NHS facilities can have on the care environment (Department of Health, 2014c). It is an environmental improvement guidance document which was used to create awareness of environment-centered issues within NHS facilities and services and could also be described as a guidance tool specific to healthcare environments that was used to sensitise healthcare facilities management personnel to the importance of the safe management of hospital services including the internal environment, water, energy and transport.

April 2013 saw the introduction of PLACE, which is the new document currently used for assessing the quality of the patient environment, replacing the old Patient Environmental Action Team (NHS England, 2013a). The major emphasis of PLACE compared to other guidance documents is on the care environment, and it provides robust indicators to be met by hospitals in this regard. It emphasises the requirement in the NHS constitution that "(the) patient should be cared for in a clean and safe environment with compassion, and dignity." The use of PLACE in combination with ICT bespoke audit tools could indicate that local factors are taken into account to maximize efficiency in the control of exogenous HCAIs.

> *Further research should focus on the impacts of cleaning*
> *and infection control related policy and guidance issued*
> *by the Department of Health... This should inform future*
> *cleaning related initiatives* (May 2013).

These findings show that the guidance documents sampled were those being used across NHS hospitals to monitor compliance with good practice in the delivery of facilities management cleaning services in the control of exogenous HCAIs. It is important to mention that the findings reflect the perspective of hospital facilities managers across NHS hospitals in England (see Figure 5.1 and Figure 5.2).

5.5.3. The level of effectiveness of adopted methods employed to ensure compliance with good practice guidance document/tools in FM cleaning service delivery in the control of exogenous HCAI in each hospital.

In the eighty-five (85) responses analyzed, 'individual ward/unit inspection' came top as the most effective method with an RII of 0.878 (see Table 5.3). This could be argued to be a direct response by the infection control team to points 1 and 3 of the 10-point commitment to improvement in the NHS set out in 'The Matron's Charter' (Department of Health, 2004a). The first commitment in the charter states that "keeping NHS clean is everybody's

responsibility," with the third giving the ward/unit Matron responsibility for ensuring everyone is committed to this action. It states that "The Matron will establish a cleanliness culture across their unit." The overwhelming consensus on this as the most efficient method shows that the monitoring of compliance with the infection control strategy is seen as not only the responsibility of the infection control team. This conclusion is further supported by the fact that the 'routine ICT inspection' approach was ranked fifth with an RII of 0.638 (Table 5.3). The measure ranked the second most effective was the use of electronic tools, relative to the use of internet medium to achieve targeted outcome with an RII of 0.748. Checklists and surveys were ranked third and fourth respectively.

Table 5.3: RII and ranking of approaches for managing good practice compliance

| Tool/approach | Respondent Scores | | | | | | |
	1 Don't know	2 Not effective	3 Less effective	4 Effective	5 Very effective	RII	Rank
Individual ward/unit inspection	4	0	8	20	53	0.878	1
Electronic tools	7	2	20	33	23	0.748	2
Checklist	7	2	34	24	18	0.704	3
Survey	6	2	40	27	10	0.678	4
Routine ICT Inspection	28	1	7	25	24	0.638	5

These findings reflect the perception among NHS hospital facilities managers in England that hospitals have processes in place to ensure that compliance with good practice protocols are managed as scheduled to achieve the desired outcome.

> *Cleanliness is everyone's responsibility, not just the cleaners* (Department of Health, 2004a)

Having identified the guidance documents/tools which are used and their perceived levels of effectiveness, the methods or approaches used to ensure compliance were explored. It is thus imperative to ascertain the frequency of checking to make sure the methods are fulfilling their purpose.

5.5.4. **Frequency of monitoring performance against the chosen compliance management method for the control of HCAIs**

Respondents were also asked to indicate the frequency of monitoring against the compliance monitoring method/approach used to achieve the desired outcome. 47 of the 85 respondents, representing 55% of the total, reported that they did this on a monthly basis, while 21 respondents (25% of the total) did it on a weekly basis. Thirteen (13) respondents, representing 15%) carry out such monitoring on a daily basis, while the remaining four respondents (5%) indicated 'other', but without providing further details (see Figure 4.5).
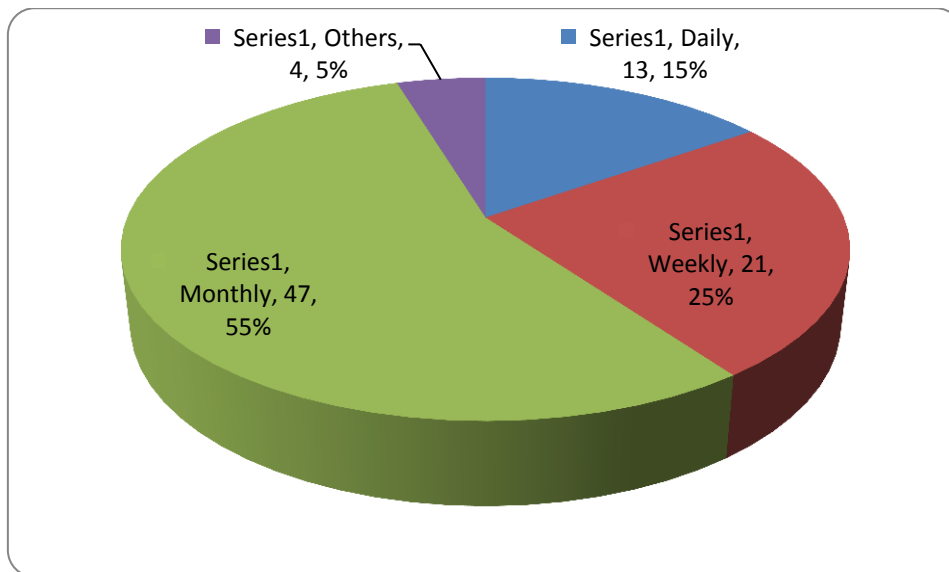
Figure 5.4: Frequency of compliance monitoring

This question sought to ascertain the level of monitoring compliance to set standards in order to meet the national standard for the cleanliness of healthcare environments. The findings show that there are variations in the frequency of monitoring across NHS hospitals in England. It should be recalled that the national standard for cleanliness in the NHS was published in 2001 in the wake of the publication of the NHS plan, following consultation with experts and professionals in the field of infection control. The aim of the national standard then was to raise standards of cleanliness to an acceptable level throughout the NHS (Department of Health, 2003a). Further to the acknowledgement that, all too often, cleaning contracts were driven by price, with insufficient focus on quality, the Department of Health published the revised National Specification for Cleanliness in 2007, which set out minimum frequencies for cleaning in hospitals in order to achieve the standard stipulated in the national

specifications (National Patient Safety Agency, 2007). It provided a comparative framework within which hospitals in England can established details of the way cleaning services will be provided and assess 'technical' aspects of cleanliness to ensure compliance with the national standard.

Findings from this question reflect the perceptions of healthcare facilities managers within NHS hospitals in England. They show that NHS hospitals in England have a variety of schedules for monitoring compliance to good practice in the control of exogenous HCAIs in FM cleaning services.

There are several influencing factors or considerations that motivate individual hospitals to ensure that they comply with the standards, and the extent to which they take these into consideration the prevailing knowledge management process in FM cleaning services for the control of exogenous HCAIs. The next question seeks to identify these influencing factors in order to achieve the overall research aim.

5.5.5. **Key drivers for monitoring compliance in FM cleaning service delivery in the control of exogenous HCAIs in each hospital.**

Over the years, several initiatives for quality improvement targeted at clinicians and non-clinicians have been introduced in the NHS to improve standards of practice and enhance quality healthcare delivery outcomes. Some of these initiatives were introduced around the time of the publication of the NHS Plan, and include the Commission for Health Improvement (CHI), launched in November 1999. This was later replaced with the Commission for Healthcare Audit and Inspection (CHAI) in 2004 (Day & Klein, 2004; Department of Health, 2005a). The current set of guidelines is PLACE, which was introduced in 2013 to replace PEAT (NHS England, 2013a). All these initiatives have a common focus, and their mandate is to identify and highlight inherent challenges and dilemmas associated with inspections and the monitoring of compliance with good practice standards in the NHS. According to Day & Klein (2004), methods of judging performance and compliance to standards within these initiatives include:

➢ Carrying out reviews and investigations of the provision of healthcare and the arrangements to promote and protect public health. These include studies that are aimed at improving economy, efficiency and effectiveness in the NHS,

- ➢ Inspecting all NHS healthcare providers, and recommending special measures where failing standards are identified, and
- ➢ Reviewing the quality of data relating to health and healthcare delivery including published surveys of the views of patient and staff.

To achieve the objectives of such initatives, certain influencing considerations were defined, with each carrying a weighting used to benchmark their relative contribution to quality healthcare outcomes. Drivers for monitoring compliance with standards in facilities management cleaning service delivery in the control of HCAIs in NHS hospitals were identified from the literature and were sampled to ascertain which of them had the greatest influence. These drivers include those detailed in "The NHS improves: A study of the Commission for Health Improvement" (Day & Klein, 2004).

Table 5.4: RII and ranking of key drivers for monitoring the compliance of FM cleaning services

Drivers	Respondent Scores					RII	Rank
	1: Don't Know	2: Not Influential	3: Less Influential	4: Moderately Influential	5: Most Influential		
Patient health & safety	1	0	8	12	64	0.925	1
Better service delivery	2	2	12	9	60	0.889	2
Meeting targets set by NHS	0	0	11	26	48	0.887	3
Avoiding extra cost to the hospital	2	6	30	19	28	0.753	4
Concerns about being labelled 'a failed hospital'	3	7	38	16	21	0.706	5
To check the effectiveness of existing approaches	4	19	42	16	4	0.593	6

Table 5.4 shows respondents' ranking of drivers for monitoring compliance with good practice standards in facilities management cleaning services in the control of exogenous HCAIs in hospitals. The findings from the ranking of the eighty-five (85) responses show that concern for patient health and safety was the top consideration in monitoring compliance with good practice in facilities management cleaning service delivery for the control of exogenous HCAIs. This variable has a RII of 0.925. The second most important consideration was the

desire for "better service delivery" by the hospital, with a RII of 0.889, while meeting NHS targets was third, with a RII of 0.887. Avoiding extra costs to the hospital, arising from claims of negligence and NHS penalties for failing standards, was ranked fourth with a RII of 0.753. Concerns about being labelled a 'failed hospital' was ranked fifth with a RII of 0.702. Monitoring compliance with good practice as way of checking the effectiveness of tools or approaches used was the least influential driver, with a RII of 0.593.

In the face of the prevailing trend in healthcare-associated infections in NHS hospitals in England, it is worth noting that the findings from this question showed that a focus on better service delivery outcomes is still on the agenda of most NHS hospital facilities managers. This was reflected in the top three considerations. All of these are fundamental objectives of the main documents relating to quality improvement in the NHS, including The NHS Plan, the NHS Constitution, the Matron Charter, PEAT and PLACE (Department of Health, 2013d, 2004, 2000; National Health Service England, 2012). It is important to mention that the findings of this research reflect the perceptions of hospital facilities managers in NHS hospitals in England.

5.5.6. **Section two Interpretations:**

This section of the questionnaire survey evaluates the current guidance documents used in facilities management cleaning service delivery in the control of exogenous HCAIs in hospitals. The effectiveness of these guidance documents was assessed, and this included examining the methods and approaches used to monitor compliance with the standards they set out, as well as the frequency of monitoring. The factors, which motivate the monitoring of compliance with good practice as detailed in the documents were also explored.

The finding from this section of the questionnaire is that there is a variety of approaches to the control of exogenous HCAIs as there is plethora of good practice guidance documents in NHS hospitals. This finding is consistent with the concerns raised in this regard leading to the publication of several guidance documents focused on cleaning service delivery in hospitals (see Table 2.4). In the light of these findings, it is imperative to explore further, to ascertain if there are other guidance documents used for the delivery of FM cleaning services which are not covered above. There is also a need to investigate the reasons for the use of a particular document in preference to another. This issue was addressed in the qualitative (face-to-face)

phase of the research sequential explanatory mixed method strategy to achieve the overall research aim and objectives.

According to Creswell (2014), qualitative data in sequential explanatory mixed method research helps to provide more depth and more insight into the quantitative results. The interviewees were asked the following closed-ended questions to help provide more depth and insight into the findings in this regard:

- ➢ Which of the available guidance documents is the hospital using to monitor compliance with good practice in facilities management cleaning service delivery for the control of exogenous HCAI?
- ➢ What are the reasons for the choice of this particular guidance document?

The next chapter presents findings from the qualitative phase of the methodological research strategy.

The next section presents the findings from the questionnaire survey on the prevailing procurement strategies/methods for the delivery of hospital facilities management cleaning services in relation to the control of exogenous healthcare-associated infections.

5.6. Section 3 - Facilities management cleaning service procurement strategies

The second section of the questionnaire sought to ascertain the prevailing procurement strategies and contract methods used in the delivery of hospital facilities cleaning services in the NHS and their interface with good practice knowledge management processes within the prevailing hospital culture, structure and technological capabilities in order to achieve Objective 2 and 5 of the research.

There are several procurement options available for the delivery of facilities management cleaning services in the healthcare sector. These options are broadly classified into two categories known as in-house (i.e., using directly employed staff) and outsourcing (Handley & Benton, 2009; Varadarajan, 2009; Belcourt, 2006). Outsourcing is the transfer of in-house services to a third-party service provider. It is the transfer of an operation that is outside the comfort zone of a business to a third-party provider (Southgate, 2007).

When the then UK Conservative government made the outsourcing (competitive tendering) of hospital facilities management services a policy in 1983, it was argued that such a policy would lead to the efficient use of resources in the health service. Healthcare authorities were

required to develop systems of competitive tendering for support services such as laundry, cleaning and catering, which would involve comparing the performance of an in-house arrangement with what could be purchased from external agencies (Department of Health and Social Security, 1983). Today the evidence is seen as mixed, as attention has been drawn to perceived falling standards in the cleanliness of hospitals since the introduction of competitive tendering (Davies, 2010; Pratt et al., 2007). This development has led to questions about the influence of the various routes for procuring hospital cleaning services contracts on the incidence of HCAIs (Davies, 2005, 2010; Pratt et al., 2007).

> *Cleaning standards have fallen: patients, staffs, the public and the government know that since the introduction of competitive tendering of cleaning services in 1983, standards in hospital cleanliness have fallen* (Davies, 2005)

The adequate cleaning of hospital environments is acknowledged to be essential both for the health and safety of staff, and for patient recovery outcomes. It is also considered to be a significant contribution to the quality of healthcare delivery (Department of Health, 2004; Auditor General of Scotland, 2000). The question of whether there is a connection between the quality of hospital environmental cleanliness and the prevalence of healthcare-associated infections has been discussed for many years. According to Pratt et al., (2007), there is a body of clinical evidence, derived from case reports and infection outbreak investigations, which suggests an association between poor environmental hygiene and the transmission of microorganisms causing healthcare-associated infections in hospitals.

> *The fact that cleaning standards in hospitals have fallen as a result of contracting-out is not disputed and led to the Labour Government in 2001 ending the compulsory element of market testing/competitive tendering for cleaning services in the NHS* (Davies, 2005)

Findings from the analysis of the completed questionnaire are presented in the following sections.

5.6.1. The procurement strategies for the delivery of FM cleaning services in each hospital

Of the eighty-nine (85) valid questionnaires, those completed by 46 of the respondents, representing 54% of the total, reported using a combination of outsourcing and in-house strategies in the delivery of their hospital facilities cleaning services. Thirty-three (33)

respondents (39%) delivered their cleaning services using directly employed in-house staff. Five (6%) indicated that they outsourced their services, while one respondent (1%) reported using the public finance initiative (PFI) option (see Table 5.5)

Table 5.5:   Types of FM cleaning contract used

Procurement method	No. of respondents	Percentage (%)
In-house	33	39
Outsourcing	5	6
A 50/50 split between in-house and outsourcing	46	54
Private Finance Initiative (PFI)	1	1
Total	85	100
Mean	2.18	

According to a report published by the Centre for Health and the Public Interest (2015), the NHS now contracts out the provision of healthcare services to the private sector to the tune of over £20 billion a year, or a fifth of the total healthcare budget. It is also stated in the report that these outsourced services are mostly contracted to clinical services providers such as dentists, pharmacies, opticians and general practitioners. The proportion of the budget devoted to outsourcing non-clinical services was not stated in the report. However, it was acknowledged that 'it is difficult to quantify how much non-medical work in the NHS has been outsourcing to date' (Lacobucci, 2015).

5.6.2. **Section three interpretation**

Managing domestic services is acknowledged to be a complex activity which requires the making of choices about where domestic staff should be based, and what their role should be (Department of Health, 2011). Having identified the popular methods of procuring facilities management cleaning services in the NHS, there is a need to further explore the reasons for the choice of a particular method. This is in order to establish how this could influence the effectiveness of the knowledge management process within hospitals' prevailing culture, structure and technological capabilities in the control of exogenous HCAIs. Therefore in the qualitative interview phase of data collection, the following closed-ended questions were asked:

> ➢ What is the adopted procurement method in delivery of the hospital facilities management cleaning services?

> ➢ What are the fundamental reasons for the choice of a particular procurement method in the delivery of hospital facilities management cleaning services?

> ➢ What are the areas that could be improve in the adopted procurement method to enhance effective good practice knowledge management in the delivery of facilities management cleaning services in the control of exogenous HCAI?

The next section presents the findings from the questionnaire survey on the prevailing knowledge management process within the hospital knowledge infrastructure capabilities for enhancing good practice knowledge management in facilities management cleaning service delivery in the control of healthcare-associated infections

5.7. Section 4 – The hospital knowledge management process and knowledge infrastructure capabilities

This section of the research aims at partly answering research question 4 and fulfilling research objective 4 toward achieving the overall aim of the research. The section begins by asking questions about the following issues:

5.7.1. Considerations which influence effective good practice knowledge management in the control of exogenous HCAIs in FM cleaning services

Since the launch of the first initiative that was aimed at reducing the prevalence of HCAIs in NHS hospitals in England, several further initiatives have been advocated, including a review of procurement strategies, and encouraging more collaboration and effective communication between clinicians and non-clinicians. The broad principles of good practice underlying these initiatives have been integrated into NHS IT systems to assist employees in improving service delivery and patient recovery outcomes.

In order to ascertain respondents' views on factors that could influence the good practice knowledge management process in the control of exogenous HCAIs in facilities management cleaning services, they were asked to identify them from a list of factors mentioned in the literature (Ayliffe, 2009; Department of Health, 2000, 2003a, 2003b, 2004b, 2008b, 2014d; NHS Commissioning Board, 2013; NHS England, 2013b).

Table 5.6:   Ranking of KMP initiatives based on RIIs

Initiatives relating to effective KMP	Respondent Scores					RII	Rank
	1 Don't Know	2 Strongly disagree	3 Disagree	4 Agree	5 Strongly agree		
Keeping all FM cleaning services in-house	4	1	8	31	41	0.845	1
Involving FM managers s in the development of bespoke guidance documents for cleaning services	8	1	4	43	29	0.798	2
Improving the communication of good practice knowledge	6	3	7	41	28	0.793	3
Increasing the IT/computer literacy levels of cleaning staff	8	1	7	43	26	0.784	4
Outsourcing all FM cleaning services	12	5	24	33	11	0.661	5

Table 5.6 presents respondents' ranking of factors that may promote effective knowledge management processes in the control of exogenous healthcare-associated infections in FM cleaning services in NHS hospitals in England. It shows that respondents ranked "keeping all cleaning services in-house" at the top, with a RII of 0.845. Conversely, outsourcing facilities management cleaning services was ranked fifth, with a RII of 0.661, as the initiative that could least enhance good practice knowledge management in the control of exogenous HCAIs.

Several factors could have contributed to the top ranking given to 'keeping cleaning services in-house', including concerns raised by ward managers and matrons about the fragmented management of standards of hospital cleanliness due to the contracting-out of cleaning services (Davies, 2010). Involving facilities manager in the development of bespoke guidance documents for cleaning services was ranked second as an initiative that could improve effective knowledge management in the control of exogenous HCAIs, with an RII of 0.798, while enhancing communication came third, with a RII of 0.793. The closeness in the ranking of these two factors evidenced the collaborative practice and the importance of communication among infection control team as a panacea for the enhanced service delivery advocated in different reports commissioned by the government over the years (National Health Service England, 2012; Department of Health, 2003a, 2004; National Audit Office, 2009a). Given the slow but consistent way in which technology has been adopted by healthcare service delivery practice, it is imperative to increase the level of computer literacy

of facilities management personnel for effective good practice knowledge management in the control of exogenous HCAIs (Lichtig, 2010). This author asserts that the adoption of a range of innovative knowledge-based technologies "is a prerequisite for a high-performing health service" (Lichtig, 2010). Apart from improving the quality of healthcare services, the author further states that technology plays a vital role in making patient care more flexible and responsive, as well as ensuring efficiency in the use of scarce public resources.

After respondents had identified factors that could enhance or impede effective good practice knowledge management in the control of exogenous healthcare-associated infections in FM cleaning services delivery in hospitals, they were asked to consent to the availability of the enabling environment for these factors to strive. Responses were analysed within the context of "Hospital Knowledge Infrastructure Capabilities" relative to the prevailing culture, structure and technological capabilities.

The next section presents the findings on this issue from respondents' perspectives.

5.7.2. The support provided by hospital knowledge infrastructure capabilities for initiatives that promote effective good practice knowledge management processes in the control of exogenous HCAIs in FM cleaning services

Given the emergence of multi-drug-resistant strains of infection-causing microorganisms, coupled with the diversity of professions involved in the delivery of healthcare services to achieve set objectives, knowledge management processes in the control of exogenous HCAIs in hospitals face a daunting task. This makes it imperative to provide an enabling working environment in hospital settings in order to facilitate collaboration in the implementation of good practice knowledge initiatives and in the management of knowledge gained from these and other initiatives for the more efficient control of exogenous HCAIs. Establishing such an environment could be facilitated through the consideration and assessment of the prevailing culture, structure and technological capabilities that directly affect the management of good practice knowledge in the control of exogenous healthcare-associated infections. According to Gold et al., (2001) these three "infrastructure capabilities" are "key to understanding the success and failure of knowledge management" processes. To elicit the perspective of respondents on the prevailing culture, structure and technological infrastructure capabilities and their interface with effective good practice knowledge management in the control of exogenous HCAIs in facilities management cleaning service delivery in hospitals, respondents

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were asked to identify and rate their importance on a Likert scale of 1 to 5, with 5 being the highest (Table 5.7).

Table 5.7: Ranking of hospital knowledge infrastructure capabilities based on RIIs

KIC	Ranking	Respondent Scores					RII	Rank
		1 Don't Know	2 Strongly disagree	3 Disagree	4 Agree	5 Strongly agree		
Culture	A culture that encourages all employees to attend infection control training	3	1	4	58	19	0.809	1
Structure	A structure that facilitates collaboration in the control of exogenous HCAIs in FM cleaning services	4	0	1	64	16	0.807	2
Culture	A culture that encourages all employees to collaborate on HCAI good practice knowledge	2	2	1	67	13	0.805	3
Technology	A technological system that stores adequate good practice knowledge resources in FM-centred services for the control of HCAIs.	12	1	13	51	8	0.699	4
	Employees have adequate training in the use of these technological systems to facilitate the sharing of good practice knowledge	6	0	46	24	9	0.671	5

In terms of the knowledge infrastructure capabilities that most support effective good practice knowledge management process initiatives in the control of exogenous HCAIs in FM cleaning services, respondents ranked the cultural and infrastructural capability element top. The structural and technological infrastructure capabilities elements were ranked second and third respectively (Table 5.7).

Within the context of the cultural infrastructure capabilities interface with other capabilities, a culture that encourages all employee to attend infection control training gained the top ranking with a RII of 0.809. The consideration of the cultural and infrastructural capabilities elements as a panacea that most supports effective good practice knowledge management process initiatives for the control of exogenous healthcare-associated infections has been acknowledged and echoed in literature. Dancer (2011) argues that cleaning, like other professional endeavours, requires teaching and training, and never more so than in a hospital. The author bemoans the lack of adequate dirt removal in hospitals, and suggests it is a result of the lack of extensive training for cleaners, compounded by the fact that newly recruited

cleaners are often provided with nothing more than a "perfunctory introduction to cleaning process" (Davies, 2010). As a consequence, the importance of mandatory infection control training for facilities management staff who are tasked with cleaning the hospital environment cannot be overemphasised. This is because if facilities management staff have limited knowledge of the underlying principles of enhanced cleaning, key microbial reservoirs in the hospital environment go unrecognised.

A departmental structure that facilitates collaboration in the control of HCAIs with FM personnel was ranked second, with a RII 0.807. This was closely followed by a culture that encourages all employees to collaborate on HCAI good practice knowledge, with a RII of 0.805. These two variables reflect the need for collaboration to be supported by hospital departmental structure in order to achieve desired outcomes. This idea is echoed in the literature including the "Matron Charter", and in the prevailing system for assessing the quality of the patient environment popularly referred to as the Patient-led Assessment of the care Environment (NHS England, 2013a; Department of Health, 2004). According to the principles set out in the "Matron Charter," cleanliness is everyone's responsibility, and not just the cleaner's (Department of Health, 2004a). Similarly, one of the cardinal principles of PLACE is the acknowledgment that "every NHS patient should be cared for with dignity in a clean and safe environment". PLACE further emphasises the ethical principle of shared responsibility between the facilities management team and the hospital management. It states that "where standards fall short, they should be brought to the attention of the managers and hold the service to account" (NHS England, 2013a). All this attests to the importance of hospital management providing an enabling structure that would motivate the facilities management cleaning service delivery team to improve their services to achieve set objectives.

Within the context of the technological infrastructure capabilities interface with other knowledge infrastructure capabilities, technological capability hold adequate good practice knowledge resources in FM cleaning services for the control of HCA was ranked top. This has an overall ranking of fourth among the capabilities of the cultural and structural infrastructure with a RII of 0.699. An infrastructure that ensures that employees have adequate training in the use of the technology used for ease of sharing good practice knowledge was ranked second. This has an overall ranking of fifth among the capabilities of the cultural and structural infrastructure with a RII of 0.671. Ensuring that there is a link with

the understanding of the adopted technologies used to facilitate good practice knowledge among stakeholders in the control of exogenous HCAIs is seen as very important in the literature. According to Williams & Dickinson (2010), the rate of adoption of new technologies into healthcare systems is slower than in other sectors. Technology that facilitates good practice knowledge in the control of exogenous HCAIs can be seen as involving a range of stakeholders across hospitals to achieve quality care delivery outcomes and in the control of the prevalence of exogenous HCAIs. Thus, consideration should also be given in the form of adequate training provision for those who will use this technology to achieve the expected objectives.

5.7.3. **The prevailing hospital knowledge management process - interpretation**

The aim of this research is to investigate the interface between knowledge management processes and hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections through facilities management cleaning service delivery in NHS hospitals in England.

This question seeks respondents' perspectives on the knowledge infrastructure capabilities that most support initiatives to promote effective good practice knowledge management in the control of exogenous HCAIs. The reasons for the ranking of each capability within the overall hospital knowledge infrastructure capabilities and any other capabilities that may enhance or impede good practice knowledge management in the control of exogenous HCAI were explored in order to achieve the research aim and objectives.

In the qualitative interview phase of the research data collection, the following closed-ended questions were asked within the context of the hospital knowledge infrastructure capabilities to explain the findings above:

> ➢ Does the hospital have a culture that encourages both clinician and non-clinician employees at all level to collaborate in the control of exogenous HCAI?
> ➢ How effectively does your hospital departmental structure facilitate the creation of good practice knowledge in the control of exogenous HCAI in FM cleaning services?
> ➢ What is the adopted technology used for storing and sharing good practice knowledge resources in the control of exogenous HCAI in FM cleaning service delivery?

The next subsection presents the findings from the questionnaire on how far hospital knowledge infrastructure capabilities support the different elements of the knowledge management process (knowledge creation, storage, sharing and usage) in the control of exogenous HCAIs.

5.7.4. Hospital knowledge infrastructure capabilities' support for the effective knowledge management process in the control of exogenous HCAIs in FM cleaning services.

An organisation has a responsibility to support creative individuals or provide a context for such individuals to create knowledge, as it cannot create knowledge by itself (Nonaka, 2011). Compared to the knowledge management process in other sectors, knowledge management in the delivery of healthcare services is noted to be a complex endeavour which requires a systematic and more complex process to improve quality healthcare outcomes (Bordoloi, 2012; Sheffield, 2008). According to Ghosh & Scott (2006), the effectiveness of the knowledge management process in healthcare service delivery as measured by its impact on both organizational and patient-care benefits is dependent on knowledge management infrastructure capabilities.

Table 5.8 presents relative importance index (RII) scores relating to prevailing knowledge management processes within the context of knowledge creation, storing, sharing and usage as supported by the hospital knowledge infrastructure capabilities in the control of exogenous HCAIs in facilities management cleaning services delivery in NHS hospitals in England. According to the findings, respondents ranked knowledge usage top among other knowledge management processes as the element most supported by the knowledge infrastructure capabilities of their hospital. Among these elements, respondents rated the fact that "employees often reference non-technological good practice knowledge resource repository" top with an RII of 0.816. In second place were the processes for monitoring compliance with good practice guidance in the control of exogenous HCAIs. This had an RII of 0.781.

Table 5.8:   Ranking of hospital knowledge infrastructure capabilities according to RIIs

KMP	KMP Ranking	Respondent Scores					RII	Rank
		1 Don't Know	2 Strongly disagree	3 Disagree	4 Agree	5 Strongly agree		
Knowledge Usage	Employees often reference non-technological good practice knowledge resources repository	9	1	9	21	45	0.816	1
	A processes for monitoring compliance with good practices	5	0	3	67	10	0.781	2
Knowledge Sharing	A processes for sharing good practice knowledge	5	0	6	67	7	0.767	3
Knowledge Storing	Both manual and technological processes for storing good practice knowledge resources	7	0	4	68	6	0.755	4
Knowledge Creation	Processes for the creation of new knowledge from existing good practice knowledge resources	7	1	7	67	3	0.736	5

The knowledge-sharing element was ranked second in terms of how far it was supported by hospital knowledge infrastructure capabilities, with a RII of 0.767, and knowledge storing was ranked third. Relating to the next element, respondents noted that "both manual and technological processes for storing good practice knowledge resources" were available in their hospitals. This had a RII of 0.755. However, it was acknowledged that employees preferred to access resources which are not stored electronically. This finding could be attributed to the lack of IT skills on the part of most cleaning personnel, i.e., the low adoption of technology in healthcare delivery, as supported in the literature. According to Williams & Dickinson (2010), the rate of adoption of new technologies in healthcare systems is slower than in other settings. This could be ascribed to hospital executives' reluctance to believe that "information technology supports health operational processes." According to England & Stewart (2007) and Vishwanath & Scamurra (2007), this is based on the following assumption:

➢ Practitioners are unable to customise systems to make them do what they want them to do, and that this is very expensive (England & Stewart, 2007; Vishwanath & Scamurra, 2007).

The knowledge creation process was ranked fourth among the knowledge management process elements supported by hospital knowledge infrastructure capabilities with a RII of 0.736. Of the elements investigated, "processes for the creation of new knowledge from existing good practice knowledge resources" turned out to be seen as the least important. This finding came as a surprise to the researcher considering the acknowledgment that "the healthcare sector is a knowledge driven sector" (Bordoloi & Islam, 2012). This finding further reiforces the relevance of this research, which aims to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections through facilities management service delivery practice. However, it is important to mention that the findings of this research reflect the perceptions of healthcare facilities managers in NHS hospitals in England.

5.7.5. **The prevailing hospital knowledge infrastructure capabilities - interpretation**

The question above has established respondents' perspectives on knowledge management processes as supported by hospital knowledge infrastructure capabilities for effective good practice knowledge management in the control of exogenous HCAIs in NHS hospitals in England. However, it is important to explore the motives behind the ranking of these processes interfaced with the prevailing knowledge infrastructure capabilities in the control of exogenous HCAIs in order to achieve the research aim and objectives. Therefore, in the qualitative interview phase of the research data collection, the following closed-ended questions were asked in order to explore perceptions of the interface of the knowledge management process and knowledge infrastructure capabilities in the control of exogenous HCAIs in facilities management cleaning services:

➢ What are the processes for the creation of new knowledge from existing knowledge resources in facilities management cleaning service delivery in the control of exogenous HCAI?

➢ How does the hospital ensure that employees have adequate knowledge of the adopted technological system used for storing, and sharing good practice knowledge resources in FM cleaning service delivery for the control of exogenous HCAI?

➢ How could the existing knowledge management processes be improve in facilities management cleaning service delivery for greater curtailment of the prevalence of exogenous HCAI?

The following section relates the last section of the questionnaire survey, and presents finding from the questionnaire on the existing level of collaboration between clinicians and the facilities management team (non-clinicians) in NHS hospitals in England within the context of the knowledge management process (knowledge creation, storage, sharing and usage) in the control of exogenous HCAIs.

5.8. Section 5 – Collaborative practice between clinician and non-clinician members of the Infection Control Team

Healthcare delivery spans fragmented professional boundaries, a situation that presents a unique and challenging situation to manage (Bordoloi & Islam, 2012; Sheffield, 2008). Fundamentally, it is acknowledged that maintaining hospital environmental cleanliness is a core service function of facilities management (Alexander, 2007). Thus, the relevance of the facilities management profession in modern-day healthcare facilities in the control of exogenous healthcare-associated infections cannot be over-emphasized. According to Alexander (2007), facilities management emerged in the NHS in response to the challenge of managing health care properties, including buildings, in a more efficient way to achieve healthcare objectives including the need to develop quality systems that ensure effective planning (Alexander, 2007). The work of facilities management is quality service-driven, and is focused on creating a caring environment that contributes to the effectiveness of healthcare provision and the control of exogenous HCAIs (Ayliffe, 1992; Thomson, 1990). Compared to other management professions in the built environment (i.e., Estate Management), facilities management in hospitals brings together estates and hotel services in an integrated approach to achieve objectives including the control and prevention of exogenous healthcare-associated infections (May, 2013; Alexander, 2007). The profession encompasses the physical, social and managerial aspects of quality healthcare provision in hospitals.

This section of the questionnaire survey seeks to gather information on the level of involvement of facilities managers - often considers as a "non-clinician" members of the infection control team - in the decision-making process in the area of developing bespoke tools for the control of exogenous HCAIs.

5.8.1. Facilities managers' involvement as members of infection control teams in the development of bespoke tools used in the control of exogenous healthcare-associated infections

Respondents were asked to state their level of involvement with clinician members of the infection control team in the development of bespoke tools used in the control of exogenous healthcare-associated infections in hospitals. Respondents' rankings of their level of involvement are presented in Table 5.9.

Table 5.9:   Level of facilities managers' involvement in the development of bespoke tools for the control of exogenous HCAIs
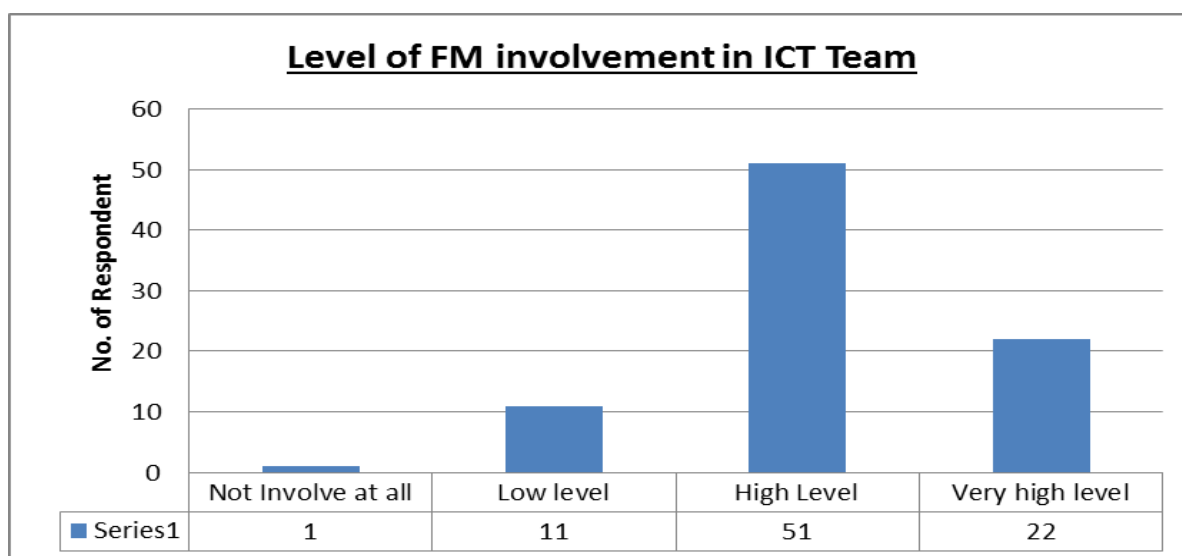
Of the eighty-five (85) respondents, fifty-one (51) of the respondents, representing 60% were highly involved in the activities of the hospital infection control team, while a further 22 of the respondents representing 25.9% assessed their level of involvement as very high. Eleven (11) of the respondents, representing 12.9%, stated that their level of involvement was low, while one respondent representing 1.2% claimed not to be involved at all.

Overall, this finding could be interpreted to imply that facilities managers have a shared responsibility in hospital infection control teams in NHS hospitals in England. On the other hand, it could be argued that this level of involvement in ICT activities in NHS hospitals could be a reflection of the changing face of facilities management service delivery practice. It could be a result of the conviction of the perceived contribution of care environment and of FM, and especially the soft role of FM, in the control of exogenous HCAIs further to the publication of the NHS Plan (Department of Health, 2000). According to May (2013), the

NHS Plan is seen as one of the catalysts that propelled FM from the background to a more prominent position within the healthcare sector. In the consultation exercise leading to the publication of The NHS Plan, the public ranked cleaning standards and the quality of hospital food high among their priorities (Department of Health, 2000). Taking such feelings into account, The Plan dedicated a whole chapter (Chapter 4) to the core services provided by FM to the NHS (cleaning and catering). It also advocated the establishment of the role of "Ward Housekeeper" in at least 50% of hospitals by 2004.

However, the high level of facilities managers' involvement in the hospital infection control team could also be seen from a negative perspective. It could be perceived as a show of compliance with government legislation, considering that the infection control team is traditionally seen as the exclusive territory of clinicians.

5.9. Chapter summary and the link to the research aim and objectives

The aim of this research is to critically investigate the interface between knowledge management processes and hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management service delivery practices in NHS hospitals.

This chapter has presented the findings from the first phase of the research, which used a questionnaire survey to explore the factors that could hinder or facilitate effective good practice knowledge management in facilities management cleaning service delivery for the control of exogenous HCAIs in NHS hospitals. The findings from this phase showed that a variety of good practice guidance documents and approaches were adopted in the control of exogenous healthcare-associated infections in hospitals. It could be argued that this is a result of the fact that there is a plethora of good practice guidance documents available to facilities managers in the control of exogenous HCAIs. Another factor might be the challenge facilities managers face in minimising the risks associated with the emergence of new strains of infection-causing microorganisms and their resistance to antibiotics. The increasingly dynamic nature of infection-causing microorganisms has made it imperative to develop an effective good practice knowledge management framework in the control of exogenous HCAIs. This further highlights the importance of this research.

Findings from the questionnaire have helped to provide detailed insights into the phenomenon under investigation and to achieve the research aim and objectives. In accordance with the research methodology, findings from the questionnaire survey were further investigated in the second phase of data collection by using qualitative face-to-face interviews in order to develop a more detailed explanation of the findings from the questionnaire.

The interviews were largely conducted with the same individuals who completed the questionnaire survey because the main reason for using the sequential explanatory mixed method design is "to follow up the quantitative result and explain the result in more depth" (Creswell, 2014).

This chapter describes the first phase of the sequential explanatory methodological strategy presented in Figure 4.11Chapter 4. The sequential explanatory mixed method is a process in which the researcher collects quantitative data in the first phase, analyses the results, and then uses these results to build the second, qualitative phase (Creswell, 2014). The next chapter presents the findings of the face-to-face interviews conducted among hospital facilities managers as the second and final phase of the research strategy.

Chapter 6.   QUALITATIVE DATA ANALYSIS

6.1. Introduction

This chapter presents and analyses the findings from the face-to-face interviews conducted with healthcare facilities managers across NHS hospitals in England as part of the second phase of the explanatory sequential mixed methodology (see Section 4.4.7. in chapter four). Details of the 10 professionals interviewed in this phase of the research are presented in Table 4.10. The face-to-face interviews were conducted with the aim of finding explanations relating to several variables that could influence effective good practice knowledge management in the control of exogenous HCAIs within the prevailing hospital knowledge infrastructure capabilities identified from the questionnaire data. This chapter presents how the findings from the face-to-face interviews help to explain the questionnaire results in greater depth to achieve the research aim and objectives.

The chapter begins with an overview of the structure of the data presentation, a profile of the interviewees and the coding of the interviewees.

6.2. Analysis of the interview data

For ease of understanding the interface between the interview questions and those in the questionnaire, an interview guide (see Appendix F) was designed to follow the structure and sequence of the questionnaire survey, which comprises five sections (See section 4.8.1). The interview data was analysed in two stages using the NVivo 10 computer-assisted qualitative data analysis software (CAQDAS) (See section 4.9). The content of each interview was first transferred verbatim into NVivo 10, thus maintaining the originality of the shared experience and of the ideas as expressed by the interviewees.

The second stage of the interview data analysis comprises of the coding and analysis of the major (semantic) themes in order to derive sub-themes (latent themes) using the thematic analysis technique. According to Blaikie (2010), thematic data analysis is a qualitative data analysis technique that involves identifying, analysing and reporting the patterns (themes) within data. The interface of the number of interviewees and the number of references made by each interviewee against a latent theme was calculated to establish the cumulative percentage of each latent theme against the semantic themes. This was to further determine

the relative importance of the influence of the semantic theme on the effectiveness of the good practice knowledge management process in facilities management cleaning service delivery. This was achieved within the context of the hospital knowledge infrastructure capabilities for the control of exogenous HCAIs, in order to achieve the research aim and objectives.

6.3. **Presentation of the interview findings**

In keeping with the assurance of anonymity given to the interviewees prior to the interview, details of the interviewees were coded in alphabetical. Quotations from individual interviewees were also coded alphabetically in the interests of anonymity (see column 3 in Table 6.1). The interviewees had an average of 22.8 years' experience of the healthcare industry. This suggests that they have a high level of experience and knowledge of the prevention and control of exogenous healthcare-associated infections in NHS hospitals.

The presentation of the findings from each interview question begins with a discussion of the focus of the question and what it is meant to achieve in order to establish a context for the reader. The findings from each question are presented within the context of the major and sub-themes. In other instance, it was presented under the major themes while the subthemes are discussed concurrently with it.

6.4. **The interviewees**

The interviewees were from both NHS acute and mental health hospitals in England. Table 6.1 presents background information on the interviewees. One of the striking findings that resonate in their accounts is that most of them started their career with the NHS as members of front line staff. Nine (9) of the interviewees confirmed that they had begun near the lowest NHS banding (staff grade) in their respective hospitals before rising through the ranks to their present jobs responsibility. Six (6) of the interviewees started as porters, moving patients from one ward to another, while three (3) started as cleaners. Only one (1) of the interviewees started as a supervisor, having joined the present hospital from another hospital. These findings suggest that their in-depth knowledge and experience about the research subject area is based on both front-line and managerial perspectives, which adds to the rigour of this research.

Table 6.1:   The face-to-face interview participants - background information

Type of NHS hospital	Job title	Job title code	Type of cleaning contract	Years of experience in healthcare
Acute hospital	Facilities Manager	FM1	in-house	over 20years
Acute hospital	Domestic Service Manager	DSM1	in-house	over 20years
Acute hospital	Facilities Manager	FM2	outsourced	16 - 20 years
Acute hospital	Senior Facilities Manager	SFM1	in-house	16 - 20 years
Acute hospital	Facilities Manager	FM3	in-house	over 20years
Acute hospital	Head of Facilities Management	HFM1	outsourced	over 20years
Mental health hospital	Facilities Manager	FM4	in-house	16-20 years
Acute hospital	Head of Facilities Management	HFM2	in-house	over 20years
Acute hospital	Facilities Manager	FM5	outsourced	16 - 20 years
Acute hospital	Head of Facilities Management	HFM3	in-house	over 20years

The presentation of the interview findings begins with Section 1 of the interview guide. In this section, findings from the questionnaire survey on the current procurement strategy were investigated further in the face-to-face interviews to gain deeper more insights and to explain the reasons for the choice of a particular strategy in preference to others for the delivery of hospital facilities management cleaning services. This section aims to explain the findings in Section two of the questionnaire survey in the first phase of the research. For ease of understanding the interface between the first and second phases of the research, the presentation of the findings from this phase is structured as follows:

➢ the Question under 6.4 relates to Section 1 of the questionnaire

➢ The Question under 6.5 relates to Section 2 of the questionnaire

➢ Questions under 6.6 relate to Section 3 of the questionnaire

➢ The Question under 6.7 relates to Section 4 of the questionnaire.

6.5. **Guidance documents used in the control of exogenous HCAIs**

National evidence-based guidelines for the prevention of HCAIs in NHS hospitals in England were developed during 1998 - 2000 by a nurse-led multi-professional team of researchers and specialist clinicians (May & Pitt, 2012). After consultation with stakeholders, the findings were compiled and summarised in the NHS Plan published by the Department of Health at the

beginning of the 20th century (Department of Health, 2000). The NHS Plan led to the launch of the clean hospital programme and other guidance documents as part of a programme to redress low cleanliness standards in hospitals (Davies, 2005). Despite the large scale of funding into the publication of the NHS Plan, and a plethora of subsequent publications surrounding cleaning services good practice in the NHS, the extent to which such publications have been reviewed is open to question (May & Pitt, 2012; Davies, 2005).

This section of the face-to-face interviews seeks to further investigate and explain the findings from the questionnaire survey (Figure 5.3) as part of the sequential explanatory mixed method research approach in order to achieve research objective 1. Objective 1 is to "identify and evaluate in-use policies, guidance documents and strategies in facilities management cleaning service delivery for the control of exogenous HCAIs, identifying their pros and cons". Research question 1 was formulated to achieve this objective. This question asked, "what are the adopted policies, guidance documents or strategies for monitoring compliance with good practice knowledge in facilities management cleaning services for the control of exogenous HCAIs in hospitals?"

6.5.1. **Good practice guidance documents in hospitals**

Table 5.4 presents the findings from the face-to-face interviews on the good practice guidance documents used in facilities management cleaning service delivery for the control of exogenous HCAIs in NHS hospitals in England. The related discussion showed that other good practice guidance documents were available which were not prominent in the literature. This is a further justification for this research. Some of these less prominent documents are Credit for Cleaning (C4C), the Standard Assurance Model (SAM), PAS 5748, and symbiotic (Figure 6.1).

Name	Sources	References	C
Symbiotic	1	1	0
SSSL	1	1	0
SAM- Standard Assurance Model	0	0	0
PLACE	10	10	0
PAS 5748	1	1	0
PAM	1	2	0
NHS National Cleaning Standard	5	5	0
NAAS-Nursing accreditation and survey	1	1	0
CQC	1	1	0
C4C	1	1	0

Figure 6.1: Good practice guidance documents mentioned in the interviews

These documents are often developed in bespoke form from core good practice guidance documents such as the National Standard for Cleanliness in the NHS (National Patient Safety Agency, 2007). They are used in conjunction with the core standards documents to allow a meaningful comparison to be made between the environmental cleanliness of different hospitals ward's and department environmental cleanliness (Allen, 2011; National Audit Office, 2009).

6.5.1.1. Credit for Cleaning (C4C)

According to Allen (2011), Credit for Cleaning (C4C) is an adaptable system that is compatible with the National Specification for Cleanliness in the NHS, and which is used to monitor the standard of cleanliness in NHS hospitals. It is also used to facilitate cooperation between nursing, housekeeping and estate staff to ensure a greater level of consistency in the monitoring of compliance with good practice. This was confirmed by HFM1:

> *"…We use C4C (credit for cleaning),...and also follow the National Specification for Cleanliness".*

The system is used to generate scores for rooms and areas, which can be reviewed against the National Specification for Cleanliness.

6.5.1.2. The Care Quality Commission (CQC)

The Care Quality Commission (CQC) is an independent regulator of quality in health and social care established by the Health and Social Care Act, 2008 (NHS England, 2014; Roberts & Watson, 2014). The Act stipulates that health and social care activities can only be carried out by providers that are registered with the CQC. CQC sets out the registration requirements that those seeking to provide services within the health and social care sector must meet before they are registered to practice. CQC also sets out the overall framework, and has developed several initiatives from service audits to risk management, but also initiatives for the control of healthcare-associated infections to ensure that the services provided are meeting essential standards (Department of Health, 2012).

CQS has powers of enforcement that it may use if registered providers do not comply with the law (Roberts & Watson, 2014). These powers range from the issuance of a fixed penalty notice, suspension or cancellation of service provider registration, to the power to prosecute the provider. To ensure compliance with statutory healthcare-associated infection prevention

regulations, NHS hospitals in England must adopt and follow the protocols set out in the CQC template. This was confirmed by FM1, who said

> *"…We have PLACE, we have got CQC, we have got our own monitoring tools call SSSL which is not too dissimilar to CQC".*

This is a further illustration of the plethora of good practice guidance documents available to hospital facilities managers, which may pose a challenge in terms of knowing, which is most the appropriate for their circumstances.

6.5.1.3. Pass 5748

Pass 5748 is a specification sponsored by the Department of Health that allows hospitals in England to demonstrate the plans they have in place to keep their hospital premises clean and safe for patients (British Standards Institution, 2014). Like other bespoke good practice guidance documents, Pass 5748 is noted to have been "built on the experience and content of the National Specification for Cleanliness in the NHS" (British Standards Institution, 2014; National Patient Safety Agency, 2007). This is why some NHS hospitals use PAS5748 in conjunction with the National Specification for Cleanliness, as confirmed by HFM2:

> *"…Pass 5748, alongside NHS National Standard for Cleanliness and PLACE, is what we use".*

6.5.1.4. The National Specification for Cleanliness and PLACE

The National Specification for Cleanliness and the Patient Led Assessment of the Care Environment (PLACE) are two of the core good practice guidance documents which "give(s) general and specific guidance on how to operate the provision of cleaning services within a health care environment" (Roberts & Watson, 2014). It was observed that regardless of which guidance document is adopted, every NHS hospital in England now uses PLACE and has a PLACE inspection visit every year (NHS England, 2013). Each of the interviewees said that their hospital cleaning services were assessed against the standards set out in PLACE, but often other methods were used alongside the guidance set out in the core documents as an additional measure to ensure that standards of cleanliness were met. An example of this was given by DMS1:

> *"…We use PLACE, and our bespoke tools call Nursing accreditation and survey (NAAS)"*

HFM2 also said

> *"…We do PLACE, and we have got the National Standard, those are the ones that we work with."*

Likewise FM3:

> *"...We use PLACE because everyone has to."*

6.5.1.5. NHS Premises Assurance Model (NHS PAM)

NHS PAM is a tool that allows NHS hospitals to better understand the efficiency and effectiveness with which they manage their estate and facilities and monitor safety levels, as well as how that affects the patient experience (Department of Health, 2014, 2016). Like bespoke versions of PAS 5748 from the National Specification for Cleanliness in the NHS, the Standard Assurance Model (SAM) is noted to complement PAM in terms of its content. This was mentioned by FM4:

> *"….We do PLACE, PAM and we have also developed our own assurance model called SAM which is Standard Assurance Model"…So we have interpreted PAM into that model."*

Other bespoke good practice guidance documents were mentioned as being used in hospitals which outsource their cleaning services in conjunction with core guidance documents to monitor compliance with infection control good practice in the control of exogenous HCAIs. One of these was termed 'symbiotic', and in the interview with FM5 it was described as being used to monitor both nursing standards and contractor compliance with good practice:

> *".....We have our own facilities management tools use obviously for monitoring cleanliness of our hospital's sites…We are not only monitoring the contractor; we are monitoring the nursing standard as well using our monitoring tools provided by our contractor called symbiotic."*

Interviewee FM2, whose hospital outsourced their cleaning services, confirmed that their process was based on one of the core guidance documents:

> *"...The entire contract is based on PLACE, NHS National Cleaning Standard...that is the fundamental thing, within that they were the need for measuring best practice guidance."*

It is not argued that the great number of bespoke good practice guidance documents used in conjunction with the core guidance documents are intended to replace the core guidance documents. Rather, it is acknowledged that they are used to achieve the required standard and "the registration requirements of the CQC" (British Standards Institution, 2014). However, it could be argued that this could perhaps be a reflection of a perception that the cleaning protocols contained in the core guidance document are not sufficient to meet the cleaning challenges posed by the dynamic nature of infection-causing microorganisms. It is therefore imperative for this research to examine empirical evidence as a basis for a good practice knowledge management framework that combines elements of past and present approaches to the cleaning of hospital facilities for the control of exogenous HCAIs. To achieve the aim of this research, it is imperative to identify the underlying factors that inform the choice of a particular core good practice guidance document in terms of its understandability, usability and adaptability.

The next question in this section of the interview data analysis presents findings about the factors underlying interviewees' choice of a particular good practice guidance document for the delivery of their hospital cleaning services.

For clarity and ease of analysis, all the bespoke guidance documents identified in Figure 6.4, including Credit for Cleaning (C4C), the Standard Assurance Model (SAM), PAS 5748 and symbiosis will be grouped together and referred to as "other bespoke documents" in the next section.

6.5.2. **Reasons for the choice of particular good practice guidance documents**

This question was asked to explore the relationship between the adaptability, understandability and usability of the good practice guidance documents and other factors that might enhance or inhibit the effective knowledge management process within the hospital knowledge infrastructure capabilities in the control of exogenous HCAIs. Findings from this question will be analysed in the context of findings from both the literature and the questionnaire survey (Figure 5.3) in the next chapter to identify correlations that would assist in achieving the research aim and objective. Responses were obtained from a total of ten (10) hospital facilities managers (Figure 6.2)

3.2. Reasons for the choice of the use of this particular guidance		
Name	Sources	References
PLACE	0	0
Unbias report	2	3
Patient Perspective	2	3
Mandatory	6	6
NHS National Cleaning Standard	0	0
Set minimum standards	1	2
Mandatory	1	1
Ease of understanding	1	1
CQC	0	0
Mandatory	1	1
Bespoke tools (Others)	0	0
High Cost of transfering to other tools	1	1
Auditing	2	4

Figure 6.2: Reason for adopting a particular good practice guidance document in FM cleaning services

6.5.2.1. Bespoke guidance documents

The dictionary meaning of *bespoke* is custom-made, made-to-order, tailor-made or tailored, and this is the meaning it has in the literature (Easterby-Smith, 2015; Oxford English Dictionary, 2014). Traditionally applied to custom-made clothing, the term has been extended to other sectors including healthcare. As already mentioned, for clarity and ease of analysis, all the bespoke guidance documents including Credit for Cleaning (C4C), the Standard Assurance Model (SAM), PAS 5748, and symbiosis identified in Table (5.4) are grouped together and referred to as bespoke good practice guidance documents. These good practice guidance documents are those which are particular to one hospital in the delivery of hospital cleaning services for the control of exogenous HCAIs. They are those identified as "ICT bespoke guidance documents" in Figure 5.3 under "adopted guidance documents for the control of exogenous HCAIs" in the quantitative phase (questionnaire survey) of the data collection. Some of the sub-themes which emerge as reasons for the use of a bespoke guidance document include:

Auditing

The role of 'infection control link practitioner' within the infection control team was specifically created to lead the translation into practice of an organisation culture in which the prevention and control of infection is rigorously pursued (Healthcare Commission, 2007). This responsibility was expected to be undertaken by someone who is not an infection control professional, but who takes particular responsibility for preventing and controlling infection in the workplace. Considering that the hospital facilities manager is charged with the responsibility of preventing and controlling exogenous HCAIs in a hospital, it is imperative that an auditing process that is tailored to meeting the requirements of core statutory good

practice guidance documents is developed to ensure compliance in preparation for the routine/annual inspection by the relevant governance body. HFM3 recounted that

> *"...We won't get an instant sort of day to day position on just using the PLACE arrangement, so prior to PLACE visits we have to get a daily auditing."*

In the case of both in-house and outsourced cleaning services, bespoke guidance documents/tools are used for auditing processes in order to gather feedback. The view of FM5 was that

> *"....We need to check the contract performance, we need to check how clean the environment is, we need that information to check to make sure that the place is clean...We also need that information to see if there is an outbreak, to have a cross reference in an audit position and obviously, we need to check if we are getting value for money...*

FM5 added that,

> *Because it is a multi-million contract we need to check from auditing perspective to satisfy our Trust auditors, and obviously the TAX payers."*

The cost of transferring, or modifying the existing bespoke good practice guidance documents was another consideration acknowledged by HFM1. According to him

> *"....The in-house monitoring tools is historical and therefore there will be financial consideration to change over to some other form of software..."*

The literature appears to support the idea of developing bespoke versions of good practice guidance documents for auditing in order to achieve expected standards of hospital cleanliness. Duty 2e of the Hygiene Code requires Trusts to have "a programme of audit to ensure that policies and practices are being implemented appropriately." This is in the context of the expectation that Trusts should "adhere to policies and protocols applicable to infection prevention and control" (Department of Health, 2006). This is made specific:

> *"To comply with duty 3e of the Hygiene Code requires each trust to have appropriate methods in place to monitor the risk of infection, so that, it is able to determine whether further steps need to be taken to reduce or control infection."* (Department of Health, 2006).

Furthermore, it is stated that

> *"...Trust(s) should consider not only the policies and protocols themselves but also the systems that ensure that they are adhered to"*.

The NHS Commission for healthcare audit and inspection also backs the use of bespoke guidance documents to check compliance with policies and protocols (Healthcare Commission, 2007). It is thus advised that bespoke guidance documents "may be used individually or in conjunction with each other" to refine the policies/protocols in order to improve their effectiveness in reducing the risk of exogenous HCAIs in facilities management cleaning service delivery.

Considering the government cost cutting measures across every sector of the economy currently being implemented, it has been pointed out that the "audit process encourages a high quality and efficient way of working that is essential to ensure compliance with standards and requirements" (Healthcare Commission, 2007). This also informs what is said about education and training in the Department of Health documents including PLACE, Winning Ways, and Saving Lives (NHS England, 2013a; NHS England, 2007; Department of Health, 2004b).

6.5.2.2. The Care Quality Commission (CQC)

As already mentioned, the Care Quality Commission (CQC) is responsible for setting out the requirements that must be met by health and social care service providers in the UK. CQC monitors, inspects, regulates and rates service providers to ensure that they provide people with safe, effective, compassionate and high-quality care. As part of their responsibilities, they monitor all NHS hospitals to check that they are maintaining high standards in infection control, including cleaning and decontamination.

In 2015, CQC published a new guidance document known as "guidance for providers on meeting the regulation", which replaced in its entirety the CQC guidance about "essential standards of quality and safety" which included 28 outcomes (Care Quality Commission, 2015). The new document relates to two groups of regulations: the Health and Social Care Act 2008 (Regulated Activities) Regulations 2014 (Part 3), and the Care Quality Commission (Registration) Regulations 2009 (Part 4). Among other things, Regulation 15 in the new document requires that facilities management service standards for the control of exogenous HCAIs should ensure that:

- Premises and equipment are kept clean, and cleaning must be done in line with current legislation and guidance
- Appropriate cleaning methods are used
- The level of cleanliness is monitored
- Staff responsible for cleaning have appropriate training, etc.,

Findings from the face-to-face interviews show that, while the CQC sets out the mandatory requirements care service providers must meet before they are registered, it also links prevailing policies and standards to their protocols/guidelines for rating the service provider's compliance during inspections. This was confirmed by FM1:

> *"...The CQC is the overarching one...When the CQC come to do an inspection, they draw from PLACE to ensure that all of this other areas has evidence that we are meeting all the requirement...They come annually and of very high profile...".*

6.5.2.3. The National Specification for Cleanliness

The National Specification for Cleanliness, which replaced The Standards of Cleanliness in the NHS, provides a comparative framework which includes an operational cleaning plan and a cleaning responsibility framework for hospitals to assess their technical cleanliness (May & Pitt, 2012; National Patient Safety Agency, 2007). The document was issued to take into account all the recommendations from previous good practice guidance documents, as well as changes since the publication of the NHS Plan. Regardless of whether they in-house or outsource the delivery of cleaning services, hospitals are expected to adhere to the specifications. It is a mandatory framework that has to be adhered to in the delivery of hospital cleaning services. SFM1 and other interviewees confirmed that the use of the National Specification for Cleanliness is mandatory in all NHS sites.

> *".....The National Specification for Cleanliness is also mandatory as well...."* (SFM1)

Compared to other good practice guidance documents, the National Specification for Cleanliness, which is often referred to as the "cleaning manual", is acknowledged to be an easy document to understand. This view was expressed by FM4:

> *"...I guess it is because of the simplicity of the healthcare cleaning manual."*

In the view of FM3, the specification sets the minimum standard that must be demonstrated:

> *"…The National Standard is the national standard which sets the most minimum requirements, and you wouldn't want to do less than the minimum requirements."*

These responses suggest that the National Specification for Cleanliness is an important core guidance document with which most bespoke good practice guidance protocols are aligned as a basis for meeting statutory standards.

6.5.2.4. Patient Led Assessment of the Care Environment (PLACE)

The Patient Led Assessment of the Care Environment (NHS England, 2013a) replaced the old Patient Environment Action Team inspection which was established in 2000 and required an independent annual assessment of a range of non-clinical services which contribute to the environment in which inpatient healthcare is delivered in England (NHS England, 2012). It is a benchmarking tool for good practice that is focused on facilities management services in NHS hospitals to ensure improvements are made in the control of exogenous healthcare-associated infections. It is noted that "participation is voluntary for both NHS and independent hospitals" (NHS England, 2012).

However, further to feedback on PEAT and the content of the assessment and delivery of inspections, a more robust and consistent inspection programme known as PLACE was launched in 2013 (NHS England, 2013). It was stated during the introduction of PLACE that it would focus entirely on the care environment, and inspection results would be reported publicly to help drive improvements in the care environment (NHS England, 2013).

The following discussion outlines how PLACE is an improvement on previous guidance documents.

Mandatory

In contrast to previous programmes like PEAT, PLACE makes it mandatory for all hospitals, hospices and day treatment centres providing NHS funded care to participate in PLACE inspections every year (NHS England, 2013). This requirement is acknowledged by all the interviewees. According to FM5,

> *"…PLACE is mandatory…PLACE come to each hospital each year."*

Both FM5 and HFM2 confirmed this:

> *"…We are required to do PLACE anyway; they are national requirement."*

HFM1added that

> *"….We choose to use PLACE because they were dictated to us, we have to do PLACE inspection."*

In the view of HFM3,

> *"….We use PLACE because it is nationally recommended."*

Further corroborating these statements, FM1 said

> *"…We have PLACE here, we use to have PEAT, but now PLACE is been recommended."*

The consistency expressed above shows the willingness of hospital facilities managers to comply rigorously with the PLACE guidance document and the zeal with which they do this. It could be argued that this arises from a view that the standards set by PLACE simply reflect the indicators that they themselves have always felt important, as suggested by some of the respondents.

The patient perspective

Like previous good practice guidance documents, PLACE requires that a team should be made up of NHS professionals including nurses, matrons, doctors, catering and domestic service managers, executive and non-executive directors, dieticians and estate directors. Patients and patient representatives, as well as members of the public, are also part of the assessment team (NHS England, 2013). However, the extent of patient involvement is not made explicit. According to the Health & Social Care Information Centre, the focus of PLACE is on strengthening and formalising the role of patients in determining both the content of the assessment and the delivery of inspections. This stance seems to have been understood by hospital facilities managers, as shown in the view expressed by DSM1 to imply that

> *"....The whole idea of PLACE compare to PEAT was because, hospital were setting up patient environmental action tools, and the government says no, the patient is the "king" we want an independent body...For us to actually get that unbiased feedback, we need the service users, the people who actually use the services to tell us that it is suitable, and that is the whole ideal of PLACE".*

HFM2 shares this view, but goes further to provide an insight into one way in which PLACE compares to previous guidance documents:

> *"....PLACE go round and ask the patient what is going on; they ask what the treatment is like, and do intentional rounding."*

FM1 goes further to talks about the way in which PLACE focuses on corroboration:

> *"...PLACE is an annual inspection, we then work with patient liaison team... We also have a number of inspection team that goes round the trust meeting the relevant managers and patients, and come up with a report".*

FM3 confirms this, stating that

> *".....PLACE is giving patient the opportunity to tell us how clean our hospital are, without us telling ourselves."*

Unbiased report

The interviewees unanimously testified to the quality of PLACE teams, which could be seen as something which put them on their toes when preparing for the annual PLACE visit. FM1 felt that:

> *"....PLACE to an extent is very autonomous...You don't influence their decision because this are people that have been in the system, we have had retired matron, had Judges; we have had GP, and this are people that are higher-up in authority...So with all intent of purpose, they come-up with better and unbiased report."*

FM1 further observed that

> *"...PLACE team is usually very rigid when they are here... whereas if it is my colleague who inspected the services they could easily ask you to improve on the services."*

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He also mentioned that PLACE teams were unbiased in their reports:

> *"....PLACE will usually come out; they might laugh with you, but at the end of the day when they come with their write-up, and because they had been around for days and seen the services, they start making comparison to ensure that all of this other areas has evidence that we are meeting all the requirement...They come annually and of very high profile."*

FM3 also highlighted this point:

> *"....PLACE gives an independent assurance of how things are, if they went into a ward and sees a litter on the floor, or the bin overflowing or the toilet clean without us having to interrogate."*

The interviewees were in absolute agreement that PLACE encouraged collaboration between all stakeholders without exception. They all felt that PLACE inspections are usually carried out in a very collegial way, but they were characterised by rigour, with thorough checks to make sure that standards are not compromised, especially in the delivery of quality healthcare services in accordance with the NHS constitution.

6.5.3. Section Interpretation

This section has addressed objective 1 and research question 1 of the research (see section 1.7). Objective 1 was to "identify and evaluate the policies, guidance documents and strategies used in facilities management cleaning service delivery for the control of exogenous HCAIs, identifying their advantages and disadvantages". These were investigated within the context of their adaptability, understandability and usability for effective knowledge management processes for the control of exogenous HCAIs in facilities management cleaning services.

Results from the qualitative semi-structured face-to-face interviews with 10 hospital facilities managers indicated that all NHS hospitals in England follow a policy of seeking "compliance with" good practice guidance document/tools that they have adapted from the core documents produced by the Department of Health in the delivery of their cleaning services for the control of exogenous HCAIs. This finding from the interviews confirmed the results from the questionnaire survey, where 35 of the 85 participants said that they used a bespoke guidance document put together by the hospital infection control team (see Figure 5.3).

6.6. **Current procurement strategies in the delivery of hospital cleaning services**

The number of environmental cleaning-related articles published in healthcare infection journals has increased in recent times (Walter, 2013). This growth in publicity about the burden of exogenous HCAIs is a reflection of the relevance of the contribution of the healthcare environment to the prevalence of HCAIs. It could also be argued that it indicates how effective facilities management cleaning services in hospitals could help in the control of exogenous HCAIs (Walter, 2013; Curtis, 2008; Dancer, 2009; Dancer, 2011). Yet although facilities management cleaning services remain critical in the control of exogenous HCAIs, selecting a procurement strategy which will achieve the desired cleaning objectives is a problem (Walter, 2013; Jenner & Wilson, 2000).

The findings from the questionnaire on the management of cleaning service contracts used across NHS hospitals shows that thirty-three (33) of the eighty-five (85) respondents, representing 39% of the total, provided hospital cleaning services using directly employed in-house staff (Table 4.2). The findings also show that only six (6) of the respondents outsourced their hospital cleaning services to external FM service providers, using the Public Finance Initiative (PFI) procurement route. Forty-six (46) of the respondents said they used both directly employed in-house staff and external cleaning service providers for their hospital cleaning services.

Findings from the face-to-face interviews showed that of the 10 facilities managers interviewed, seven acknowledged using directly employed (in-house) staff in the delivery of cleaning services, while three outsourced their cleaning services to an external service provider (Figure 6.3 and Figure 5.3). These figures represent 70% and 30% respectively.

Critical in these findings is the disparity between the in-house and the outsourcing option in the delivery of hospital cleaning service contracts.
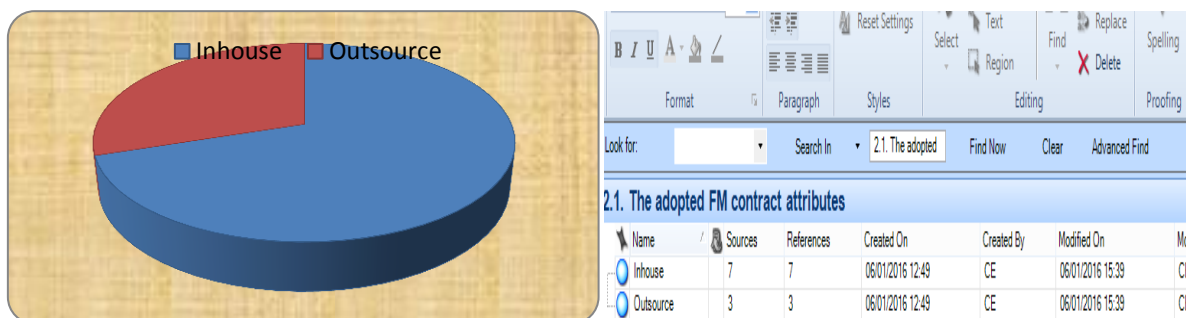
Figure 6.3:   Procurement strategy used for hospital cleaning services

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The literature has identified several factors that could influence the choice of a particular procurement strategy in the delivery of hospital cleaning services (Davies, 2010; Görg & Hanley, 2004). According to Davies (2005), the decline in cleaning standards in hospitals and the prevalence of healthcare-associated infections have been specifically attributed to the procurement strategy used for the delivery of cleaning services. It could be argued that the dilemma of choosing the right strategy is one of the reasons for the high percentage of hospitals using a combination of in-house provision and outsourcing for their hospital cleaning services in an effort to reduce the prevalence of exogenous HCAIs. In order to achieve the overall aim of the research, it is important to explore the underlying reasons for the choice of a particular procurement method, and how this impedes or promotes the effective knowledge management process within the hospital knowledge infrastructure capabilities.

The next section of this analysis of the interview data presents findings about the reasons that inform the use of in-house provision or outsourcing for the delivery of hospital cleaning services.

6.6.1. Reasons for the choice of a particular procurement strategy for the delivery of hospital cleaning services

Within the context of the use of directly employed in-house staff rather than an external service provider (outsourcing), five of the facilities managers interviewed stated that their choice was often informed by the opportunity of having control of the facilities management (cleaning) budget. Other reasons provided include the opportunity to monitor staff training, as well as to increase staff productivity. On the other hand, the two interviewees who outsourced their hospital cleaning services admitted that their choice was informed by the drive to bring new skills into the in-house team (within the context of prevailing good practice knowledge transfer). The other reason given was the liberty it gives the facilities manager. It was stated that, with outsourcing, the facilities manager only has to focus on managing the contract, eliminating the human resource management aspect (Figure 6.4).

2.2. The reasons for the adopted contract in FM cleaning services		
Name	Sources	References
Budget Control	0	0
Cost control	5	6
Increase Productivity 1	0	0
Feel part of the hospital team	3	4
High level of responsibilities	4	6
Increased Productivity	0	0
Control of new ways of working	4	4
Direct link with staffs	3	3
Flexibility to response to various needs	4	4
Scope to develop service	3	4
Staff understand the hospital process	5	5
Outsource Contract	0	0
Contract management only	1	1
Knowledge transfer	2	2

Figure 6.4:   Reasons for choosing FM cleaning service contracts

The first part of the analysis of the face-face-interviews presented findings on views about the use of directly employed in-house staff. The second part presented findings on views about outsourcing hospital cleaning services to external contractors. The analysis will be carried out within the context of respective hospital prevailing knowledge infrastructure capabilities support to the knowledge management process in the control of exogenous HCAIs (Figure 6.4).

6.6.1.1. Budget Control

The opportunity to manage the facilities cleaning services budget from a cost control perspective was identified by five of the interviewees as one of the reasons for providing hospital cleaning services using directly employed in-house staff. The respondents also stated that they were very much acquainted with the increasing challenges posed by the continuous emergence of highly resistant strains of healthcare-associated infection-causing bacteria (super-bugs) in healthcare facilities. The interviewees discussed their awareness of antibiotics-resistant bacteria, especially those that are now resistant to antibiotics previously used in the successful treatment of infections attributed to them. In the words of one interviewee (DSM1),

> *"....Techniques for fighting HCAI changes quickly, the specification changes, the equipment's changes....the technology changes, so you have to be on top of it with the flexibility of the day-to-day management of budget."*

Another interviewee, HFM2, added that...

> *".....increasingly we are finding that a lot of the work we are getting the team to do are very ad-hoc, increasingly finances are getting really tight."*

HFM2 further stated that.

> *"....I am given a level of responsibility for what can be ordered up to a certain cost, so we don't have to wait for procurement to say we can or cannot have it. I mean getting further approval from procurement…"*

These views concur with those reported in the literature. In the view of Kagioglou & Tzortzopoulos (2010), facilities maintenance is one of the core domains of knowledge around which facilities management revolves. This knowledge includes not only budgeting and priority setting for different activities according to the preferred policy; but also service life planning (Lichtig, 2010). It has also been pointed out that where services are provided in-house, work can be carried out swiftly within budget without incurring extra costs. This view was expressed by FM3:

> *"...should in case there is a spillage, there is something here, there is something there, we wouldn't be putting an extra cost in for different thing."*

It is widely acknowledged that the NHS is such a large organization that in the delivery of quality healthcare services to control the prevalence of HCAIs "some things regularly slip through the cleaning net with no-one taking responsibility" (Department of Health, 2000, 2004a). The importance of budgetary considerations mentioned by interviewees when deciding whether to provide their hospital cleaning services using in-house staff could be seen to have a potential benefit in that is provides the opportunity of "allocating adequate budget with due attention to infection control, and environmental cleanliness" (Department of Health, 2004a). It could also be argued that the concerns expressed by DSM1 have the potential for ensuring that there are adequate and appropriate supplies of equipment and other requisite materials for the effective control of exogenous HCAIs.

6.6.1.2. Staff training

Hospital environmental hygiene encompasses a broad range of routine activities including cleaning the general hospital environment and maintaining shared equipment, as well as the education and training of staff (Pratt et al., 2014). Staff training came second in the ranking of major consideration that inform the engagement of directly employed in-house staff for hospital cleaning services. Four (4) of the respondents viewed this in relation to ease of monitoring to ensure that cleaning staff are up to date with new skills and techniques, and

receive other requisite training in the control of exogenous HCAIs. Referring to the ease of ensuring that directly employed staffs have the requisite skills and knowledge, FM1 stated that

> *"......Working for NHS has lots of opportunities, we offer NVQ for staffs, staffs are sent for training courses to learn new techniques, and changes in legislation as it affects their work...... and the environment is quite good".*

The literature tends to confirm the suggestion that domestic staff employed by contractors have not always had adequate training when compared to directly employed hospital staff in NHS hospitals in England in the recent past. The House of Lords Science and Technology Committee observed that "it is especially difficult to ensure training of contract cleaners" (Davies, 2005). The committee also echoed the fears of the Infection Control Nurses Association (ICNA) on this issue. It should be recalled that ICNA stated that "although training requirements may be written into the contract, this is often cut because of cost" by the contractors. Davie (2010) also amplified this concern, saying that "contractors do not have any desire to provide training to their domestic staffs", and "the norm has always been not to provide anything more than a cursory induction for new domestic staff." This has been borne out in several cases of a decline in standards that have led to incidents in NHS hospitals. In the serious case review of Winterbourne NHS hospital, it was reported that the majority of staff at the hospital were unregulated support (including domestic) workers who were not subject to any code of conduct or minimum training standard (Department of Health, 2012). Compared to external cleaning staff, directly employed in-house staff will request the mandatory training that requires annual refresher sessions. According to DSM1,

> *"...I also think that because of them been part of our team they will have the same training like everybody else such as infection prevention training and all that type of thing will automatically be there for them as part of the hospital...they also talk about their training need during their appraisal."*

Supporting this view, HFM3 said that directly employed cleaning staffs are better trained to carry out cleaning tasks effectively than those from a contractor. He stated that

> *"...you find your inhouse staff handy for most of the routine works, and you find that the inhouse team are better trained..."*

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The literature lends credence to the views expressed by these interviewees. According to Ayliffe et al. (1999),

> ...*"Contracting out can lead to health authority losing control of the necessary specialised training for cleaners in the use of effective procedures, equipment, and materials"*.

The findings from the synthesis of literature and the views expressed by the interviewees both emphasise the importance of giving domestic staff the requisite training so that they are able to perform their cleaning tasks optimally. It has been argued that training is imperative, considering that hospital cleaning in the 21st century requires a number of new skills in order to be able to use current cleaning techniques, tools and materials in different situations (Dancer, 2011; 1999). The Department of Health (2004) echoed this view in the "Matron Charter," which suggested that the matron should be responsible for making sure that both clinical and non-clinical staff receive on-going training and education related to infection control.

6.6.1.3. Increased Productivity

Over the decades, there have been numerous attempts to model productivity of domestic staffs working ethics in NHS hospitals to reduce the prevalence of exogenous HCAIs. This is shown in several studies that have suggested measures of efficiency and compliance with good practice in the control of exogenous HCAIs, especially in the context of labour efficiency, using such tools as KPI, and balance score card (Bigliardi & Dormio, 2010; Amaratunga, Haigh, Sarshar & Baldry, 2002). The National Health Service Wales (2010) overtly stated in one of its that "improving the efficiency of the health service through productivity and value for money has always been part of healthcare objectives." In the interview findings, "increased productivity" was acknowledged by the interviewees as the third (3) consideration informing their choice of cleaning services provided by in-house staff. In the context of "increased productivity", the benefits include the following:

- ➢ Cleaning staff feel part of the hospital team
- ➢ Control of new ways of working, and scope to develop services
- ➢ Direct links with staff, and a high level of responsibility
- ➢ Flexibility to respond to various needs
- ➢ In-house staff understands hospital processes.

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Cleaning staff feel part of the hospital team

Concern about hospital cleaners not having a sense of belonging to the wider hospital management team in the control of exogenous HCAIs has been raised in recent past. While it is often stated that successful healthcare delivery services rely on teamwork, it is acknowledged that the work of hospital cleaners is often overlooked (May 2013; Department of Health, 2004; Dancer, 1999). John Reid, the then Health Secretary under the Labour-led Government, acknowledged in 2004 that "cleaners do not always feel part of the healthcare team" (White & Calvel, 2004). This sentiment was shared in 2007 by Andy Burnham, the then Health Minister (Davies, 2010). The minister argued that "the distance between hospital cleaners and the rest of the NHS family" poses a potential problem for Trusts to 'find the levers' to combat hospital infections. McMaster (2007) agreed, and argued that hospital cleaners see themselves differently to general building cleaners. The findings from the face-to-face interviews support the stances echoed in the literature. The interview findings are about how the integration of hospital cleaning staff could increase their productivity in the control of exogenous HCAIs. There is an acknowledgment that when cleaning staff are directly employed by the hospital, their morale increases spontaneously, affecting the way they carry out their cleaning duties and accept responsibility. This view was expressed by HFM2:

> *"....I think also that if staff feel that they belong to the organisation, say they belong to the hospital they already then have some sort of relationship with the hospital, they are employ, they are on the same terms and condition with everybody else, they are not been paid differently to other people whom they are working alongside, I think straight away their moral is increased".*

In interviews with hospital cleaning staff across NHS hospitals in England conducted by the Cleaner's Union, this opinion was unanimously echoed as a concern. Interviewees were unanimously of the opinion that "cleaner hospitals cannot be secured simply by the existing cleaning staff working harder… any improvement has to be a team effort" (Unison, 2004). The importance of making cleaning staff feel part of the team was also implied in the comment made by HFM2, who stated that

> *"...With it being in-house is better because I know the people, they know obviously what I want, and if I need anything to go with, obviously with the role I have got, obviously is fine, as long as I give them a good business plan for what I want".*

As is logical, the literature suggests that the outsourcing of hospital cleaning services in the area of collaborative practices works against high quality hospital cleaning. According to Davies (2005), the contractual culture which is part of outsourcing atomizes functions within hospitals, and contributes to the breakdown of a team-based approach that unifies clinical and non-clinical staff. The author further agues that such consequences reduce the flexibility and overall effectiveness of hospital cleaning.

Control of new ways of working, and scope to develop services

Hospital cleanliness is a lot more than just making the environment look pleasant and tidy. It involves the maintaining of building fabric and features, considering that infection-causing microorganisms thrive in both animate and inanimate. It is imperative that cleaning staff are able to adapt to the challenges posed by the increasing resistance of such microorganisms to antibiotics and by changes in technology and hospitals designed to meet 21st century healthcare delivery demands. 'Control of new ways of working and scope to develop services' was also cited as one of the factors that can increase productivity which informed the choice of directly employed in-house staff for hospital cleaning services. Changing realities were elaborated by DSM1, who stated that

> *"...Like I said earlier, techniques for fighting HCAI changes quickly, the specification changes, the equipment's changes, the technology changes, so you have to be on top of it".*

On the other hand, however, HFM3 focused on flexibility and the control of staff, including starting and finishing times:

> *"....In my view, i guess the advantage of having an in-house staffs is being in control...of the start and finishing time, having a bit more control element".*

Finally, FM1 viewed this issue from the perspective of the leverage to improve bespoke working methods to deliver hospital cleaning services to the required standard to mitigate the identified risk of infections that could eventually lead to the prevalence of exogenous HCAIs. FM1 declared that

"...It's got scope for developing services and to be honest, the staffs feel more valued because they feel part of hospital team, staffs feel more inclusive".

In-house staff understands hospital processes

FM1, DSM1 and HFM3 were all of the opinion in the face-to-face interviews that directly employed cleaning staff understands hospital processes more than those working for a contractor, which has the advantage of getting more cleaning done. They noted that with the cleaning services being delivered by directly employed in-house staff, the staff accept a high level of responsibility. They also work more collaboratively with other stakeholders, including the infection control team, to improve the patient experience and the control of HCAIs. In the view of HFM3,

"...It is very much more about the patient, patient environment, very much closely working with the infection control and the nursing team to ensure that the patient has as little disruption to their treatment while in hospital".

This spirit of collaboration is informed by the fact that the directly employed staff know the hospital infection control policies and procedures. According to FM1,

"....Being in-house, there is much more ownership and understanding of the health service and the service narrowing up with that being a caring organization and not just about cleaning" (FM1).

Findings from the literature, including the Health and Safety Executive's Stoke Mandeville investigation team, seem to support the notion that directly employed in-house staff understand the hospital infection control policies and procedures, and are willing to take responsibility when compared to those from a contractor. Evidence given during the investigation stated that "the standard of cleanliness on the ward is largely dependent on the conscientiousness of the individual staff" (Healthcare Commission, 2006). This eyewitness testimony at the Stoke Mandeville investigation should be seen against the background of falling standards on the part of hospital cleaning contractors.

Flexibility to respond to various needs

Flexibility to respond to various needs was cited as one of the factors that increase productivity, which is also an advantage of using directly employed staff for hospital cleaning services, while a lack of such flexibility may be a feature of contracted staff which often

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works against high quality hospital cleaning. It is also felt to contribute to a basic teamwork approach that enables clinical and non-clinical staff to work together (Davies, 2005). Two of the interviewees (FM3, HFM2) indicated that the flexibility of staff in responding promptly to various cleaning needs leads to better cleaning results. FM3 said

> *"....Well, I think obviously there is a specification, but we go beyond that specification with it been in-house…, our cleaning staffs are more familiar with the hospital infection control policies than agency staffs, and also know what is expected of them."*

The importance of this flexibility and the ability of in-house cleaning staff to respond swiftly to urgent cleaning needs in cases such as identified HCAI risks was also emphasised by HFM2:

> *"…We have control and the flexibility to respond to various needs with domestic services been in-house…"*

The interviewees also stated that as well as responding promptly when called upon, in-house staffs are also readily available to carry out routine cleaning of the healthcare environment to combat the prevalence of exogenous HCAIs. In the view of HFM2,

> *".....you find your in-house staffs handy for most of the routine works."*

All these factors supporting the use of directly employed in-house staff rather than the engagement of external providers suggest a shared belief that in-house cleaning staff have a better understanding of the direction and objectives of the hospital. This view was summarised in the comment made by HFM2:

> *"…With it being in-house is better…. if I need anything to go with, obviously with the role I have got, obviously is fine, as long as I give them a good business plan for what I want".*

Of the ten (10) facilities managers interviewed, three said that they outsourced hospital cleaning services to an external provider (see Figure 6.3). Some of the reasons that informed their choice include the following:

6.6.1.4. Knowledge transfer

The introduction of new technologies into hospitals by healthcare facilities cleaning companies is one reason given for outsourcing hospital cleaning services. It was assumed that,

because external cleaning contractors manage cleaning services for several hospitals, they are often better acquainted with newer cleaning technologies which may achieve better cleaning results.

The literature agrees that the environmental cleaning regime is of critical importance in healthcare settings to reduce the risk of healthcare-associated infections (Gillespie et al., 2013). It is noted that traditional routine cleaning methods in healthcare settings to remove epidemiologically important pathogens from surfaces that have been contaminated conventionally involves the use of detergents and disinfection with chemicals (Gillespie et al., 2013; Dancer, 2009; 2011). However, with advances in technology driven by the demand for quality healthcare delivery in the 21st century, "newer technologies for environmental cleaning are now becoming available" (Gillespie et al., 2013). According to this author, some of these newer technologies include the use of "ultra-microfiber clothes which consist of a combination of polyester and polyamide that removes particles by absorbing the dirt and bacteria, by holding it tightly in the fibre and not transferring it during cleaning". Other newer methods include "steam technology", which uses a very high temperature (140^{0}C) under pressure to loosen dirt, and enables microfiber cloth to remove microorganisms that cause HCAIs from surfaces such as laminates, steel and vinyl. This technology is also known to remove Clostridium difficile spores in vegetative form from different surfaces.

Outsourcing hospital cleaning is presumed to provide an opportunity for the hospital facilities management team to learn new skills from the contractor. According to FM5,

> *"….The benefits of engaging a contractor is in terms of good value for money…because they are international contractor, they bring their own innovations and technologies into the contract so they can share their experiences onto the Trust in what they do on other sites".*

Another consideration that may support the outsourcing of hospital cleaning service in preference to using directly employed in-house staff is the freedom it gives to focus only on the management of the service contract, rather than having to deal with all the complexities of both human resource issues and the management of services standards. This was clear in the view of FM2:

> *"…I don't necessarily think one is better than the order. However, I suppose one of the benefits is that it becomes contract management only".*

While some parts of the literature seem to support the notion of knowledge and skills transfer as a potential positive for the outsourcing of hospital cleaning services, others present a differentiated view of what may be involved in "contract management." According to Davies (2010), outsourcing hospital cleaning services presents NHS managers with the challenge of creating a common approach to service delivery and maximising teamwork to meet service standards. The Centre for Health and the Public Interest (2015) raised concerns about the cost implications of outsourcing hospital cleaning services in NHS hospitals, stating that 'given the complexity of NHS services contract, administering, monitoring and enforcing of NHS contract is costly.'

This sub-section has presented hospital facilities managers' reasons for adopting a particular procurement strategy for the delivery of hospital cleaning services, and the implications these have for protocols for the control of exogenous healthcare-associated infections.

Questions in the next sub-section seek interviewees' personal experience in areas where improvements could be made, to achieve not only research question 2 and objective 5, but also the overall aim of the research.

6.6.2. Potential for improvement in the procurement strategy used for hospital cleaning services to optimise efficiency in the control of exogenous HCAIs

The interviewees were asked to share their experience on areas that could be improved in the adopted/adapted procurement strategies to optimise efficiency in hospital facilities cleaning services for the control of exogenous HCAIs. This open-ended question had the aim of further encouraging the interviewees to share relevant personal experiences that could help in achieving objective 2 and question 2 of the research undertaken. According to Parahoo (2014), the degree of control that the interviewer exerts should not "turn interaction into a rigid questions and answer session, but should be as near as possible to normal conversation." Potential areas of improvement that could increase efficiency in hospital cleaning services in the control of exogenous HCAIs include those presented within the "non-clinical service functional boundaries" in Figure 2.3.

Areas mentioned by the interviewees for improvement in the strategies for hospital cleaning services that could optimise efficiency in the control of exogenous healthcare-associated infections are presented in Figure 6.5.

2.3. Areas that could be improve in the Inhouse adopted FM contract				
Name		Sources	References	Created On
Collaboration		0	0	06/01/2016 13:15
Avoiding cross management of service		1	1	06/01/2016 13:15
Better working relationship		5	5	06/01/2016 13:15
Improve communication		2	2	07/01/2016 14:11
Increase staffing level		0	0	06/01/2016 13:16
employment of skillful staffs		2	3	06/01/2016 13:16
Increase routine monitoring and supervis		4	4	06/01/2016 13:16
Outsourced contract		0	0	07/01/2016 14:13
Getting the Service Levele agreement rig		1	1	07/01/2016 14:14
Improve communication		1	2	07/01/2016 14:15

Figure 6.5: Potential areas of improvement to maximise efficiency in HCAI control

6.6.2.1. Avoiding the cross-management of services

Facilities management practice covers an extremely wide range of activities and involves a range of diverse professionals. It is often the umbrella term under which a wide range of property- and user-related functions from backgrounds outside the built environment work together, with the aim of taking control, adding value and supporting workplace facilities. Facilities management service functions in hospitals include catering, cleaning, maintenance of the built facilities, and so on (see Section 2.7 and 2.8 in Chapter 1). Because of the importance of the cleaning service function in the control of exogenous HCAIs, concern has been raised about the cross-service management functions often expected of hospital facilities managers. This concern was heightened by SFM1, who argued that

> "…With services being sometimes cross managed between catering, portering, and the manager's don't end-up with the relevant skills to understand how things should be clean, the methods and the techniques".

This respondent also added that

> "…This is often the case whereby the hospital facilities manager manages both the cleansing services and the maintenance of the built facilities', as well as ensuring that the hospital meets food safety standard legislation.".... The facilities manager also liaises with the infection control team to formulate and implement measure to avoid the contracting and spreading of infection".

This concurs with findings from the literature. According to Thomson (1990), facilities management offers organisations many solutions for improving business performance, but fails to recognise areas where real value can be added. It instead adopts piecemeal approaches that reap no longer-term rewards, and often offer little short-term gain. The author argues that there is often a problem of facilities managers not understanding their functions, which is often as a result of the cross-management of services that fall within the remit of the profession.

6.6.2.2. Employment of skilled staff

Considering the increasing recognition of the interface of the hospital environment and the prevalence of healthcare-associated infections, there is a good case for focusing not only on the management of services, but also on employing people with the right technical skills. The views expressed by the interviewees reflect concerns in the literature that the management of healthcare facilities is often in the hands of people who do not have actual experience of cleaning, and can actually bring only a theoretical or paper-based perspective to bear (Dancer, 2009; Dancer, 1999, 2011; Department of Health, 2013a, 2016). In the interviews, SFM1, who has over 30 years' experience in hospital facilities management, confirmed this concern:

> *"....My only thought in regard to your question will be whether locally or nationally there is more of a focus on just having qualification and not the relevant proficiency in understanding cleaning and cleaning science, and therefore the management supervisor has no relevant skill in managing cleaning services in the healthcare."*

One way of improving cleaning outcomes in hospitals in the face of the current challenges is the continuous training of staff. FM1 agreed with this idea, stating that

> *"....Training is an area that is paramount in the sense that, healthcare associated infection is something that is manifesting every day as things are changing... Infections are constantly becoming immune to antibiotics and all that, it is that awareness training…That is why every three months we have refresher training and it's something that is constantly in their brain…".*

According to Sehulster & Chinn (2003c), hospital cleaning, disinfection and waste management staff are at the highest risk of contracting HCAIs in health settings, which adds weight to the views expressed by SFM1 and FM1. The training of facilities management

cleaning staff should therefore focus on the specific hazards of cleaning tasks, the transmission of disease and the use of personal protective equipment and other relevant equipment in order to minimise the prevalence of exogenous HCAIs. It is also imperative that staffs are constantly reminded of the impact of their services on visiting stakeholders in terms of healthcare-associated infections.

6.6.2.3. Increasing routine monitoring and supervision of cleaning

Conventionally, the term cleaning is used to describe the physical removal of soil, dirt or dust from surfaces (Pratt et al., 2014). Despite the technological innovations introduced into hospital cleaning services, it is acknowledged that hospital cleaning remains "a hard task, and (a) labour intensive job" (Unison, 2004). Standard infection control precautions from the facilities management cleaning service perspective involve enhanced (terminal) cleaning, disinfection, and the decontamination of surfaces, rooms, bed spaces and of the entire healthcare environment.

According to Pratt et al. (2014), enhanced cleaning is a cleaning method which goes beyond standard cleaning, while disinfection is the use of chemical or physical methods to reduce the number of pathogenic microorganisms on surfaces. The author describes decontamination as the use of processes including cleaning or disinfection that result in the removal of hazardous substances (e.g., microorganisms or chemicals). All these processes involve an increased cleaning frequency of all surfaces using additional cleaning equipment, and require substantial manpower resources to achieve expected standards. This account from the literature corroborates views expressed by the interviewees. DSM1 reported that

> *"...At the moment, we do a lot of barrier cleans at the hospital; we do 400 per month for sidewards, bed space, etc. I think that is a lot and could be better if we could target our resources. 400 is an awful lot that we do per month, we have put-in, and it has gone as a staff and cost pressure, but at the moment it is a big pressure the amount of clean. I think that is something we need to look at".*

The view expressed by DSM1 was echoed by SFM1:

> *"...Particularly in this hospital, we need to do more routine monitoring; we need to improve on our routine staffs".*

Similar issues were reported by the Healthcare Commission's investigation into the outbreak of Clostridium difficile at Stoke Mandeville hospital, which focused on staffing levels and their impact on infection control and care quality. The investigation found that

> *"Staff, patients, and their families reported that inadequate numbers of nurses had a negative impact on the quality of care and good practice in the control of infection"* (Healthcare Commission, 2006).

It could be argued that views such as those expressed above on the need to increase routine cleaning and monitoring as a means of improving cleaning standards arise from hospital facilities managers' understanding of statutory requirements. It is a statutory expectation that "any unsatisfactory levels of cleanliness found during measurement of cleaning services should be rectified without delay as part of the routine cleaning services (Association of Healthcare Cleaning Professionals, 2009). The literature confirms that any improvement in cleaning standards requires a major increase in the number of hours worked, which in turn means an increase in the number of cleaning staff (Pratt et al., 2014; Unison, 2004). The points made in the literature support the issues identified by the interviewees as considerations that could improve current practice for the control of exogenous HCAIs, particularly in the light of the dynamic nature of the microorganisms which cause exogenous healthcare-associated infections.

6.6.2.4. Establishing appropriate Service Level Agreements (SLAs)

Hospital cleaning services may be provided directly by the hospital or through a third-party facilities management cleaning service provider under a Service Level Agreement, which is a standard contract, or as part of a Public Finance Initiative (PFI) Agreement (Association of Healthcare Cleaning Professionals, 2009). Because of the problems which are acknowledged to be associated with contracting in healthcare, an addendum to the main contract known as a Service Level Agreement is often used to define other requirements in the contract. This issue was mentioned by HFM1:

> *"...Getting the actual procurement of the contract really good is a challenge...Again how they train their staffs which is down to the contractor to manage is another headache for us to manage".*

Concerns have been raised about the "asymmetry of information which makes it almost impossible for a commissioner of services to know whether a provider is delivering according

to the terms of the contract, or is cutting corners or reducing quality in order to gain extra revenue" (The Centre for Health and the Public Interest, 2015). According to the Centre for Health and the Public Interest (2015), the safe delivery of healthcare in England now depends increasingly on "how effectively the NHS monitors and enforces this myriad of contracts with the private contractors". Given the complexity of monitoring healthcare contracts, it was recommended that "the service level agreement (SLA) should ensure that all Trust are clear on the services and standards expected of their provider." These include a "regular site visit to private providers of NHS services" (The Centre for Health and the Public Interest, 2015; Department of Health, 2009).

6.6.2.5. Improving communication

It is acknowledged that poor levels of communication between clinical and non-clinical staff, as well as between directly employed staff and those working for a contractor, could make it difficult for hospitals to 'find the levers' to combat the prevalence of infection (Davies, 2010; Liyanage & Egbu, 2005). This was frustrating for FM5, whose hospital had engaged one of the big-name facilities management service providers to manage the cleaning services of several NHS Trusts in England. He stated that

> *"...I think probably, and this is for our trust and not national thing; base on both ends, the infection control team need to collaborate more with the facilities management team".*

The House of Common Health Committee Report (1999) on the "future of NHS staffing requirement" had earlier warned that "the often spurious division of staffs into clinical or non-clinical groups can create an institutional apartheid which might be detrimental to staff morale and to the patient." It was recommended that Trust and ward-level management be educated on the importance to combat the divisive or elitist attitudes that often lead to domestic staff being invisible (Davies, 2010; Unison, 2004). This will mean increasing awareness about the importance of the role of every member of the team, and more specifically it means improving communication with non-clinical staff about potential infection risks and specific cleaning and hygiene regulations (Unison, 2004).

6.6.3. **Section interpretation**

This section has addressed objective 2 and research question 2 (see section 1.7) by presenting the perceptions of interviewees from the data collected in the second phase of the research method as set out in Section 4.5 in Chapter 4. Objective 2 was to "identify the prevailing procurement strategies in the delivery of hospital cleaning services and its interface with effective knowledge management protocol for the control of exogenous HCAIs in hospitals", while research question 2 asked "What is the level of effectiveness of the adopted procurement strategy in the delivery of hospital cleaning services in the control of exogenous healthcare-associated infections?"

This section presents perspectives on the outsourcing and in-housing of hospital cleaning services both from the interface with extant literature and from the findings of the questionnaire survey. It might be assumed that most NHS hospitals in England use directly employed in-house staff for the delivery of hospital cleaning services. However, the evidence presented in Table 5.5 and Table 6.1 shows that a combination of in-housing and outsourcing cleaning services is often the approach adopted by NHS hospitals in order to achieve both economic and social-corporate responsibility objectives by reducing the prevalence of exogenous HCAIs.

Given the challenges associated with the prevailing strategy and its interface with facilities management cleaning protocols for the control of exogenous HCAIs, the findings from this section will be interface and discussed in the next chapter before drawing conclusions.

The following subsection addresses research question 3 and objective 3 of the research (see outlined in Section 1.7). It focuses on investigating the prevailing knowledge management processes in hospital facilities management cleaning services. This investigation was carried out within the context of the hospitals' prevailing culture, structure and technological knowledge infrastructure capabilities as they support the control of exogenous HCAIs in facilities management cleaning services.

6.7. **Hospital knowledge management processes and infrastructure capabilities**

This subsection of the face-to-face interview seeks to further investigate the findings from the questionnaire survey (Figure 5.3) as part of the explanatory mixed method to answer research question 4 and achieve objective 4. Objective 4 is to "critically investigate the factors that

inhibit effective knowledge management processes in hospital facilities cleaning services within the hospital structure, prevailing culture, and technological capabilities. Research question 4 was asked to achieve this objective. The question was: *"what are the hospital adopted knowledge management processes in healthcare facilities management cleaning services for the control of exogenous healthcare associated infections in hospitals?"*

6.7.1. The culture of collaboration between clinician and non-clinician employees (facilities management team) relating to good practice knowledge in the control of exogenous healthcare-associated infections in each hospital

According to Ayliffe (2009), close collaboration is needed between the infection control team, medical microbiologists, biomedical scientists and the other non-clinician healthcare workers to detect and minimise the spread of emerging antibiotic-resistant microorganisms which cause healthcare-associated infections. Findings from the interviews on the prevailing culture of collaboration between clinicians and non-clinicians relating to good practice knowledge in the control of exogenous HCAIs were categorised into three major themes, namely collaboration, communication and improvement models (Figure 6.6).

4.1. How would you describe the culture of good practice knowledge collaboration				
Name	Sources	References	Created On	Created E
Collaboration	0	0	06/01/2016 13:43	CE
Identify problem and deals with it c	5	5	06/01/2016 13:44	CE
Learn from problems	1	1	06/01/2016 13:43	CE
Regular meetings and discussion	5	6	06/01/2016 13:44	CE
Routine Inspection	3	3	06/01/2016 13:44	CE
Communication	0	0	06/01/2016 13:45	CE
Communicate good practice appro	3	4	06/01/2016 13:47	CE
Sharing information	7	7	06/01/2016 13:47	CE
Improvement model	0	0	06/01/2016 13:45	CE
PLAN, DO, STUDY, ACT	1	1	06/01/2016 13:45	CE

Figure 6.6:   The prevailing culture of knowledge management in hospitals

6.7.1.1. Collaboration

In the context of the investigation of collaborative practice between clinician and non-clinician staff in the control of exogenous HCAIs in facilities management cleaning services, five of the interviewees stated that they collaborated to resolve any problems identified. According to DSM1, the facilities management team works collaboratively with the ICT:

> *"....Our relationship is such that we work very closely with infection control team...As part of that, we have regular contact with infection control team and all the other consultants".*

This respondent also said that

> *"....If there is a problem we would rather know about it and deal with it, and learn from it".*

Agreeing with DSM1, FM4 observed that

> *"....We deal hand-in-hand with the infection control team...we work on daily update from infection control team on where we stand on our infections."*

HFM3 made a similar point:

> *"...We have a culture of working together and delivering together....We share information together because at the end of the day facilities is a combination of so many factors, looking at what is on-ground, what we want to achieve".*

The literature tends to support the importance of collaboration in the control of healthcare-associated infections, which it views as a challenge to public health. Davis et al. (2014) observes that a collaborative effort involving a broad range of stakeholders is needed to address current and emerging challenges in healthcare. Practices used to enhance collaboration include regular meetings of stakeholders to discuss responsibilities and agree on processes. There was unanimity among the interviewees that they met on a regular basis to discuss emerging concerns in relation to healthcare-associated infections. For example, HFM2 reported that

> *".....Well in terms of myself, we have a meeting every other month with the medical director, the head of infection prevention and we go through anything that is of concern to them...We also discuss how we are going to do deep clean".*

HFM2 added that

> *"....We also have meeting with infection prevention committee, I go to that, and we share good practice idea and all that sort of things".*

It was noted from the interviews that regardless of whether hospital cleaning services are outsourced, all stakeholders collaborate to ensure that standards are met. This was clear from

the interview with FM5, whose hospital outsourced their cleaning services to a third party service provider:

> *".....Because we outsourced our services, we have daily meeting depending on the level from strategic to operation, we then liaise with all team, including our senior infection control personnel".*

HFM1 reported that

> *"...Our relationship is such that we work very closely with infection control...As part of that, we have regular contact with infection control and all the other consultants".*

Routine inspections

Routine inspection is a practice that is encouraged in several government publications as a way of identifying and addressing issues pertinent to the prevalence of healthcare-associated infections (Keogh, 2013; Department of Health, 2004a). It is recommended that routine spot inspections are made by the matron in NHS hospitals to identify areas that are not meeting acceptable standards, and are followed up with actions to prevent the prevalence of infections (Department of Health, 2004a). Findings from the interviews show that this is done in NHS hospitals using electronic devices such as a personal digital assistant (PDA) through which findings are communicated to a wider range of stakeholders for discussion. According to SFM1,

> *"...We generally tend to, for example, we walk around with a PDA, and the information gathered is documented in a PDA and is sent around".*

Communication

Effective communication of clear quality improvement strategies is core to the development of any action plan to reduce the prevalence of exogenous HCAIs in hospitals. According to HFM3,

> *"....We have regular meeting, so I get to pick up information from there, and I get to share that information".*

The literature highlights the importance of sharing information and communicating good practice knowledge for the effective management of healthcare-associated infections to all stakeholders. This was amplified in the Matron Charter (Department of Health, 2004a), which states that "it is important to make sure there is good communication between the trust

infection control team and staff" in the area of infection control. It is acknowledged that effective communication also assists in the development of models for the improvement of good practice.

Improvement models

It is acknowledged that "facilities management traditionally lacked specific management tools that meet its needs, rather, it borrows many of its methods and tools from manufacturing" (Amaratunga et al., 2002). One of the process improvement models used for monitoring good practice knowledge compliance, as noted by DSM1, is the 'Plan, Do, Study and Act' model. This is also known as "Deming's circle", after Dr. Williams Edward Deming, who first proposed it (Moen & Norman, 2009).

> *"...We have got a lot of PLAN, DO, STUDY AND ACT*
> *system and that sorts continue".*

Initially implemented in the manufacturing industry, the Deming circle is a process designed to drive the continuous improvement of a task in meeting set objectives (Sokovic, Pavletic & Pipan, 2010; Moen & Norman, 2009). Collaboration among stakeholders in the control of exogenous healthcare-associated infections through regular meetings and routine inspections, facilitated through the sharing and communicating of good practice knowledge, is a prominent theme in the interviews. However, there is a paucity of processes used to monitor agreed strategies. Intriguingly, only one of the 10 interviewees reported having agreed that an improvement monitoring process was in place. This substantiates claims about the lack of a review of the good practice guidance documents used in facilities management cleaning services for the control of exogenous HCAIs (May & Pitt, 2012; May 2013).

The interface of the improvement processes and models available to achieve the research objective is discussed in chapter 7.

6.7.2. Hospital departmental structure as a means to facilitate the creation of good practice knowledge in the control of exogenous HCAIs in FM cleaning services

Like the structural elements of any organisation, those of hospitals are acknowledged to "have often had the unintended consequence of inhibiting collaboration, and sharing of knowledge across internal organisational boundaries" (Gold, Malhotra, & Segars, 2001). It is further posited that structures that promote individualistic behaviour in which locations, divisions and functions are rewarded for "hoarding" information can inhibit effective knowledge

management across hospital boundaries in the control of exogenous healthcare-associated infections in facilities management cleaning services. Figure 6.7 presents the findings from the interviews that relate to ascertaining the extent to which hospital departmental structure facilitates effective knowledge management in hospital cleaning services for the control of exogenous HCAIs. The findings will be discussed in the context of the major themes identified in the interviews, including collaboration and communication, and training that is focused on the control of exogenous healthcare-associated infections.

4.3 How does your hospital departmental structure facilitating		
Name	Sources	References
Collaboration	0	0
Brainstorming with other stakeholders	3	3
monthly infection control meeting	5	5
Regular Team briefing with staffs	3	3
Communication	0	0
Regular communication	3	3
Sharing information	3	4
Round the clock onsite cleaning team	1	1
Training	1	2
Continue focused on HCAI control trai	3	4

Figure 6.7: Hospital structure knowledge facilitation processes

Collaboration

As discussed above (see section 6.7.1.1. some of the interviewees testify to the support of the hospital department in promoting collaboration among stakeholders in the control of exogenous HCAIs through:

> ➢ Brainstorming with other stakeholders
>
> ➢ Monthly infection control meetings, and
>
> ➢ Regular team briefings for staff

According to HFM2

> *"...Because we have that focus meeting regularly, everyone seems to be carried along on the way forward in meeting our cleaning objectives".*

Supporting the comments of HFM2 on collaboration with other stakeholders through regular meetings, DSM1 reported that

> *"...We attend a monthly C-Diff meeting and a monthly infection control meeting to understand what is going on in the hospital… and if there is anything that we need to know we pic-up the phone".*

FM1 had a similar story:

> *"....In terms of meeting we have a formal monthly meeting to discuss how we can escalate issues, we also have regular contact with the medical director."*

However, FM3, who has worked for the NHS for over 26 years, seemed to have a slightly different view. While she acknowledged that some level of collaboration among stakeholders in the control of exogenous HCAI was valuable, she felt that improvements were possible:

> *"...It's probably reasonably effective, but things could be better. I think there should be something more, and i don't think we should be just talking of hospital everlasting".*

FM3 suggested that there should be collaboration between different hospitals so that everyone would be made aware of the full range of good practice. She was concerned that, to make up for the ambiguities in the current good practice guidance documents, it is imperative that shared practice is available to every NHS hospital. She felt that

> *"....All infection prevention team seems to work different ways across the country, so, I don't know whether there is more to learn from other hospitals."*

Her suggestion was that

> *"...We should be talking about hospital country wide, so where their is hospital that hasn't got infection, what are they doing differently, there is no national collaboration, there is nothing like this is the best cleaning product to use, this is this, and this is that. I think they just need to be more guidance at all levels."*

FM3 is clearly frustrated about practices that she has observed to be embedded in the NHS in her many years of service, and feels she knows the root cause:

> *"...To be honest, i think its more of the higher up."*

She also feels other things are not equally shared:

> *"...We are just looking at a machine now such as the AUV, some hospitals have had it for ages, and we are just getting it now".*

SFM1 seems to share these feelings. He decries the poor level of collaboration among infection control stakeholders as prevailing practice within the NHS:

> *"...Because we need to have that liaison relationship, it tends to be poor practice which is the NHS as a thing".*

The opinions expressed by FM3 and SFM1 offer a different perspective on the argument that hospital departmental structure supports collaborative practice among stakeholders in the control of exogenous HCAIs.

Communication

Regular communication aimed at sharing good practice information in the control of exogenous HCAIs is something that the interviewees perceived could be better promoted by hospital departmental structure. Notwithstanding what was reported in this practice is seen as a luxury. According to SFM1,

> *"...The DIPC will obviously feed information into the infection control team, and the infection control team then will come to me to either say there is infection control training - we are quite lucky here."*

He also stated that the structure of the department allows for the continuous presence of cleaning staff round the clock, as a consequence of which he is allowed to manage a specialist cleaning team in addition to the regular cleaning team:

> *"...I have my own environment cleanliness team which runs from 9 in the morning to 9 at night; they would deal with any cleaning to do with HCAI",*

He added that these specialist cleaners team are continually trained to keep them abreast of new cleaning techniques:

> *"...We have a team that we train-up on a need to know basis. As soon as anything changes, we get them in and train them up".*

This analysis of the findings on how hospital departmental structure facilitates the creation of good practice knowledge in the control of exogenous HCAIs makes it clear that there are disparate opinions among hospital facilities managers on the extent to which this is actually achieved.

The next question looks at the prevailing technology adopted to disseminate good practice knowledge in the control of exogenous HCAIs among stakeholders.

6.7.3. Technologies used for storing and sharing good practice knowledge in the control of exogenous HCAIs

As in any organisation, good practice knowledge resides in multiple repositories and is distributed asymmetrically in hospital settings. According to Jasimuddin (2005), knowledge has to be integrated through a knowledge transfer process and stored in knowledge repositories for future use, as the transfer and storage of knowledge are crucial for its successful application. Findings from the face-to-face interviews showed that good practice knowledge is stored and shared in NHS hospitals using emails, shared drives and a system called E-Cart (Figure 6.8).

Figure 6.8:   Technologies used for storing and sharing good practice knowledge

The interviewees unanimously confirmed that the hospital good practice knowledge guidance documents are stored in a central repository often referred to as a "shared drive", as well as being shared in emails. According to FM3,

> *"....It always tends to be IT base…Generally, all the information we have are on the share drive, and we also use emails".*

This was confirmed by HFM3:

> *"...in terms of sharing we have drives…once we have policies, then the whole trust can access it through the intranet".*

SFM1 provided an overview of the activities involved in the storing and sharing of good practice knowledge on the shared drive in the control of exogenous HCAIs in facilities management cleaning services:

> *"...we use IPAD to do audit, this are then downloaded onto share point and share with divisions to see how their cleanliness is doing."*

He also described follow-up actions:

> *"...If it is the nursing duties that we are failing on, we go to the nursing part of it; If it is facilities then we get in touch with facilities side and report back to HICC - Hospital Infection Control Committee".*

Similar to the shared drive is another system called E-Cat. This is also used to store and share good practice knowledge in the control of exogenous HCAIs. DSM1 described one of the ways it can be used:

> *"...We use a system for monitoring called E-CAT, once an audit has been done we automatically get informed electronically".*

This question has identified the technological systems used to store and share good practice knowledge in facilities management cleaning services for the control of exogenous HCAIs. The next question seeks to ascertain how far all stakeholders understand how this is to be used.

6.7.4. Levels of employees' knowledge of the technological system used for storing and sharing good practice knowledge resources in the control of exogenous HCAIs in FM cleaning services

The findings from the interviews showed that each hospital has its own approach to making sure that their staff are conversant with knowledge storage and sharing mechanisms. These approaches include regular stakeholders meetings and periodic reviews of staff competence and training. According to FM1,

> *"...I think it's just down to each relevant manager…, but within the management team, we have shared access to relevant information, and all of that is either shared through the monthly team brief or presentations at ward level".*

In FM1's hospital, observations and assessment of cleaners take place on a regular basis:

> *"...The cleaners are assessed on a regular basis, and their cleaning supervisors will do observations".*

He also noted that

> *"...Every member of staff has their cleaning methods which they are trained, and if they are concern by their supervisor they are assisted back in training".*

Supervision of cleaning staff involves the supervisor facilitating the cleaning and at the same communicating expected good practice standards to staff members to ensure that they have a full understanding of the standards required. This "hands-on" approach could be seen as the sharing of tacit knowledge, and has elements of both communication and practical training. Staffs are also made aware of the possibility of further "spot-checks" by the matron or the Director of Infection Control to make sure that standards are not compromised. According to FM4,

> *"...At the time the monitoring is taking place, the supervisor communicate with the domestic staffs to say this is what i am doing, and the domestic staffs will understand that their work is been checked by the matron and the director of infection control."*

The practices described here by the interviewees could be summarised as a form of training by either tacit or explicit means. The training includes both face-to-face and e-learning methods, and these are followed up with refresher training. This sort of training often goes beyond the initial induction, which is mandatory for new employees (Davies, 2010). FM3 confirmed this, reporting that

> *"...As part of the induction training, all staffs are pointed and shown through local induction good practices locations".*

Similarly, FM5 said that

> *"...We have Mandatory training; we have hand washing, which is one of the player when it comes to infection control every 12- month".*

SFM1 also stated that

> *"...We have e-learning when you come in, there are mandatory e-learnings that you have to go through...Apart from the e-learning, we dosed-it down to practical learning".*

He added that

> *"...We come back to the staff after 3-months to ensure that what is learned is actually put into practice, else if there is a need for refresher training will be carried out".*

DSM1 mentioned the computer-based training used in the NHS, and especially e-learning:

> *"…In terms of technology, it is on a computer when the infection control trainer goes and does the training; she has the computer screen…."*

Yet she had doubts about its effectiveness:

> *"…But to be honest, for our staffs, I think it is more visual; I don't think just them seating and doing E-learning for our staffs is particularly helpful…".*

She went on to say

> *"…To be honest, our domestic staffs would just come along to training that is just put on, and we wouldn't be expecting them to access anything technical really, we obviously.."*

She felt that e-learning does not sit well with domestic staff, as most of them are not computer literate. She felt that face-to-face training was more appropriate, as trainees would have the opportunity to ask questions and get answers:

> *"…A lot of our people haven't got computer skills, first language isn't English, I thinks the way we do it is still the better way, a face to face classroom delivery and then people can ask question, somebody can say, can you clarify something, and can say oh no you shouldn't be doing it that way really".*

Her opinion was supported by HFM1, who acknowledged that

> *"…Not all cleaning staffs have got computer and are IT literate, so we tend to print a hard copy".*

This view was further echoed by FM3, who pointed out that

> *"…we do e-learning, but we tend to focus more on the face to face training as most of our cleaning staff have IT issues."*

The findings discussed here have made it possible to identify the prevailing hospital knowledge infrastructure capabilities in support of knowledge management processes in facilities management cleaning services for the control of exogenous HCAIs. The next section will look at how hospital facilities managers play a key role in hospital knowledge infrastructure capabilities in the creation of good practice knowledge from existing knowledge in the control of exogenous HCAIs.

6.7.5. Processes for the creation of new knowledge from existing guidance documents in FM cleaning services in the control of exogenous HCAIs

This research aims to develop an effective good practice knowledge management framework that will assist hospital facilities managers in the control of exogenous HCAIs. This will be achieved by examining current knowledge management processes and available good practice guidance documents in relation to the hospital knowledge infrastructure consisting of the prevailing culture, structure and technological capabilities.

Findings from the face-to-face interviews show no correlations among the views expressed by the interviewees on the processes used for the creation of new knowledge from existing guidance documents in the control of exogenous HCAIs. Interviewee HFM2 was of the opinion that reviewing the processes used is something of a challenge to his hospital. According to him,

> *"…That is a bit that we are not so good at, that bit around*
> *learning and evaluating of our processes".*

Disappointing as this view might seem, it bears out the concerns raised in the literature, which is also part of the justification for this research. May & Pitt (2012) and May (2013) raise concerns about the lack of either a formal review by the Department of Health or of local empirical studies to assess the effectiveness of cleaning and infection control guidance since the publication of the NHS Plan by the Department of Health in 2000 (Department of Health, 2000).

On the other hand, FM1 stated that in his hospital the annual visits are followed up by directly replicating the inspection to monitor how far targets are being achieved:

> *"…Well, like with PLACE, what we do, obviously when we*
> *have a PLACE visit, and we are doing an action plan,*
> *what we have done is to do some mini PLACE so that we*
> *go out in between time and do more monitoring".*

6.8. Chapter summary

This chapter represents the completion achievement of the second phase of the adopted research sequential explanatory mixed methodology research strategy set out above (detailed in Section 4.5. According to Creswell (2014), the sequential explanatory mixed method approach is a research process in which the researcher collects quantitative data in the first phase, analyses the results, and then uses them to plan the second, qualitative, phase. Findings

from the second phase are used to either validate or invalidate the findings from the first phase (Creswell & Plano Clark, 2008; Creswell, 2014). The findings from the first phase were presented in Chapter 5. The presentation of the interview findings in this chapter follows the same structure as that of the questionnaire survey (see Appendix C). The findings generated from this phase (chapter) revealed that there is heterogeneity in the approaches used in facilities management cleaning service delivery in NHS hospitals for the control of exogenous HCAIs. The findings also support the concerns raised about the lack of a review of the good practice guidance documents used in the control of infections in NHS hospitals since the publication of the NHS Plan (Department of Health, 2000). They also highlight the importance of having an effective good practice knowledge management framework in facilities management cleaning services for the control of exogenous HCAIs.

The findings presented in this chapter will be used in the discussion of the interface between the three research data collection instruments as detailed in Figure 4.14, i.e. the review of the literature, the questionnaire survey and the interviews, to achieve the research aim and objectives.

Chapter 7.   **DISCUSSION OF FINDINGS**

7.1. **Introduction**

This chapter presents further analysis and discussion based on a synthesis of the findings from the literature reviewed, the questionnaire survey and the face-to-face interviews (Chapters 2, 5 and 6 respectively). The discussion and presentation of data in this chapter will follow the same structure as the research questionnaire and the interview guide presented. This chapter thus contains:

- ➢ Section 1 -   General information
- ➢ Section 2 -   Infection control good practice guidance documents
- ➢ Section 3 -   Facilities management procurement strategy
- ➢ Section 4 -   Knowledge management processes and infrastructure capabilities
- ➢ Section 5 -   Collaborative practice within the Infection Control Team

The discussion within each section will be related to the relevant research question to demonstrate how the targeted research objective was achieved. Table 7.10 presents the interface between each section, the relevant research question and research objective, and where the objective was achieved in the thesis.

It should be noted that many of the key points arising from the analysis, interfaced with the findings from the literature reviewed presented in Chapter 2, have already been covered within the body of the analysis of the findings presented in Chapters 5 and 6 respectively. Creswell (2014) suggests that it is usual to discuss the findings of the data analysis together with the results, and for this reason, and due to word constraints, the discussion in this chapter includes references to relevant sections, tables and figures in other chapters of this thesis.

The discussion is influenced by the abductive sequential mixed research approach adopted (see 4.3.4. and 4.3.5). This method incorporates the use of quantitative and qualitative methods in a sequential manner for the in-depth exploration and explanation of the phenoma under investigation (see Section 4.4.7.3).

Table 7.1: The section, the research question, the research objective interface

Section	Research Question	Research Objective	Achievement of Research Objective
1. **General Information**	2. Facilities management procurement strategy		
2. **Infection control good practice guidance documents used**	1. What policies, guidance documents or strategies are used for monitoring compliance with good practice knowledge in facilities management cleaning services for the control of exogenous HCAIs in hospitals?	1. To identify and evaluate the policies, guidance documents and strategies used in facilities management cleaning service delivery for the control of exogenous HCAIs, identifying the advantages and disadvantages	Section 2.6, 6.5
3. **Facilities management procurement strategy**	2. What is the level of the procurement strategy used in the control of exogenous healthcare-associated infections?	2- To identify the prevailing procurement strategies in the delivery of hospital cleaning services and their interface with effective knowledge management protocols for the control of exogenous HCAIs in hospitals	Section 5.5, 6.6
4. **Knowledge management process and infrastructure capabilities**	3. What is the nature of the working relationship between the facilities management team (non-clinicians) and the clinicians in the control of exogenous HCAIs?	3- To critically evaluate the role of the facilities manager within the infection control team in the control of exogenous HCAIs	Section 2.4, 2.6, 2.8,5.8 and 5.9
5- **Collaborative practice within the Infection Control Team**	4. What are the knowledge management processes adopted for the control of exogenous HCAIs?	4 To critically investigate the factors that inhibit effective knowledge management processes in hospital facilities cleaning services within the hospital structure, prevailing culture and technological capabilities	Section 5.5 to 5.6, and 6.5 to 6.7
	5- What are the benefits of having a good knowledge management framework for the control of exogenous HCAIs in facilities management cleaning services?	5- To develop and validate an effective knowledge management framework for the control of exogenous healthcare-associated infections (HCAIs) in facilities management cleaning services	Section 8.1

Finally, the key findings from the questionnaire survey, the face-to-face interviews and the literature review are used to further refine the conceptual framework developed further to the literature reviewed and presented in Section 3.3 in Chapter 3.

7.2. Section 1: General information - discussion

Contemporary healthcare delivery is increasingly seeking to implement evidenced-based practice across disciplines, forcing healthcare professionals to demonstrate the effectiveness of their interventions in terms of cost savings to the system and benefits to the patient (Andrew & Halcombe, 2009). Among other considerations, this is influenced by rapid social change, emerging technologies, the pressures of contemporary living styles, an aging population, the increasing costs of healthcare delivery and the increasing incidence of complex chronic diseases (Andrew & Halcombe, 2009; Weston, 2008; Department of Health, 2000). It is acknowledged that these increasing demands have impacted the delivery of healthcare services and created an urgent need for a review of the role of both clinician and non-clinician service delivery models to promote safe practice interventions in order to achieve the objectives set (Andrew & Halcombe, 2009; Gould, Drey, Millar, Wilks & Chamney, 2009).

The NHS has one of the largest property portfolios in Europe, with 15,782 hospitals and other facilities valued at almost £40 billion (Department of Health, 2013c). These facilities range from large acute hospitals to small community clinics, ambulatory care units and buildings that house administrative and administrative support workers across England. It is also recognised that 25% of the NHS annual budget, excluding capital and finance charges, equating to £7.4 billion, is spent on its estate and facilities maintenance. This has made its expenditure on estate and facilities management its third largest cost after staff and drug costs (Department of Health, 2013c). With such a large property portfolio, there is a need for an adequate cleaning regime to curtail risks of the spread of exogenous healthcare-associated infections.

> *"...hospitals provide a reservoir for microorganisms, many of which are resistant to antibiotics"* (Dancer, 2011).

Contemporary evidence from across the literature and from empirical research demonstrates that improved cleaning outcomes can reduce the spread of HCAIs among patients (Health Estate, 2015). There is thus a rapidly growing recognition that the contribution of the healthcare environment to the prevalence of exogenous HCAIs now presents an overwhelming challenge to healthcare facilities managers (NHS England, 2013a; Gillespie et al., 2013; Dancer, 1999, 2009, 2011; Davies, 2010; Controller and Auditor General, 2009; Department of Health, 2003, 2004a; Ayliffe et al., 1999). This challenge is further exacerbated by the plethora of good practice policy guidelines available to hospital facilities managers in a sector in which knowledge management is 'fragmented across organisational and professional boundaries' (Muir Gray & de Lusignan, 1999).

Cleaning the hospital environment is generally acknowledged to be a core operational function of the facilities management discipline (NHS, 2012; 2009; Dancer, 2011). Alexander (2007) singled out facilities management as the discipline that brings together estate and hotel services into one integrated process in support of the core service functions of an organisation. These services include cleaning, catering, laundry, car parking and security, and are often grouped together as integrated FM services, "soft FM" or "supply services" delivered to various NHS hospital sites (Alexander, 2007). As a dominant non-clinical service provider to the NHS, it has been emphasised that facilities management needs to reassess and critically analyse new knowledge, and where appropriate to incorporate the findings into clinical decision-making to improve the patient experience and reduce the prevalence of exogenous HCAIs (Andrew & Halcomb, 2009; Dancer, 1999).

Further to the publication of the NHS Plan, which dedicated a whole chapter (Chapter 4) to the facilities management service function including its responsibilities for the healthcare environment, the discipline of facilities management within healthcare has been brought into the limelight. As a consequence, it is now acknowledged that, for the effective management of exogenous HCAIs, it is imperative that healthcare facilities managers should understand the knowledge management systems and their interface with available infection control policies, processes, and procedures (3 Ps). This must be within the context of the hospital knowledge infrastructure capabilities in order to facilitate a targeted and sustainable reduction in the prevalence of exogenous HCAIs. It could be argued that this will require hospital facilities managers to use existing good practice knowledge management processes (knowledge creation, storage, sharing and usage) so that they recognise the value of new data, assimilate

the information and apply it to create new knowledge within the hospital knowledge infrastructure capabilities (prevailing culture, structure and technological capabilities).

According to Gold et al. (2001), the more frequently an organization carries out the steps involved in knowledge management processes, the more routine the norms and the efficient integration of the processes will be. Ghosh & Scott (2006) argue that "the effectiveness of knowledge management systems in healthcare delivery as measured by its impact on both organisational level, and patient care benefits are dependent on the levels of knowledge management infrastructure capabilities. Similarly, because of the relevance of knowledge management to quality healthcare delivery outcomes, Orzano et al. (2008) claim that the critical knowledge management processes (finding, sharing and developing knowledge) lead to better decision-making and organization learning, which in turn lead to better organisation performance in terms of quality, satisfaction and productivity. (Gold et al., 2001) argue that knowledge infrastructure capabilities consisting of technology, structure and culture along with the knowledge process architecture of acquisition, conversion, application and protection are essential organizational capabilities or "preconditions" for effective knowledge management.

While the literature highlights the importance of knowledge management processes and knowledge infrastructure capabilities for achieving set objectives, this research has shown that there is no clear alignment of the knowledge infrastructure capabilities to enable organizations to adapt processes to fit their its prevailing influencing capabilities and achieve their objectives.

The aim of this research is to critically investigate the interface between the knowledge management process and hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management service delivery practices in NHS hospitals. Five research questions (see section 1.7.2) were generated as a guide to achieving the research aim and objectives set out in Figure 1.7 from the data collection instruments, which comprise the literature review, the questionnaire survey and face-to-face interviews.

Sections 5.3 and 6.4 present an overview of the survey and interview respondents and of their organisations. The purpose of this is to provide readers with background information about the population from which the researcher collected information to achieve the research aim and objectives.

7.3. Section 2: Infection control good practice guidance documents/tools used

Further to the concerns about a perceived decline in the standards of hospital cleanliness raised by the Infection Control Nurses Association and the Association of Domestic Managers, the government launched several initiatives in addition to existing regulations to improve standards of hospital cleanliness (Griffiths, Renz, Hughes & Rafferty, 2009; Pratt et al., 2007). These initiatives include a combination of guidelines and policies to be implemented by healthcare professionals to minimise the risk of infections spreading in healthcare facilities (Ikram & Satti, 2009; Department of Health, 2004). An obvious criticism of the documents relating to environmental cleanliness and published after the NHS plan is the lack of a review of the documents effectiveness (May 2013).

The great number of policies, guidance and strategies, together with the prevalence of antibiotic-resistant infection-causing microorganisms (superbugs) and an increased media focus on HCAIs reinforces the idea that infection control in healthcare settings requires a multifaceted approach. One major gap in the published literature relating to NHS hospital cleanliness over the years has been the lack of a focus on the assessment of anticipated outcomes in the context of hospital knowledge infrastructure capabilities, which consist of the prevailing culture, structure and technological capabilities. It could be argued that a shift in the paradigm towards a consideration of the way in which the hospital knowledge infrastructure capabilities influence the knowledge management processes developed from available guidance documents will go a long way to reducing the incidence of exogenous HCAIs in hospitals. Within the incumbent of facilities management cleaning services delivery practice in NHS hospitals, there is a paucity of literature in this regard (Abidi, 2008; Ghosh & Scott, 2006; Gould et al., 2009).

While there is an acknowledgment that the cleaning service function is part of the services rendered by the facilities management discipline to NHS hospitals, it is recognised that there is little literature dealing with environmental cleanliness and healthcare-associated infections in facilities management journals. A growing number of articles on this topic are appearing in

clinical journals. This lack undermines government publications, including The "Matron's Charter", whose main focus is facilities management services delivered to the NHS (Department of Health, 2004a). It could also be argued to undermine the NHS Plan, which dedicated a whole chapter to emphasising the importance of facilities management's core service provision (cleaning, environmental and catering services) to the NHS.

Further to the extensive literature review (see Table 2.4), the work of May (2013), May & Pitt (2012) and May & Smith (2003) could be seen as a set of comprehensive studies which have focused on the core cleaning service function of the facilities management discipline in the NHS in the late 20th and the early 21st centuries. These studies provide a chronology of the Department of Health policies and guidance documents relating to cleaning standards which have appeared since the publication of the NHS Plan, including a consideration of the thinking which has influenced the revision of these documents. The core of this work is an analysis of the role of the ward housekeeper, whose main role could be seen as that of an anchor person, a bridge between clinicians and non-clinicians including visitors and other stakeholders in the ward. The pivotal role of the ward housekeeper could be seen as designed to ensure the effective service delivery outcomes in hospitals set out in the agenda in the Matron's Charter. The 10 points of this agenda are:

➢ Keeping the NHS clean is everybody's responsibility

➢ The patient environment will be well-maintained, clean and safe

➢ Matrons will establish a cleanliness culture across their units

➢ Cleaning staff will be recognised for the important work they do. Matrons will make sure they feel part of the ward team

➢ Specific roles and responsibilities for cleaning will be clear

➢ Cleaning routines will be clear, agreed and well published

➢ Patients will have a part to play in monitoring and reporting on standards of cleanliness

➢ All staff working in healthcare will receive education in infection control

➢ Nurses and infection control teams will be involved in drawing up cleaning contracts, and Matrons have authority and power to withhold payment

➢ Sufficient resources will be dedicated to keeping hospitals clean.

Other studies by Alexander (2007), Liyanage (2006) and Liyanage & Egbu (2006, 2004, 2005) focus on the service functions of FM practice in general and their interface with the

control of exogenous HCAIs in the NHS. The work of Macdonald, Price & Askham (2009) deals with one of the policy documents (PEAT) which were published in the wake of the NHS plan. These works attempt to find out why some trusts seem to have achieved significant and sustained quality in their environment during one of the government initiatives to improve hospital environmental cleanliness while others failed. The study focused on attitudes, behaviour, opinions and perceptions, which could not be generalised. The gap which can be identified in this and other studies is their lack of focus on the factors that could facilitate the achievement of hospital environmental cleanliness targets as set out in guidance documents (May, 2013; May & Pitt, 2012).

The aim of this research is to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections through facilities management cleaning service delivery practices in NHS hospitals. Its outcome could be viewed as a driver of the 10-point commitment in the Matron's Charter, using the relevant guidance documents.

Further to the information gathered from the review of the literature, the following guidance documents were identified as being used to monitor compliance with good practice in the control of HCAIs in facilities management cleaning service delivery practice in NHS hospitals:

- ➢ Infection Control Team bespoke guidance documents
- ➢ The national specification for Cleanliness in the NHS: A framework for setting and measuring performance outcomes
- ➢ Patient Led Assessments of the Care Environment (PLACE)
- ➢ NHS Premises Assurance Model (NHS PAM)
- ➢ A combination of an ICT guidance document and PLACE
- ➢ Facilities management bespoke audit tools for cleaners (checklist and tick box)
- ➢ Others

The discussion of these guidance documents is presented in the context of the questionnaire findings (presented in Section 5.5.1 to 5.5.5).

7.3.1. **Synthesis and discussion of findings:**

It may be recalled from Table 5.2 that the three main good practice guidance documents used in the delivery of hospital cleaning services were those which had been adapted from core

guidance documents, including the National Specification for Cleanliness and PLACE. These bespoke documents had a Relative Importance Index of 0.779, while the two latter documents had a joint ranking of 0.727 (Table 5.2).

The first phase of this research also investigated the findings from the ranking of how effectively, in terms of their adaptability, understandability and usability, these guidance documents might enhance or inhibit effective knowledge management processes within the hospital knowledge infrastructure capabilities. It was concluded that individual ward/unit inspections, the use of electronic tools and the checklist (tick box) were considered the most effective, with Relative Importance Index scores of 0.878, 0.748 and 0.704 respectively (see Table 5.3).

The frequency with which the effectiveness of these guidance tools was reviewed and monitored in order to ascertained their efficacy was also investigated. It was shown that this was often done on a monthly, weekly or daily basis, with percentages of 55, 25 and 15 respectively (see Figure 5.4).

The factors which influence the monitoring of compliance with the adopted good practice guidance documents in the delivery of hospital cleaning services in the control of exogenous HCAIs were also investigated. The findings showed that patient health and safety, better service delivery and meeting NHS targets were seen as the most important considerations; with Relative Importance Index scores of 0.925, 0.889 and 0.887 respectively (see Table 5.4).

Within the context of these findings, objective 2 of the research was partially achieved.

The second phase of the data collection aimed to ascertain the rationale for choosing a particular good practice guidance document from the many documents available to facilities managers in order to fully achieve objective 2 of the research.

Results from the face-to-face interviews with 10 hospital facilities managers indicated that all NHS hospitals in England have a form of compliance with good practice guidance document for the delivery of hospital cleaning services, which may be adapted from the core documents produced by the Department of Health. This overwhelming result corroborates the findings from the questionnaire survey, where 35 of the 85 participants reported that they had developed a bespoke version of their guidance document from other core guidance documents (see Figure 5.3).

Findings from the face-to-face interviews also showed that the core good practice documents most often used by hospital facilities managers in the delivery of cleaning services for the control of exogenous HCAIs are "NHS National Specification for Cleanliness" and "Patient-led Assessment of the Care Environment" (PLACE).

Findings from literature showed that these guidance documents incorporated recommendations and findings from previous good practice guidance documents, including The NHS Plan, Winning ways, The Matron Charter, PEAT (Department of Health, 2000, 2002, 2004a, 2004b; National Patient Safety Agency, 2007; National Health Service England, 2012; NHS England, 2013a)

7.3.2. Summary and key issues discussed

Findings from the three data collection instruments used in this research including the literature review, the questionnaire survey and the face-to-face interviews showed that all the good practice guidance documents used in the delivery of facilities management cleaning services for the control of exogenous HCAIs are covered in this research. It is important to mention that this assertion reflects the perceptions of NHS hospitals facilities managers in England. This is further evidence of the rigour and validity of this research.

Findings from across the research data collection instruments show that hospitals often prefer to use their own bespoke good practice guidance document in the first instance (see Table 5.2). One of the reasons for developing bespoke guidance documents is for auditing current practices to ensure that statutory KPIs against which the annual inspection from the regulatory authority is benchmarked are met (see Section 6.5.2.1). The discussion with the hospital facilities managers during the face-to-face interviews showed that bespoke guidance documents came top of the 'other' guidance documents. One of the key reasons given for this is that they are used for auditing ongoing practices (see Section 6.5.2.1).

Table 7.2:   Summary and key issues in the use of good practice guidance documents

Major themes	Sub-themes	No. of respondent	references	%of respondents	%of references	Percentage cummulative of major themes
Bespoke Guidance document	Auditing	2	4	20	12	12.12
CQC	Mandatory	1	1	10	3	3
The National Specification for Cleanliness	Ease of understanding	1	1	10	3	12
	Mandatory	1	1	10	3	
	Set minimum standards	2	2	20	6	
Patient Led Assesment of the Care Environment (PLACE)	Mandatory	10	11	100	33	73
	Patient Perspective	8	10	80	30	
	Unbias report	2	3	20	9	

A macro-analysis of the emerging sub-themes in the core good practice guidance documents showed that Patient Led Assessment of the Care Environment (PLACE), with its focus on patients' views and their interface with quality healthcare delivery, was ranked top with a total reference percentage of 30%. It was felt that the national specification for cleanliness set a minimum standard to be met, and that it was easy to understand. These indicators have total percentage references of 20% and 10% respectively (Table 7.2).

However, it could be argued that these indicators are already part of the KPIs to be met according to the statutory requirements. As important as the KPIs in these core documents might be in the delivery of quality healthcare, it has been pointed out that they are not encompassed in one document. Therefore, a bespoke good practice guidance document could be valuable as providing comprehensive guidance for judging performance and compliance with standards in line with the KPIs contained in the core documents to enable the delivery of care that meets NHS constitutional objectives. The literature also emphasises the importance of bespoke guidance documents for auditing. According to Day & Klein (2004), they are a tool for inspecting and recommending special measures where failing standards are identified, as well as for:

➢ Carrying out reviews and investigating the provision of healthcare and arrangements for promoting and protecting public health. This includes studies aimed at improving economy, efficiency and effectiveness in the NHS

➢ Reviewing the quality of data relating to health and healthcare delivery, including published surveys of the views of patients and staff.

Section 5.5.5. and Table 5.4 present considerations for monitoring compliance with good practice guidance in hospital cleaning services that necessitate the need for the creation, storing, sharing and usage of good practice knowledge within the prevailing hospital culture, structure and technological capabilities as identified by hospital facilities managers and which are suggested in the literature. These considerations, in order or priority, include:

➢ Patient health and safety

➢ Better service delivery

➢ Meeting NHS targets

➢ Concerns about being labelled a failed hospital

➢ Checking the effectiveness of guidance on compliance with good practice.

All these considerations are concerns for which the core good practice guidance documents such as PLACE and the National Specification for Cleanliness include a KPI for measuring the hospitals' strategies during their annual inspections (Care Quality Commission, 2015; NHS England, 2013a). Table 7.3 presents the fundamentals to be achieved in terms of an effective knowledge management process in relation to the good practice guidance documents used within the hospital knowledge infrastructure capabilities in the control of exogenous healthcare-associated infections in facilities management cleaning service delivery in NHS hospitals.

Table 7.3:   Fundamentals for an effective knowledge management process in the control of exogenous HCAIs in good practice guidance documents

		Hospital knowledge management process			
		Knowledge creation	**Knowledge storing**	**Knowledge sharing**	**Knowledge usage**
Hospital. knowledge infrastructure capabilities	Hospital culture	continuous good practice initiatives/creation	✓	continuous sharing of good practice knowledge	✓
	Hospital structure	continuous review of good practice KPIs	✓	✓	routine monitoring and supervision
	Hospital technology	✓	✓	✓	✓

A summary of the findings from this section shows that the prevailing hospital culture, structure and technological capabilities support the storing of good practice knowledge in the guidance adopted or adapted in facilities management cleaning services for the control of exogenous HCAIs in NHS hospitals in England. It also shows that:

➢ The prevailing culture supports the usage of good practice knowledge

➢ The hospital departmental structure supports the sharing of good practice knowledge

➢ The hospital has available technological capabilities for the creation, sharing and usage of good practice knowledge.

However, there is a lack of adequate routine monitoring of the usage of this good practice knowledge by hospital departments. Despite the technological capabilities available for the creation, storing, sharing and usage of good practice knowledge in the control of exogenous HCAIs in facilities management cleaning services, the findings show that hospitals lack a culture of creating and sharing the requisite good practice knowledge (Table 7.3). There is a lack of constant reviews and routine monitoring to ensure compliance with the use of the acquired knowledge as required in the core guidance by the hospital department. As a consequence, hospitals in England have developed bespoke auditing guidance tools which often mirror the KPIs in the core documents such as PLACE, and which they often refer to as "mini-PLACE."

The key findings from this section presented in Table 7.3 will be used to refine the conceptual framework developed in this research further to the literature review presented in Figure 3.1.

7.4. **Section 3: Facilities management procurement strategy**

Based on research question 2 (see Section 1.7.2), this section discusses the findings from the literature review, the questionnaire survey and the face-to-face interviews, which seek to identify the type of facilities management cleaning contract prevalent in NHS hospitals in England. These findings will enable the researcher to ascertain how such contracts for the delivery of facilities management cleaning services promote or inhibit effective knowledge management in the control of exogenous HCAIs to achieve objective 2 and the overall aim of the research. The findings are discussed in the context of knowledge management processes and hospital knowledge infrastructure capabilities in relation to the prevalence of exogenous HCAIs. For ease of analysis and clarity, the discussion will be structured according to the

Relative Importance Index (RII) rankings of the factors identified from the questionnaire survey (see Section 4.8.2.2). This will be related to the number of references made to the latent themes derived from the semantic themes in the face-to-face interviews.

7.4.1. Reasons for adopting a particular procurement strategy in facilities management cleaning services in hospitals

Findings from the investigation of the facilities management cleaning service contracts used across NHS hospitals in the first phase of the data collection (questionnaire survey) show that thirty-three (33) of the eighty-five (85) respondents, representing 39% of the total, carried out hospital cleaning using directly employed in-house staff (Table 5.5). The findings also show that only six (6) of the respondents outsourced their hospital cleaning services to external FM service providers via the Public Finance Initiative (PFI) procurement route. Forty-six (46) of the respondents reported that they used both directly employed in-house staff and external cleaning service providers for cleaning services. It could thus be inferred that the questionnaire survey reveals heterogeneity in the procurement strategies used for facilities management cleaning services in NHS hospitals in England (Table 5.5). These strategies include both the use of directly employed staff (in-house) and the engagement of external service providers (outsourcing) (The Centre for Health and the Public Interest, 2015; Davies, 2010; King, 2004).

Findings from the qualitative face-to-face interviews show that, of the ten (10) hospital facilities managers interviewed, seven reported that they used directly employed (in-house) staff for the delivery of cleaning services, while three outsourced their cleaning services to external service providers (Figure 6.1 and 5.3). This represents 70% and 30% respectively.

7.4.1.1. Synthesis and discussion of findings

Results from the qualitative face-to-face interviews with hospital facilities managers using semi-structured interviews indicated that budget control from a cost control perspective came first in the ranking of the factors that informed the choice between the provision of hospital cleaning services using either directly employed in-house staff or an external cleaning service contractor (Figure 6.2). This factor has been used as an excuse in the history of the NHS cost-cutting drive to ensure quality healthcare service delivery in order to achieve government objectives. It should be recalled that when competitive tendering for hospital cleaning services

was introduced by the Conservative government in 1983, the argument centred on cost control (Conservative Party, 1983; Department of Health and Social Security, 1983):

> *To release more money for looking after patient, we will reduce the costs of administering the Health Service. We are asking health authorities to make the maximum possible savings by putting services like laundry, catering and hospital cleaning out to competitive tender* (Conservative Party, 1983).

According to the report produced by the Centre for Health and the Public Interest (2015), the NHS now contracts out the provision of health services to the private sector to the tune of over £20 billion a year, or a fifth of the total healthcare budget. Prior to the introduction of competitive tendering for hospital cleaning services by the Conservative government in 1983, not many NHS hospitals used contract cleaners. Only 2% of the expenditure on NHS hospital cleaning services in England went to contractors in each financial year (Davies, 2005; Wright & Milne, 2004).

Findings from the face-to-face interviews show that, in the 33 years (1983 -2016) since the idea of cost control was used as the reason for advocating the outsourcing of hospital cleaning services, it can be claimed that the stated objective has not been met. Rather, the findings overall suggest that the aim of controlling the costs of hospital cleaning may often be best achieved by engaging directly employed in-house staff in the provision of hospital cleaning services. This came top among the factors taken into account in the choice of in-house cleaning staff. Nonetheless, the results of the questionnaire survey shows that 46 respondents, representing 54% of the 85 surveyed, use a combination of in-house and outsourcing strategies for cleaning services (see Table 5.5).

Table 7.4:   Reasons for the adopted cleaning service contract

Type of contract	Semantic (major) themes	Latent Themes	No. of respondents	No.of References	%of Respondents	%of References	Percentage cummulative of semantic themes
In-house	Budget Control	Cost control	5	6	50	15.00	15.00
	Staff training compliance	monitoring staff training	4	4	40	10.00	10.00
	Increase Productivity	Better collaborative way of working (Feel part of the hospital team)	7	10	70	25.00	67.50
		Control of new ways of working & scope to develop services	7	8	70	20.00	
		Staff understand the hospital process	5	5	50	12.50	
		Flexibility to response to various needs	4	4	40	10.00	
Outsourcing	New skills	Incoming knowledge transfer	2	2	20	5.00	7.50
		Contract management only	1	1	10	2.50	

Whereas there are obvious pros and cons in the use of both in-housing and outsourcing hospital cleaning services, the use of a specific strategy is dependent on the particular circumstances of the NHS hospital. This explains why the findings show that 46 of the 85 participating hospitals engaged both external cleaning service providers and directly employed cleaning staff.

Having examined the argument from both the perspective of outsourcing and in-housing hospital cleaning services (Table 5.5 and 7.4), one might surmise that most NHS hospitals in England engage directly employed in-house staff for the delivery of cleaning services. However, from the evidence presented in Table 5.5 and 6.1, it is clear that a combination of the two is often the approach adopted, to achieve both economic and social corporate responsibility objectives in the reduction of the prevalence of exogenous HCAIs.

In addition to the literature findings, three theories were used by the researcher to further support this empirical finding from the questionnaire survey and the face-to-face interviews presented in Tables 5.5 and 6.1. Each of these provides a rationale for using either external cleaning contractors or directly employed in-house staff for hospital cleaning services to minimise the prevalence of exogenous HCAIs. These theories are public choice theory, rights theory, and industrial organization theory purported Shleifer, 1998, Donahue, 1989 and Niskanen, 1971.

Public choice theory: This suggests that competition will restrict any "excessive" supply of public services, and thereby cut delivery costs (Niskanen, 1971).

Property right theory: Property right theory argues that private ownership offers stronger incentives for cost reductions (Shleifer, 1998).

Industrial organization theory: industrial organization theory maintains that private contractors will be more likely to take advantage of economies of scale (Donahue,1989).
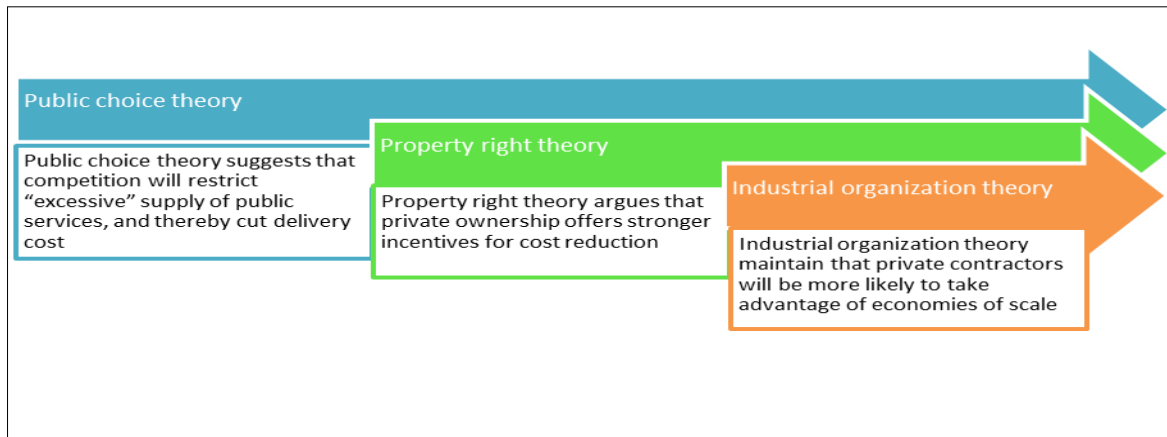
Figure 7.1:   Possible theoretical bases for using in-house staff for hospital cleaning services (adapted from Donahue, 1989; Niskanen, 1971; Shleifer, 1998)

7.4.2. **Property right theory**

The public choice theory lends support to the government policy of putting facilities management services such as laundry, catering and hospital cleaning out to competitive tender in order to separate 'core' from 'non-core' functions in NHS hospitals (Conservative Party, 1983). Advocates of the government stance on contracting out such as Domberger & Rimmer (1994) identify a number of advantages of this approach over using directly employed in-house staff. Some of the arguments put forward include:

 ➢ To concentrate on core business
 ➢ The belief that market discipline drives down prices
 ➢ Periodic contract renewals lead to higher motivation and productivity among both managers and workers
 ➢ The use of a private sector provider enhances flexibility, adaptability, responsiveness to change, and the capacity for innovation in service provision.

7.4.3. **Industrial organisation theory**

Industrial organisation theory, on the other hand, echoes the stance of the public sector theory. However, the theory maintains that the private contractors engaged to carry out the services

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will be more likely to take advantage of economies of scale. This literally means that saving costs in the delivery of hospital cleaning services may require standards to be compromised by contractors. It is acknowledged that 'the standard of hospital cleanliness have fallen since the introduction of competitive tendering in 1983, as the contracting out of cleaning have made it difficult for hospital ward managers and matrons to control standards' (Davies, 2005, 2010; Ghosh et al., 2006). This has remained a concern for infection control teams. This concern has led to a clamour for bringing hospital cleaning services in-house. Davies (2010) argues that

> *Patients, staff, the public and the Government know that since the introduction of competitive tendering of cleaning services in 1983, standards in hospital cleaning have fallen* (Davies, 2010)

At the Royal College of Nursing conference held in Bournemouth in 2008, nurses overwhelmingly called for hospital cleaning to be brought back in-house to tackle infection control (British Broadcasting Corporation, 2008). Their argument was that, since the outsourcing of hospital cleaning contracts in the 1980s, there has been an increase in hospital infections, and a decline in hospital cleanliness standards. In addition, it was stated that "private cleaning firms do not have public sector ethos of in-house team, and there was higher staff turnover which contributes to poor performance" (British Broadcasting Corporation, 2008). Nevertheless, the government continued to advocate the outsourcing of hospital cleaning services, while at the same time acknowledging the importance of good quality hospital cleaning in the control of healthcare-associated infections. The government claimed that as part of its policy to tackle healthcare-associated infections, they had "made hospital cleaning one of its highest priorities in the fight against such infections as MRSA and Clostridium difficile" (Department of Health, 2008a). Yet apparently contradicting themselves, they also argued through the Department of Health that "ensuring that hospitals are clean and safe is not as simple as bringing all cleaning services in-house" (Department of Health, 2008b). The nurses cushioned the government stance, arguing that hospital infections had always been a big and pressing issue that was not being helped by contracting hospital-cleaning services out. The issue of poor standards of hospital environmental cleanliness delivered by contractors continues to be a concern to hospital management and infection control teams.

The findings of a report about the concerns raised by an NHS Trust in the northwest of England showed that poor cleaning standards were still an issue at all the hospital sites visited by the Trust Infection Prevention Committee (IPC). This was despite the fact that, on paper, the required scores had been achieved overall by the contractor. (British Institute of Facilities Management, 2016). As a consequence, the IPC team subsequently set up an improvement plan for the contractor. According to the press briefing following the publication of the IPC team improvement measures by the British Institute of Facilities Management (2016), the IPC stated that:

> *"...concerns about overall contract performance and standard on all sites have been formally escalated. The trust expects to see an improvement in performance, and this is being closely monitored on a weekly basis"* (IPC Team, 2016).

The IPC team further said

> *"Monitoring of contractor compliance with training, cleaning chemicals, HR documentation, and records has also been implemented"* (IPC Team, 2016).

In response to the concerns raised by the IPC team vis-a-vis the standard of floor and damp cleaning, the contractor's operations director for health (given the code ODHFM for the purposes of this research) stated that:

> *"....Maintaining the highest standards of cleanliness and infection control in any hospital is critical to performance and our cleaning score"* (ODFM, 2016)

The response of the contractor in this case confirms the fears of the Infection Control Team Nurses Association (ICNA), and these were echoed in the House of Lords Science and Technology Committee report (Department of Health, 1998), which said that "although training requirements may be written into the contract, this is often cut by the contractor because of cost."

This case gives further weight to the idea that contractors may be driven more by 'paper-centric' rather than 'practice-centric' considerations in their work.

It also suggests that the facilities managers interviewed may have good reasons for preferring to use directly employed in-house staff for cleaning.

7.4.4. **Property right theory**

Property right theory argues that private ownership offers stronger incentives for cost reductions. This theory lend more toward the paradigm of the argument proffered in literature (British Broadcasting Corporation, 2008; Davies, 2010). Both literature acknowledged that the provision of hospital cleaning services by hospital directly employ in-house staff enhances effective cleaning regime, and a panacea for achieving required cleaning standard in the control of the prevalence of exogenous HCAIs from the perspective of:

➢ Cost control

➢ Monitoring to ensure cleaning staff training compliance

➢ Increased productivity

➢ Good practice knowledge management and transfer

Property right theory could presumably be seen as anchored in and embodying the aspirations, strengths and weaknesses of both the public choice and the industrial organization theories. In this, it strikes a balance between healthcare professionals' desire that the cleaning regime should meet the required standards for the control of the prevalence of exogenous HCAIs, and the government aim to minimise costs and at the same time optimise quality standards.

7.4.5. **Summary and key issues discussed**

This section has synthesised and discussed findings from the research data collection instruments to achieve research objective 2 and answer research question 2 presented in section 1.7. in Chapter 1. Key factors identified as an impediment to the effective knowledge management process within the hospital knowledge infrastructure capabilities in the procurement strategies used include those listed in Table 7.5. These are additional to those factors that restrict the creation, storing, sharing and usage of good practice knowledge within the prevailing hospital culture, structure and technological capabilities as identified by hospital facilities managers in the face-to-face interviews and discussed in the literature presented in Section 6.6.2.

Table 7.5:   Factors impeding effective knowledge management in FM procurement strategies

Type of contract		Latent Themes	No. of rerspondent	No. of References	%of respondents	%of references	Percentage cummulative of major themes
In-House		Avoid cross management of services	1	1	10	6	**6**
		employment of skillful staffs	2	3	20	17	**17**
		Increase routine monitoring and supervision	4	4	40	22	**22**
		Improve communication	7	7	70	39	**39**
Outsourcing		Getting the Service Level agreement (SLA) right	1	1	10	6	**6**
		Improve communication	1	2	10	11	**11**

Table 7.6 presents the fundamental factors that impede the knowledge management process within the hospital knowledge infrastructure capabilities in the control of exogenous healthcare-associated infections in facilities management cleaning services delivery. The flip side is that these could also be seen as factors which if eliminated could enhance the effective knowledge management process, as indicated in the table.

Table 7.6: Fundamental factors relating to the effective knowledge management process

		Hospital knowledge management process			
		Knowledge creation	**Knowledge storing**	**Knowledge sharing**	**Knowledge usage**
Hospital knowledge Infrastructure capabilities	Hospital culture	Non-employment of skilled staff	✓	Delay in sharing good practice knowledge	✓
	Hospital structure	1.Cross-management of services 2. Not getting the Service Level Agreement (SLA) right	✓	✓	Inadequate routine monitoring and supervision
	Hospital technology	✓	✓	Inadequate communication of good practice knowledge	✓

Findings from this section show that the prevailing hospital culture, structure and technological capabilities support the storage of good practice knowledge in facilities management cleaning services for the control of exogenous HCAIs in NHS hospitals in England. It is also clear that the hospital structure supports the sharing of good practice knowledge. There are some indications that the prevailing culture supports the usage of available good practice knowledge in the control of exogenous HCAIs by the staff, and that there is the technology to support the use of this knowledge. However, there are concerns. To guarantee that this good practice knowledge is actually used in the control of exogenous HCAIs, it was suggested that compliance must be strictly monitored. It could be argued that this is not always happening because of historical cultural factors which still prevail in the NHS. It should be recalled that recommendation "e" of the national audit report on "Reducing Healthcare Associated Infection in Hospitals in England" (National Audit Office, 2009) states that

> *"...While staff are more aware of good infection control practice, and compliance is improving, compliance is still not universal. Given the delay between failure to comply and infection, some staff still do not see a clear link between their actions and healthcare associated infection"*
> (National Audit Office, 2009).

It was also recommended in the report that "while there is a consensus on good practice; in order for these improvements to be sustained, staff need to see compliance as fundamental to safe care."

Key findings from this section presented in Table 7.6 will be used to refine the conceptual knowledge management framework presented in Figure 3.1 in Chapter 3.

The following section discusses and recapitulates results from research question 1 to achieve research objective 1 (see Section 1.7 and Table 7.1). These will be discussed in terms of their adaptability, understandability and usability within the prevailing hospital culture, structure and technological capabilities for effective knowledge management for the control of exogenous HCAIs in facilities management cleaning service delivery.

7.5. Section 4: Knowledge management processes and infrastructure capabilities

7.5.1. Synthesis and discussion of findings on hospital knowledge management processes

The healthcare environment is a complex setting in which a variety of professionals work together to achieve set objectives. Healthcare delivery in the NHS is a complex knowledge-driven process which involves the personal values and social norms of different professional groups with differing rules and job specifications. It is acknowledged that knowledge management processes and knowledge management capabilities provide an opportunity for improving the performance of healthcare professionals engaged in a collaborative process in order to meet set objectives (Nilakanta et al., 2009; Sheffield, 2008). Several factors could inhibit or facilitate effective knowledge management in the control of exogenous healthcare-associated infections in the NHS. Findings from questionnaire survey show that delivering hospital cleaning services by using directly employed staff enhances effective knowledge management in the control of exogenous healthcare-associated infections. Other initiatives identified that could improve effective knowledge management in the control of exogenous healthcare-associated infections presented in Table 5.7 include:

> ➢ Involving facilities managers in the development of bespoke guidance documents for hospital cleaning
> ➢ Enhancing the communication of good practice knowledge
> ➢ Increasing the IT/computer literacy level of cleaning staff

These findings are consistent with the findings from the face-to-face interviews conducted with healthcare facilities managers and with those from the literature presented in Section 6.5 to 6.5.1 keeping cleaning services in-house came top, with a Relative Importance Index of 0.845, ahead of other factors such as the involvement of facilities managers in the development of bespoke cleaning service guidance documents, which came second with a Relative Importance Index of 0.798. Enhancing the communication of good practice knowledge and increasing the IT literacy of cleaning staff came third and fourth, with RII of 0.793 & 0.784 respectively, and the outsourcing of cleaning services was rated the least important factor (see Table 5.6). Findings from the literature and the face-to-face interviews corroborated the questionnaire findings (see section 5.7.1 and Table 7.3 and 7.6).

This section has discussed factors that could facilitate effective knowledge management. The next section focuses on the prevailing hospital culture, structure and technological capabilities and their relationship to these factors to achieve the research objective.

7.5.2. **Synthesis and discussion of findings on hospital knowledge management processes**

Findings from the questionnaire survey (Table 5.7) demonstrated that hospitals have a culture of getting all staff to attend infection control training. This came top with a RII of 0.809, while a culture of collaboration of good practice knowledge was ranked third with a RII of 0.805. Findings from the face-to-face interviews corroborate the questionnaire findings, as presented in Table 7.7.

Table 7.7: Interview findings on aspects of FM cleaning services culture in the control of exogenous HCAIs

Major themes	Sub-themes	No. of respondent	references	%of respondents	%of references
Collaboration	Identify problem and deals with it collaboratively, and learn from it	6	6	60	22
	Regular meetings and discussion	5	6	50	22
	Routine Inspection	3	3	30	11
Communication	Communicate good practice approach to all departments	3	4	30	15
	Sharing information	7	7	70	26
Improvement model	PLAN, DO, STUDY, ACT	1	1	10	4

Also, findings from the questionnaire survey on how the hospital departmental structure facilitates collaboration in the control of exogenous HCAIs was rated second in this regard behind the prevailing culture with a RII of 0.807. The face-to-face interviews support these findings, as demonstrated in the latent themes presented in Table 7.8.

Table 7.8: Interview corroboration of questionnaire findings of Hospt. Department structural interface in FM cleaning services delivery in the control of exogenous HCAI

Semantic (major) themes	Latent Themes	No. of respondents	References	%of Respondents	%of References
Collaboration	Brainstorming with other stakeholders	3	3	30	12
	Collaborate with other Trust	1	1	10	4
	monthly infection control meeting	5	5	50	19
	Regular Team briefing with staffs to review policies	3	3	30	12
Communication	Regular communication	3	3	30	12
	Sharing information	3	4	30	15
	Round the clock onsite cleaning team	1	1	10	4
Training	Continue focused on HCAI control training for staffs	1	2	10	8
		3	4	30	15

Results from the questionnaire survey also confirmed that NHS hospitals have the technological capability to store good practice knowledge resources in the control of exogenous HCAIs, and that staff are trained in the use of these capabilities. These have a RII of 0.699 and 0.671 respectively (see Table 5.7). The questionnaire survey further demonstrated that despite the availability of good practice resources held in technological repositories, hospital cleaning staff frequently refer to non-technological (manual) repositories (see Table 5.8). Results from the face-to-face interviews support these findings from the questionnaire and provide further insights on how this is often achieved, as shown in Table 7.9.

Table 7.9:   Hospital knowledge management infrastructure capabilities

Semantic (major) themes	Latent Themes	No. of respondents	References	%of Respondents	%of References
Meetings	monthly meeting	2	2	20	11
Periodic review of competence	Annual appraisal	1	1	10	5
	Observation and supervision	1	1	10	5
	Supervisor communicate with the domestic staffs	2	2	20	11
Training	Face to face training	5	5	50	26
	Mandatory E-Learning	4	5	40	26
	Refresher training	2	2	20	11
Updating good practice documents	Updating good practice documents	1	1	10	5

7.5.3. **Summary of the interface of key findings**

Table 7.10 presents an amalgamation of the findings from the face-to-face interviews in the context of the prevailing hospital knowledge infrastructure capabilities in relation to the prevailing cultural, structural and technological capabilities presented in Table 7.7, and 7.8. The discussion of the prevailing hospital knowledge infrastructure capabilities' support for effective knowledge management processes in order to achieve objective 4 was interfaced within the context of the RII of the questionnaire findings (see Table 5.8) and the weighting of the references in the face-to-face findings (see Table 7.10).

According to Azen & Budescu (2003), researchers are often interested in understanding and establishing the relative importance of the predictors included in their model, and there are a number of relatively simple methods by which they can compare the importance of predictor variables. For clarity and ease of understanding of the discussion in this section, weighted score dominance analysis is used to present the relationship between the sub-themes, the major themes and the cumulative percentage of the references made to the sub-themes in the face-to-face interviews. This method provides a quantitative dimension for comparing and rank-ordering the relative importance of predictor variables which incorporates an empirical covariance matrix with the proposed weights to provide the relative importance of different measures (Kosinski, 2013; Miller, Konopaske & Byrne, 2012; Wysocki, 2004). This approach is based on a combination of the approaches of Miller et al. (2012) and Kosinski (2013).

Details of the face-to-face interview, questionnaire survey and literature findings in this regard are presented in Section 5.7.2 and 6.7.3. The following section presents the combined

findings from the three data collection instruments to demonstrate the achievement of objective 3.

Table 7.10:   Weighted scores of hospital knowledge infrastructure capabilities

KIC	Major themes	Sub-themes	No. of interviewees (n)	References (r)	% of interviewees (Pi)	% of references (Pr)	Weighted score of sub-themes	Cumulative percentage of references (Cpr)	Weighted score of major themes
Good practice knowledge collaboration (cultural focus)	Collaboration	Identify problem, deal with it collaboratively, and learn from it	6	6	60	22	2	55	2
		Regular meetings and discussion	6	6	50	22	2		
		Routine inspections	3	3	30	11	6		
	Communication	Communicate good practice to all departments	4	4	30	15	4	41	4
		Share information	7	7	70	26	1		
	Improvement model	PLAN, DO, STUDY, ACT	1	1	10	4	9	4	10
Good practice knowledge management (departmental focus)	Collaboration	Brainstorm with other stakeholders	3	3	30	12	5	47	3
		Collaborate with other trusts	1	1	10	4	9		
		Monthly infection control meetings	5	5	50	19	3		
		Regular team briefing with staff to review policies	3	3	30	12	5		
	Communication	Regular communication	3	3	30	12	5	31	5
		Sharing information	3	4	30	15	4		
		Round-the-clock onsite cleaning team	1	1	10	4	9		
	Training	Continue to focus on staff	1	2	10	8	7	23	6

		training for control of HCAIs	3	4	30	15	4		
Hospital knowledge management infrastructure capabilities	Meetings	Monthly meetings	2	2	20	11	6	**11**	**8**
	Periodic review of competence	Annual appraisals	1	1	10	5	8	**21**	**7**
		Observation and supervision	1	1	10	5	8		
		Supervisors communicate with domestic staff	2	2	20	11	6		
	Training	Face-to-face training	5	5	50	26	1	**63**	1
		Mandatory E-learning	4	5	40	26	1		
		Refresher training	2	2	20	11	6		
	Updating good practice documents	Updating good practice documents	1	1	10	5	8	**5**	9

Legend

Knowledge Infrastructure Capabilities (KIC)

No. of Interviewees (**n**):   Total number of interviewees (**tn**):   = 10

References (**r**):   Total number of reference (**tr**):

Percentage of Interviewees (**Pi**): = (n/tn)*100   Percentage of references (**Pr**):   = (r/tr)*100

Cumulative Percentage of References (**Cpr**) = (sum of Pr)

Highest Weighting (area most focused on) = **1**

7.5.4. **Discussion of key findings:**

Findings from the face-to-face interviews showed that activities within the prevailing culture in the delivery of facilities management cleaning services for the control of exogenous HCAIs tend to be based on collaborative practice. This came second in the overall ranking of the three knowledge infrastructure capabilities presented in Table 7.10. This is consistent with the views of 67 of the 85 facilities managers from various NHS hospitals, who agreed about the importance of collaboration in the prevailing culture of good practice knowledge management in the control of exogenous HCAIs (Table 5.7). This involves identifying HCAI risks and dealing with the source collaboratively within a hospital structure that provides an enabling environment for brainstorming with other stakeholders at infection control meetings, which was ranked third on the nine-point ranking.

The facilities managers interviewed all agreed that hospital knowledge infrastructure capabilities support e-learning, classroom-based training and refresher training in their hospitals. This came top in the ranking of both the major themes and the subthemes, as shown in Table 7.10. Corroborating this finding, 58 of the 85 hospitals that completed the questionnaire agreed that their hospital had a culture which encourages all employees to attend infection control training. This culture also came top of the three knowledge infrastructure capabilities in the questionnaire survey, with a Relative Importance Index of 0.809 (see Table 5.7). However, this training is insuufficiently focused on the control of exogenous HCAIs. Findings across the three KICs in the face-to-face interviews presented in Table 7.10 showed that, while there is an embedded culture of infection control training, there is only a weak departmental focus on training that is specific to the control of exogenous HCAIs. This had a weighting of 5.5 on the nine-point scale. It could be argued that the preference for manual good practice knowledge repositories among cleaning staff is a result of a lack of adequate training on how to use electronic resources. The relationship between the three sources of data in this regard is presented in Section 6.6.1.2.

Findings from the face-to-face interviews confirmed that there was a culture of active communication and sharing of good practice knowledge among stakeholders in hospitals. This came top of the prevailing culture of good practice knowledge management sub-themes, facilitated through regular meetings in which the problems identified are discussed. Again, there is evidence of a lack of adequate departmental support in this regard, as this attribute was weighted fourth on the nine-point scale in the context of support from the hospital department. The relationship between the three sources of data is presented in Section 6.6.2.5 and 6.7.1.1.

Within the context of the focus of this section of the research objective as presented in Table 7.10, findings across the three methods of data collection indicated shortcomings in the practical review of the efficacy of staff training and of good practice knowledge management processes in terms of a focus on the control of exogenous HCAIs. It was also shown in the face-to-face interview findings that the weighting of activities in this area weighted below average mark of 4.5 of the highest weighted value of 9. These activities and their overall weighting include:

➢ Observation and supervision: 8/9

➢ Supervisors communicate good practice to domestic staff: 6/9

➢ Routine inspections of hospital cleaning services to ensure standards are maintained: 6/9

➢ Use of continuous quality improvement tools such as the Plan, Do, Study, Act model: 9/9

This discussion and the key findings presented have achieved objective 4 of this research. These findings will be used to modify the conceptual framework presented in Figure 3.1.

The following section discusses and recapitulate results from research question 4 to achieve research objective 4 presented in Section 1.7 and Table 7.1. These results will be discussed within the context of hospital facilities managers' involvement in the hospital infection control team, and the level of acceptance of their contribution to the management of exogenous HCAIs as part of their remit.

7.6. **Section 5: Collaborative practice within the Infection Control Team**

With the continuing emergence of new strains of infection-causing bacteria and their resistance to antibiotics, there is a recognition that "microorganisms like viruses and bacteria co-exist with people and share a common environment." This has led to the acknowledgment that "neither the infection control team nor managers alone can prevent, or control infection" (Department of Health, 2004a; Healthcare Commission, 2007). These challenges have been a catalyst that backs the calls for continuing collaborative practice among the diverse professionals working in the healthcare sector in several government publications, including "The Matron Charter", which explicitly stated that "cleanliness is everyone's responsibility" (Department of Health, 2004a). It is therefore imperative to seek facilities managers' expert contribution in the area of bespoke good practice guidance on cleanliness in the healthcare environment for the control of exogenous HCAIs (Alexander, 2007; Dancer, 2009; Dancer, 1999).

> *"...Cleanliness is everyone's responsibility"* (Department of
> Health, 2004a).

Findings from the first phase of the research have achieved this research objective, which aims to evaluate the role of hospital facilities managers within the infection control team in the control of exogenous HCAIs. It was shown from the findings presented in Section 5.8.1 that facilities managers are very much involved in the activities of the infection control team. Of the 85 responses to the questionnaire, 51 of the respondents (60% of the total) claimed to be highly involved in the activities of the hospital infection control team, while 22 (29%) said their level of involvement was very high. This result is consistent with the foregoing discussion of the findings on collaborative practice of the face-to-face interviews. The literature which corroborates this conclusion is presented in section 5.8.

7.7. **Chapter summary**

This chapter has presented the findings from the three data collection instruments used in this research (see Figure 4.14). The findings discussed in this chapter have achieved research objectives 1 - 4, as presented in Table 7.1. Also, the key findings from the questionnaire survey, the face-to-face interviews and the literature in each section were used to modify the knowledge management framework for the control of exogenous HCAIs in facilities management cleaning service delivery developed earlier on the basis of the literature reviewed as presented in Figure 3.1 in Chapter 3.

The next chapter presents the modified framework. It also demonstrates how the findings from this chapter were used to modify the conceptual framework to achieve objective 5 of the research.

Chapter 8. MODIFICATION AND VALIDATION OF CONCEPTUAL FRAMEWORK

This chapter presents the modified effective knowledge management framework in facilities management cleaning services for the control of exogenous healthcare-associated infections (EICKMF) first developed on the basis of the literature review in Chapter 3 (see Figure 3.1). The validation of the modified framework is also presented in this chapter. The overall aim of this chapter is to achieve research objective 5, presented in section 1.7.1, and Table 7.1. Findings from the three sources of data collection were used to achieve the objective of this chapter.

This research was conducted to ascertain the extent to which hospital knowledge management process elements, which include the processes of knowledge creation, storing, sharing and usage, along with hospital knowledge infrastructure capabilities consisting of the prevailing culture, structure and technology, are essential hospital preconditions for effective knowledge management in facilities management cleaning service delivery for the control of exogenous HCAIs.

The chapter begins with an overview of the justification for the research further to that which was presented in Section 1.6.

8.1. The need for an effective knowledge management framework

Healthcare-associated infections are major causes of increased morbidity and mortality (see Section 1.6. They are infections that a patient has acquired in hospital or the care environment, and include infections that were incubating at the time of admission but which reveal themselves in the patient after discharge (See Section 1.1.1.2 and 2.3 in Chapter 1 and 2). According to Ikram & Satti (2009), healthcare- associated infection control (HIC) refers to a combination of various guidelines, policies and modalities used to minimise the risk of infections spreading in healthcare facilities. In the UK, a large number of policies and guidance documents have been produced which focus on the control of infections since the publication of the NHS Plan. These infection control guidance documents include those which focus on infections that are acquired from the hospital or other physical environment as a consequence of inadequacies in facilities management cleaning service delivery (see Section 2.4.3 and 2.8.2.1 in Chapter 2). Despite these efforts, concern continues to be raised about the lack of a formal review by the Department of Health, or of local empirical studies, to assess the effectiveness of the cleaning and infection

control guidance documents produced since the publication of the NHS Plan (May, 2013; May & Pitt, 2012).

As new strains of infection-causing microorganisms continue to emerge in healthcare settings, the importance of creating a new good practice knowledge management framework to enhance the curtailment of the prevalence of healthcare-associated infections is now well established. Existing infection control strategies often become outdated as a consequence of the dynamic nature of infection-causing microorganisms (Cameron, 2014; Gray, 2001). Finding a solution has become more important as the dynamic nature of infection-causing bacteria, and especially those acquired from the care environment, continues to pose a challenge for clinician and non-clinician infection control teams. It could therefore be argued that existing practices for reducing the prevalence of HCAIs have become too "paper-centric" rather than "practice-centric." This is a result of the dynamic nature of infection-causing microorganisms, which enables them to become resistant to antibiotics, and of a "paperwork" culture within the NHS (see Section 1.6. . This necessitates continued integration, coordination and management of both individual and organizational knowledge to maximise the efficiency of good practice and collaborative HCAI infection control strategies. Gold et al. (2001) cite four mechanisms for facilitating the knowledge usage process. These include facilitating rules and directives, sequencing routines, and group problem-solving and decision-making. These are further grouped under social networking and the policy and technology interface. This interface has been explored to achieve the research aim and objectives.

The research commenced with the synthesis and review of literature pertinent to the research subject area (Chapter 1, and 2). This led to the development of the initial conceptual framework presented in Figure 3.1 in Chapter 3. The framework presents a theoretical and conceptual roadmap showing how the research aim and objectives presented in section 1.7.1 were to be achieved. Based on the findings from the three research instruments presented in Chapters 5 and 6 and summarised in Chapter 7, the initial conceptual framework was modified using vital constructs and variables that emerged from the research participants' understanding and perception of the prevailing knowledge management processes in facilities management cleaning services in NHS hospitals in England.

8.1.1. **Modifying the conceptual knowledge management framework**

Ravitch & Riggan (2012) argue that a framework is a constructed artefact which incorporates pieces borrowed from other disciplines, but its structure and overall coherence is unique to the research. According to Jabareen (2009), a conceptual framework is a network or "a plan" of interlinked concepts that together provide a comprehensive understanding of the phenomenon or phenomena. Conceptual frameworks contain a philosophical interface of ontological, epistemological and methodological assumptions, where each concept of the interface plays an ontological or epistemological role. According to Guba & Lincoln (1994), the ontological assumptions relate to knowledge of the "way things are," "the nature of reality," "real" existence and "real" action. Epistemological assumptions, on the other hand, relate to "how things really are" and "how things really work" in an assumed reality. The methodological assumptions relate to the process of building the conceptual framework and assessing what it can tell us about the "real" world.

Within the context of the modified research framework, the prevailing hospital knowledge infrastructure capabilities represent the ontological assumptions which relate to the way things are (the prevailing hospital culture), the nature of reality (the prevailing hospital structure), real existence (the prevailing hospital good practice knowledge storage and sharing capabilities) and to the real action (the technological interface of the prevailing hospital culture and structure) in the control of exogenous HCAIs in facilities management cleaning services.

Hospital Knowledge Infrastructure Capabilities		
Hospital Culture	**Hospital Structure**	**Hospital Technology**

Figure 8.1:   Ontological assumptions within the research framework

The epistemological assumptions about "how things really are" and "how things really work" in the assumed reality of this research relate to prevailing good practice knowledge management processes. These are viewed from the perspective of how knowledge is created, stored, shared and used in the control of exogenous HCAIs within the prevailing hospital knowledge infrastructure capabilities.

Hospital Knowledge management process			
knowledge creation	**knowledge Storing**	**knowledge Sharing**	**knowledge Usage**

Figure 8.2:   Epistemological assumptions within the research framework

The methodological assumptions, which relate to the process of building the conceptual framework and assessing what it can tell us about the "real" world, relate to how the hospital knowledge management process could be aligned with the hospital knowledge infrastructure capabilities in the control of exogenous HCAIs in facilities management cleaning services. This is achieved by the exporation of the findings from the three research data collection instruments presented in Chapters 2, 5 and 6 and summarised in Chapter 7, leading to the development and modification of the research framework.

Based on these considerations, the research framework (see Figure 8.3) presents in graphical form the relationship between the vital constructs and concepts of both the knowledge management process and knowledge infrastructure capabilities. It shows how they interact to achieve an effective good practice knowledge management process within the hospital knowledge infrastructure capabilities in the control of exogenous HCAIs in hospitals through facilities management cleaning service delivery.
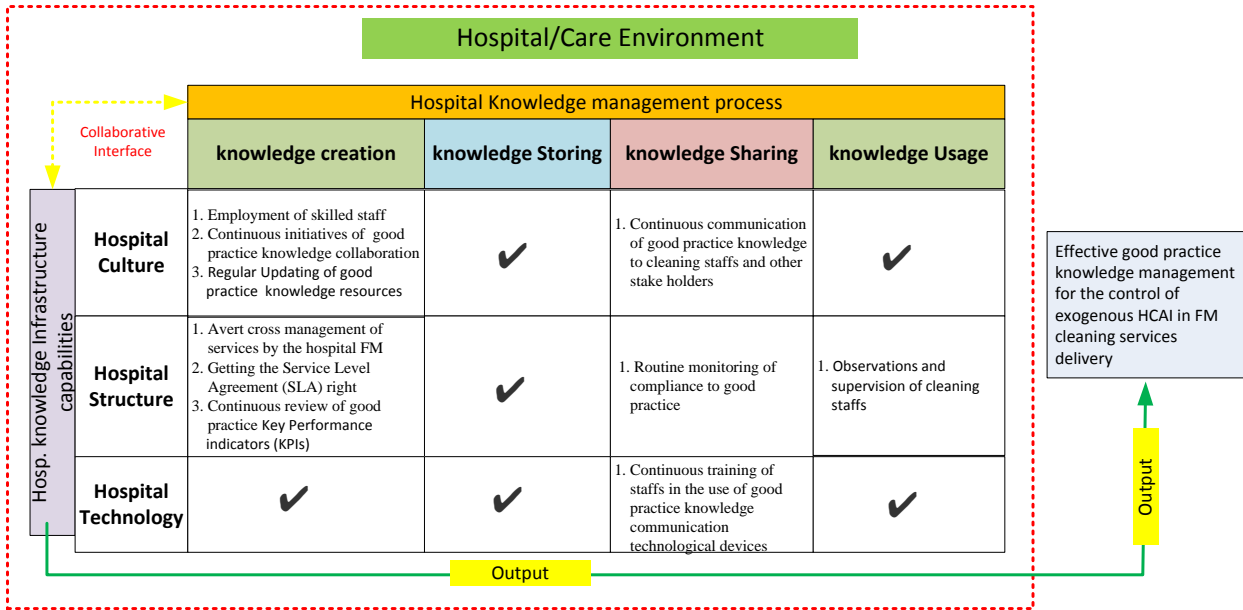
Figure 8.3:   The good practice knowledge management framework for exogenous infection control in FM (KMFEIC)

The next section describes the various elements in the conceptual framework developed from the findings from the literature and from facilities managers' views across NHS hospitals in England collected by the questionnaire survey and face-to-face interviews. It explains how the various components interact to achieve the research aim and objectives.

8.1.2. **Elements of the conceptual framework explained**

The foregoing discussion has introduced the modified conceptual framework, which is based on the results from the research data collection instruments. Findings from the research showed that the most significant impediment to effective good practice knowledge management in the control of exogenous HCAIs is the prevailing hospital culture. It was also concluded that the fundamental components of effective good practice knowledge management in facilities management cleaning services for the control of exogenous HCAIs in NHS hospitals include a culture of good practice knowledge creation. This can be achieved through the employment of skilled staff, continuous initiatives relating to good practice knowledge, and the regular updating of existing good practice knowledge resources (see modified framework, Figure 8.3). A culture which facilitates the continuous communication of evolving good practice knowledge to cleaning staff is also another suggested cultural interface that could enhance effective good practice knowledge in the control of exogenous HCAIs. Findings from the research also showed that robust hospital cultural capabilities would enable the hospital to access individuals' tacit knowledge, reconcile the knowledge and convert it into explicit knowledge. This knowledge could then be transformed into bespoke good practice knowledge resources to be used in the control of exogenous HCAIs. As noted in the discussion, hospitals with an effective cultural knowledge infrastructure capability that encourage dialogue between clinicians and non-clinicians often spur good practice initiatives.

It has become apparent that the quest to move beyond information management and into the realm of effective good practice knowledge management is a complex undertaking for hospitals. It involves the development of a structure that allows the hospital to create, store, share and distribute the knowledge to be used. Hospital knowledge structural infrastructural capabilities is the second consideration in the framework. This element is critical in leveraging the interface of the other two (i.e. cultural and technological capabilities) hospital infrastructure capabilities, as these often have the unintended consequence of inhibiting collaboration and the creation and sharing of good practice knowledge in the control of exogenous HCAIs across the various hospital departments. As shown in Figure 8.3, considerations suggested by the research participants for effective good practice knowledge creation include avoiding the cross-management of services by the hospital facilities manager, continually reviewing good practice KPIs through collaboration, and getting the service level agreement (SLA) right. Routine monitoring of compliance with good practice protocols by means of enhanced observation and supervision of cleaning staff is another thing for hospital departments to focus on in order to ensure the sharing and usage of the created good practice knowledge in the delivery of the

hospital cleaning services. These considerations suggest what is required is departmental structural capabilities that:

➢ Inspire specialised practice, to be achieved by allowing the hospital facilities manager to focus on the core function of the hospital facilities cleaning services rather than also having responsibility for the "cross-management" of other services such as catering;

➢ Focus on the identification of appropriate Service Level Agreement (SLA) requirements for external cleaning service providers prior to formalising any contractual agreement. This includes setting the indicators (KPIs) to be used to measure the standards achieved in areas such as environmental cleanliness, staff training and adherence to hospital policies, processes and guidance documents in the control of exogenous HCAIs;

➢ Support a culture that encourages individuals to share their tacit knowledge rather than "hoarding" information, which often inhibits effective knowledge management in the control of exogenous HCAIs in hospitals. This includes practices such as providing rewards and incentives for staff that generate and share new infection control good practice, as well as those that champion compliance to good practice guidance protocols;

➢ Facilitate a flexible rather than a rigid departmental structure that encourages good practice knowledge sharing and collaborative initiatives among clinicians and the facilities management team in the control of exogenous HCAIs.

The above considerations should all be underpinned by routine monitoring of compliance with the good practice guidance policies and protocols used in the control of exogenous HCAIs in facilities management cleaning services. This can be achieved through enhanced observation and supervision of cleaning staff, aimed at ensuring that cleaning services are delivered to the agreed SLA (when outsourced) and the expectations of the hospital infection control team.

There is a recognition that the hospital environment is complex and knowledge-driven, and one in which diverse professionals, i.e. clinicians and non-clinicians, engage with one another, and are in close contact with patients, visitors and other stakeholders in a collaborative manner. The hospital environment is also acknowledged to be characterised by fragmented tacit and explicit knowledge distributed across professional boundaries (see Section 1.5). Therefore, for the sustainable management of the prevalence of exogenous HCAIs, hospitals must leverage their existing good practice knowledge protocol that is focussed on the control of exogenous HCAIs to create new knowledge that puts them in a good position to tackle the regularly emerging strains of infection-causing microorganisms. This could be achieved through the development of an "absorptive capacity", i.e. an ability to use prior knowledge to identify the value of new

information, assimilate it and apply it in order to create a robust hospital culture and structural capabilities. This will then enable the hospital infection control team to deal with the challenges inherent in managing the tacit knowledge of individuals, and to be able to convert it into explicit knowledge, before transforming it into good practice knowledge resources for use in the control of exogenous HCAIs.

The third element of the framework is the hospital's technological capabilities in relation to the first two capabilities for the control of exogenous HCAIs in facilities management cleaning services. These are vital for the promotion of a culture of the continuous communication and sharing of good practice knowledge with cleaning staff and other stakeholders in the control of exogenous HCAIs. From the perspective of hospital structure, sophisticated technological capabilities are needed to capture tacit individual good practice knowledge, as well as explicit resources embedded within, available through and derived from the network of collaboration across the various hospital departments for the control of exogenous HCAIs. Establishing such linkages can eradicate barriers to the continuous communication of good practice knowledge to cleaning staff and other stakeholders in the hospital. In the context of this research and the discussion of technological capabilities in the research framework, technological capabilities for the effective and continuous communication of good practice knowledge for the control of exogenous HCAIs in facilities management cleaning services have the aim of achieving the following capacities:

➢ **Corporate intelligence:** corporate intelligence technological capabilities enable the hospital to generate good practice knowledge for the control of exogenous HCAIs that is particular to the prevailing hospital culture and structural characteristics relative to corporate aims and objectives;

➢ **Collaborative knowledge discovery:** collaborative knowledge technological capabilities enable clinician and non-clinician employees of the hospital, and those from other hospitals, to collaborate and share tacit and explicit knowledge in the control of exogenous HCAIs in facilities management cleaning services;

➢ **Knowledge-mapping:** knowledge-mapping technological capabilities enable the hospital to effectively track knowledge generated through collaboration, and to create good practice knowledge protocols particular to the prevailing hospital culture and structural capabilities in order to solve inherent infection control challenges;

➢ **Opportunity generation:** opportunity generation technological capabilities enable the hospital to explore and track the effectiveness of the mapped knowledge using feedback from patients, staff and visitors. This will enable the hospital to continuously align

prevailing practice in facilities management cleaning services to the hospital's corporate aims and objectives in the control of exogenous HCAIs. It will also enable the hospital to take appropriate measures to prevent the good practice knowledge from being stolen or used inappropriately.

This discussion suggests that the hospital's prevailing cultural and structural capabilities are both moderated by its technological capabilities. These capabilities determine how good practice knowledge for the control of exogenous infections is communicated across departmental boundaries and how it can be retrieved. Robust hospital technological capabilities will potentially reduce the fragmentation of good practice knowledge; enhance mutually supportive links between theoretical and practical knowledge boundaries, as well as creating a pathway for the exploration of new knowledge opportunities. They also provide an enabling environment which allows experimentation with the acquired knowledge to be used in the control of HCAIs, and specifically those from exogenous sources.

Within the scope of this research (see Section 1.8. findings show that it would be possible to develop a culture that supports the storing and usage of good practice knowledge, as well as a structure that supports the storing of good practice knowledge. Also, there are technological capabilities that can encourage good practice knowledge creation, storage and usage. These have been indicated with a tick in the relevant boxes in Figure 8.3. However, it is important to mention that the extent to which these capabilities are maximised is relative to the individual hospital.

8.1.3. **Framework summary**

The areas ticked in Figure 8.3 are those which did not emerge as core factors inhibiting the control of healthcare-associated infections in facilities management cleaning services in NHS hospitals. Findings from the research indicated that the NHS has adequate technological capabilities for the creation, storing and usage of good practice knowledge. However, there is a need to train staff, and especially cleaning staff, on the use of technological devices such as the intranet, computers and IPads used in sharing and communicating good practice knowledge guidance. This could be done by instituting a departmental structure that focuses on the routine monitoring of compliance with infection control good practice guidance in the control of exogenous healthcare-associated infections (HCAIs).

8.1.4. **Effective knowledge management framework application process flow and assessment matrix interface**

The EKMF which is the outcome of this research is not intended to constitute a theory (see Section 1.8). Its purpose is to contribute to the existing body of knowledge based on empirical findings. The EKMF process flow diagram (see Figure 8.4) expands on the constituents' features of the EKMF and provides an overall summary of the basic flow and interaction of the discrete elements in the application of the framework in phases. The first phase of the EKMF process flow called "hospital value analysis" begins with a brainstorming session by the Infection Control Team (ICT) to review the prevalence level of exogenous HCAI, and to ascertain whether set targets are been met within the hospital exogenous infection control policy statement and statutory guidelines. The other phases are explored using a 5 points Likert scale assessment matrix presented in Figure 8.5.
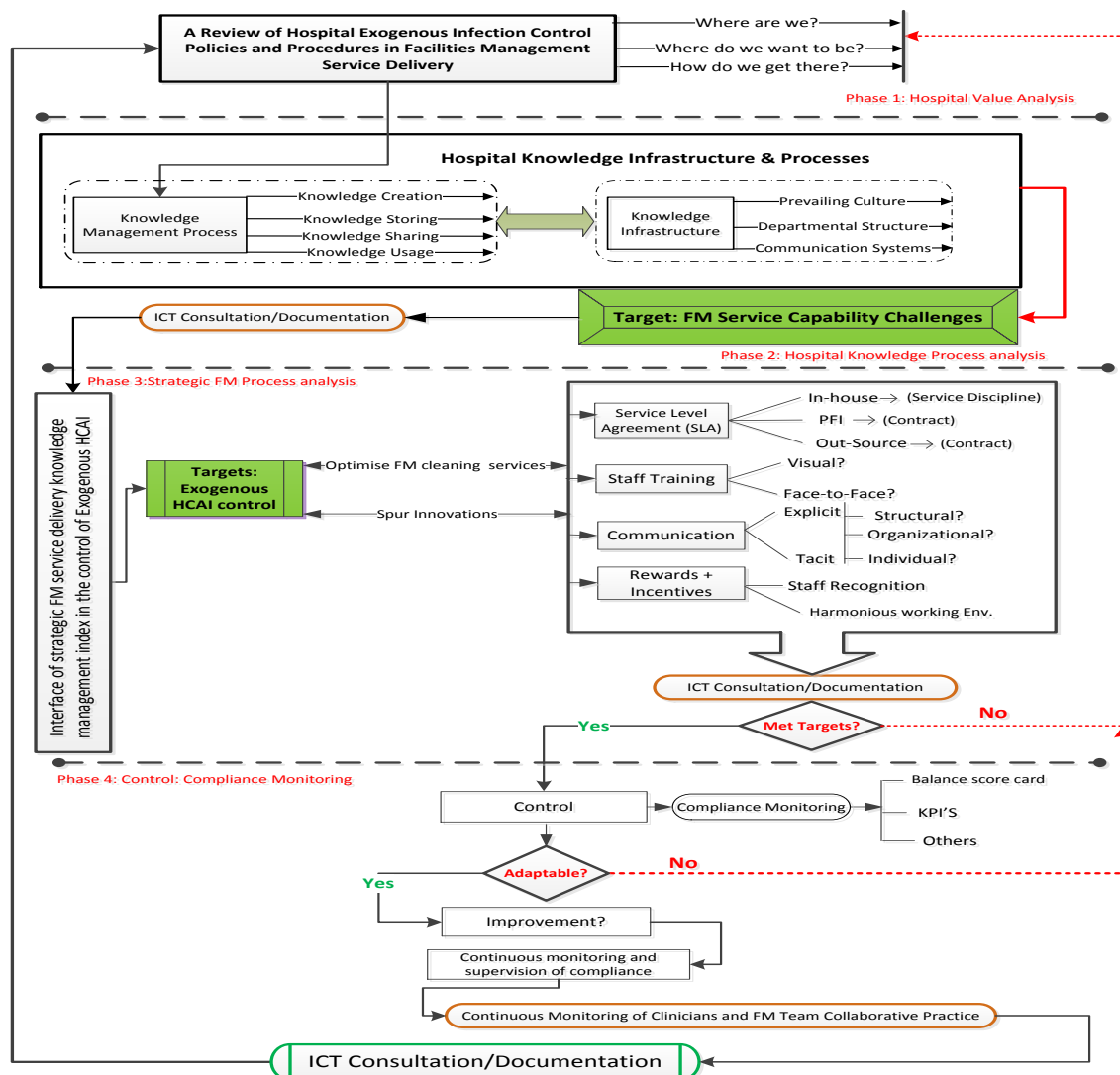
Figure 8.4:   Effective knowledge management framework process flow diagram

1= strongly agree   2. = agree   3. = Don't know   4. = disagree   5. = Strongly disagree

Figure 8.5: Effective knowledge management framework assessment matrix

	Weighted score (WS)	Cumulative weighted score (CWS)	Ranking of cumulative weighted score (RCWS)
Hospital Knowledge Infrastructure			
1. Staff are aware of hospital HCAI policies and procedures			
2. There is adequate supervision of staff adherence to HCAI cleaning policies			
3. Staff are fully aware of the hospital mission statement on HCAIs			
4. Staff know who to contact for clarification of HCAI issues			
5. There is an adequate budget for cleaning materials and equipment			
6. There are contingency sums to cover cleaning material and equipment shortfalls			
7. There is an adequate budget for ad hoc cleaning staff			
HCAI Knowledge Management			
1. Cleaning staff attend mandatory annual infection control training			
2. Changes to HCAI legislation are regularly communicated to staff			
3. Staff are well trained on how to use cleaning materials and equipment			
4. There is adequate supervision of cleaning staff to ensure their competence in the use of cleaning materials and equipment			
Service Level Agreement (SLA):			
1. All SLAs are in line with National Standards and the hospital HCAI policies and procedures			
2. Both the service provider and the ICT are clear about the required service standards			
3- There is an adequate monitoring regime to ensure compliance with required standards			
4- The SLA is reviewed regularly to accommodate emerging HCAI challenges			
Good Practice Guidance Documents			
1. Changes to HCAI cleaning standards are regularly communicated to staff			
2. Staff understand relevant HCAI good practice guidance documents to national standards			
3. Guidance documents developed for the particular hospital are adaptable, understandable and usable			
4. The hospital acknowledges and rewards staff for sharing good practice knowledge			
5. Findings from the analysis of cleaning-related surveys are communicated to cleaning staff			
6. Cleaning staff are free to provide feedback on the guidance documents used			
7. The feedback provided is often used to improve the guidance document in the control of exogenous HCAIs			
Collaborative Practice			
1. There is adequate recognition of the hospital facilities manager's input on exogenous HCAI issues at high-level meetings on HCAI control with the clinician members of the ICT			

Legend:

(1). Weighted score (WS) = scale rating   (2). Cumulative score (CWS) = sum of scale ratings

(3). Ranking of weighted score (RCWS) = with 1 being the highest achievable weighting for the most achieved variable category

The application of the Effective knowledge management framework assessment matrix for evaluating the knowledge management process within the hospital knowledge infrastructure capabilities draws on findings presented in various sections of this research presented in Chapter 7. A five-point Likert scale has been developed to be used by the assessor to ascertain the extent to which each variable is achieved. The cumulative weighted score gives an indication of the total achievable variable under each category, with 1 being the highest achievable score. A cumulative weighted core less than 1 indicates an area for improvement (see Table 7.10).

The second phase of the framework process flow described as 'knowledge management process analysis phase' provides an overview of the interface between hospital knowledge infrastructure capabilities and knowledge management process. Section 1 and 2 of the framework assessment matrix (see Figure 8.5) present a summary of variables identified from findings across the research instruments under section 4 of the research structure (Section 7.1,7.5.1,7.5.1,7.5.3,7.5.4) that needed to be achieved in order to curtail the prevalence of exogenous HCAI in hospital.

The third phase of the framework process flow described as 'strategic FM process analysis phase' provides an overview of the interface between section 2, 3 and 5 of the research structure (see Section 7.1 in Chapter 7). Section 3,4 and 5 of the framework assessment matrix (see Figure 8.5) present a summary of variables identified from findings across the research instruments under section 2, 3 and 4 (Section 7.3, 7.3.1, 7.3.5,7.4,7.4.1,7.4.2, and 7.6) that needed to be achieve in order to curtail the prevalence of exogenous HCAI in hospital.

The fourth and final phase of the framework process flow described as 'control' provides an overview of compliance and monitoring strategies to be implored by the infection control team (ICT) to benchmark, and ascertain the adaptability of the achieved variables in the assessment matrix to curtail the prevalence of exogenous HCAI in hospital.

8.2. **Validation of the conceptual framework:**

The credibility of a research is something that needs to be demonstrated as part of the research process itself. According to Denscombe (2010), for research to achieve credibility, it needs to demonstrate in one way or another that the findings are based on practices that are acknowledged to be the basis of good research (Denscombe, 2010). In the qualitative research paradigm, a primary aim is for the researcher to capture authentically the lived experience of people (Creswell, 2014; Creswell & Plano Clark, 2008). It has been argued that the concept of reliability belongs to quantitative research, and it has been criticised as having little relevance to qualitative studies (Parahoo, 2014). However, validation is acknowledged to be an integral part of qualitative research to ensure rigour in the way data are collected, analysed and interpreted (Parahoo, 2014; Sarantakos, 2013).

From the quantitative perspective, reliability in this research has been achieved through the use of a questionnaire survey according to the definition of reliability by Parahoo (2014) and Sarantakos (2013). According to Parahoo (2014), in qualitative interviews in their most structured form, no predetermined or standardised tools are used, and the interviewer is also a 'tool' of data collection. The author further states that structured interviews can be replicated and the data can be examined for consistency. The semi-structured interview format was used in this research. According to Parahoo (2014) and Sarantakos (2013), some qualitative validation techniques used by researchers over time have included:

➢ Cumulative validation
➢ Communicative validation
➢ Argumentative validation
➢ Ecological validation
➢ Reflexivity
➢ Validation of data by the interviewees themselves.

Reflexivity is the continuous process of reflection by the researcher on his/her own values, preconditions, behaviour or presence and those of the respondents which can affect the interpretation of responses (Parahoo, 2014). However, some researchers have criticised the concept of reflexivity, arguing that reflexivity by the researcher is not always possible as it is a daunting task for the researcher to 'stand back and examine the effect of one's preconceptions, especially if one is not always aware of what they are'. This is why researchers return to the interviewees to find out whether or not they agree with the findings from the analysis of the collated data (Parahoo, 2014).

The main objective of a qualitative study is to describe the variation in a phenomenon, situation or attitude, whereas quantitative research helps the researcher to quantify the variation (Kumar, 2011). The aim of this research is to critically investigate the interface between the knowledge management process and hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare-associated infections (HCAIs) through facilities management cleaning service delivery in NHS hospitals. To achieve rigour in the use of the research instruments, the knowledge management framework was validated using the healthcare facilities managers in NHS hospitals in England from whom the data were collected, to ascertain how far they accepted the framework within the remit of the research aim. Sarantakos (2013) refers to this validation technique as 'communicative validation', while both Parahoo (2014) and Hantikainen (2001) call it 'expect validation'. According to Bryman (2012), it is a validation process in which a researcher provides the people on whom the research has been conducted with an account of the research findings and requests their feedback on the findings (see Appendix E).

The validation of findings is very important in any research. The framework needs to be assessed in several areas to determine whether its structure is correct by examining the output under a given set of measures to ensure that it is useful to the practitioners and researchers (Fellows & Liu, 2003; Eppler & Wittig, 2000). The aspects of a framework which Eppler & Wittig (2000) suggest might require improvement include:

➢ Applicability of the framework
➢ Interdependencies between different criteria
➢ Inclusion of problem areas and elements of the solution

The knowledge management framework in facilities management cleaning services for the control of exogenous HCAIs in this research was validated to ascertain if the structure of the framework satisfies these broad criteria, using analytic (scientific) and pragmatic (operational) evaluation criteria (Eppler & Wittig, 2000). According to Eppler & Wittig (2000), the analytic criteria are based on academic standards which require clear definitions of the terms used in a framework, the positioning of the framework within existing literature, and a consistent structure. The pragmatic criteria are those which make the framework applicable (operational) in terms of its conciseness, illustration and practicability (see Table 8.1).

Table 8.1: Knowledge management framework validation criteria, based on Eppler & Wittig (2000)

Evaluation criteria	Focus	Evaluation questions (adapted questions used in questionnaire)
Analytical (scientific)	Definition	Are all individual terms of the framework clearly defined?
		How well defined are the terms and concepts of the framework in the control of exogenous healthcare-associated infections through facilities management cleaning service delivery?
	Positioning	Has the context of the framework been made clear?
		How well does the framework apply to the delivery of hospital cleaning services?
	Consistency	Are the elements of the framework mutually exclusive and collectively exhaustive?
		How well do you feel the framework is consistent in combatting the infections acquired from the hospital environment?
Pragmatic (operational)	Concise	Does the framework contain a relatively small amount of the elements?
		Do you feel there are too many elements in the framework?
	Illustration	Can the framework be illustrated through examples such as presentations, training or case studies?
		Can the framework be demonstrated easily to others?
	Practicability	Can the framework be used as a tool to improve real-life problems?
		Can the framework be used as a tool to improve good practice knowledge management processes in the control of exogenous healthcare-associated infections through facilities management cleaning services in hospitals?

8.2.1. **Validation process**

The validation process was conducted among facilities managers from NHS hospitals in England, using a purposive sampling technique (see Section 4.7.4). Respondents' opinions were solicited using a questionnaire which consists of both closed and open-ended questions with a five-point Likert scale. The scale ranges from "strongly agree" to "strongly disagree", with weightings of 1 = "strongly agree", 2 = "agree", 3 = "don't know", 4 = "disagree" and 5 = "strongly disagree" (see Appendix E). The open-ended questions in the questionnaire offer respondents the opportunity to provide additional information relevant to the improvement of the framework that was not captured in the Likert scale closed-ended questions. The questionnaire, along with the framework and the description of the framework elements, was distributed to the selected 23 respondents via post, email and SurveyMonkey. Respondents were asked to rate their views on the conceptual framework against the analytical (scientific) and pragmatic (operational) criteria listed Table 8.1.

8.2.2.   **Validating the data analysis**

A total of 11 of the 23 questionnaires distributed were returned fully completed. This represents 48% of the total questionnaires. The questionnaire data was analysed using version 23 of the Statistical Package for the Social Sciences software (SPSS). Techniques for the analysis of descriptive data were used to analysed the collected data. According to Pallan (2013), descriptive statistics describes the basic characteristics of the sampled data in a study. It addresses specific research questions and provides a summary of the sample in a simple-to-understand format. The data were presented in both graphical and tabular form for ease of understanding and interpretation. According to Kumar (2011), one of the objectives of a graph is to present data in a way that is easy to understand and interpret, and especially, interesting to view.

This first section of the questionnaire elicited information on the characteristics of the respondents. The aim of this section is to provide readers with a background overview of the population from which the researcher collected information. There are three questions (Q1 to Q3) in this section.

Table 8.2:   Job titles of respondents in the framework validation process

Job Title	Frequency	Percentage	Valid Percent	Cumulative Percentage
Facilities Manager	5	45.5	45.5	45.5
Head of Facilities/Director of Facilities/Estates	3	27.3	27.3	72.7
Domestic Services Manager	1	9.1	9.1	81.8
Works Manager	1	9.1	9.1	90.9
Others	1	9.1	9.1	100
Total	11	100	100	

It was observed from the analysis of the data that 46% of the respondents were Facilities Managers, while 27% were either Head of Facilities or Director of Facilities/Estates. Domestic Manager, Works Manager and "others" (who was identified as a facilities management lecturer at a university) each accounted for 9% respectively (see Table 8.2).

Respondents were further asked about their length of experience (in years) in the healthcare sector and in the control of exogenous HCAIs (Q2 and Q3).

Table 8.3:   Respondents' years of experience in healthcare and in the control of HCAIs

Years of experience	Years of experience in the healthcare sector		Years of experience in the control of HCAIs	
	No. of respondents	Percentage (%)	No. of respondents	Percentage (%)
6 - 10 years	2	18.2	3	27.3
11 - 15 years	2	18.2	4	36.4
16 - 20 years	3	27.3	2	18.2
Over 20 years	4	36.4	2	18.2
Total (N)	11	100	11	100
Mean		3.82	3.27	
Standard Deviation		1.17	1.10	

The mean value of respondents' years of experience in the healthcare sector was 3.82, with a Standard Deviation (SD) of 1.17, while the average years of respondents' experience in the healthcare sector was between 16 and 20 years. Respondents' mean years of experience in the control of HCAIs was 3.27, with a SD of 1.10. This means that the average years of respondents' experience in the control of HCAIs was between 16 and 20 years.

Respondents' experience in the healthcare sector, together with their experience in the control of HCAIs, are very important for achieving the research aim and objectives. This information also adds rigour to the validity of the good practice knowledge management framework. It could be concluded that the more experience the respondents have in the research subject area, the greater the rigour which is added to the framework.

The second and final section of the validation questionnaire sought respondents' ratings of the framework (see Table 8.1) against analytical (scientific) and pragmatic (operational) criteria, as suggested by Eppler and Wittig (2000).

The first criterion evaluated was the definition criterion. This criterion sought to determine whether all the individual terms and concepts in the framework were clearly defined.
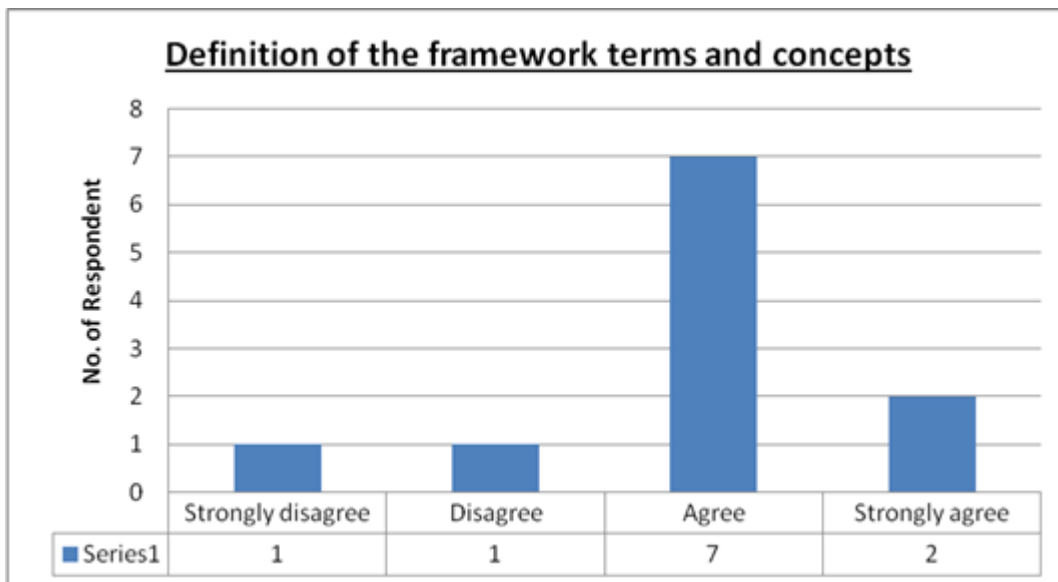
Figure 8.6:   Ratings of the definition of terms and concepts in the framework

The analysis of the results showed that seven of the respondents, representing 64% of the total, agreed that the terms and concepts in the framework were well defined, while two of the respondents strongly agreed. Two of the respondents, each representing 9% of the total, respectively disagreed and strongly agreed (see Figure 8.6). The written comment provided by the respondent who disagreed is

> *"This was studied by both the Head of facilities services and the Assistant DIPC (Director of Infection Prevention and control), and these are our comments....., difficult to understand the terminology."*

This respondent further stated that

> *"We agree that a fully detail version of the framework ticked boxes will be a starting tools."*

It may be that this respondent found terms such as "exogenous" difficult to understand throughout the framework. However, the overall result suggests that the definition of terms in the framework is appropriate for the control of exogenous HCAIs in facilities management cleaning service delivery practice. This criterion has a mean value of 3.91, which suggests that respondents perceived the elements of the framework to be clearly defined within the context of the control of exogenous HCAIs in facilities management cleaning service delivery practice.
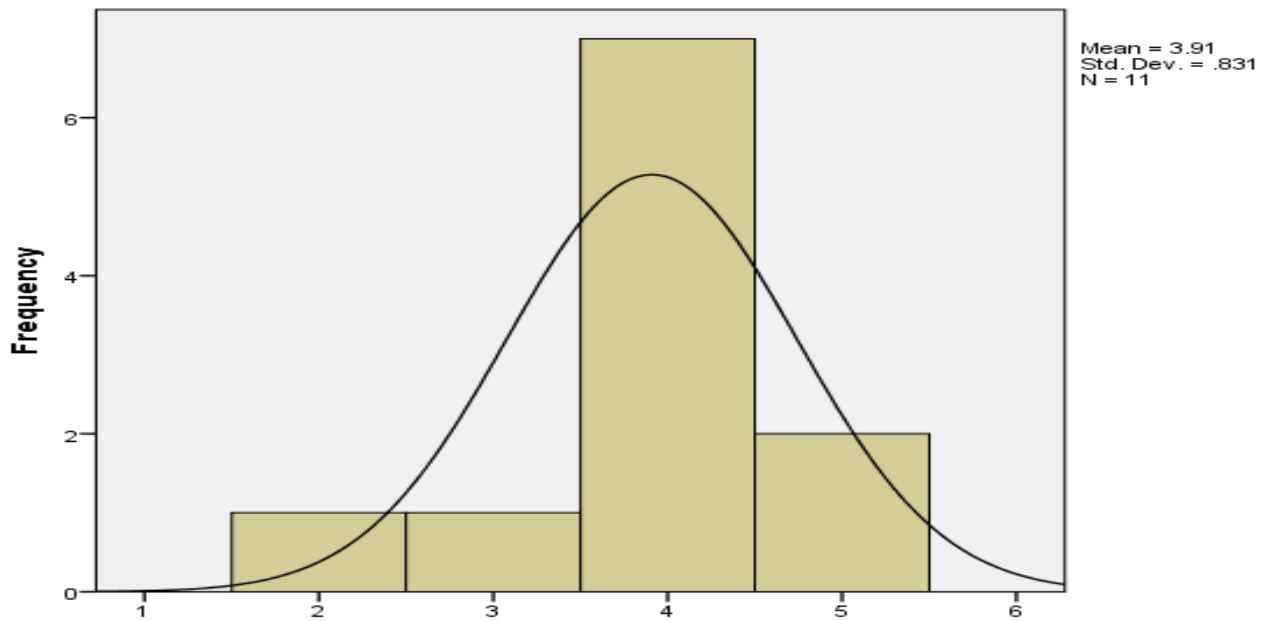
Figure 8.7:   Definition criterion: histogram

The next criterion to be evaluated is the positioning criterion, which sought to determine how well the framework applies to the delivery of hospital cleaning services for the control of exogenous HCAIs.
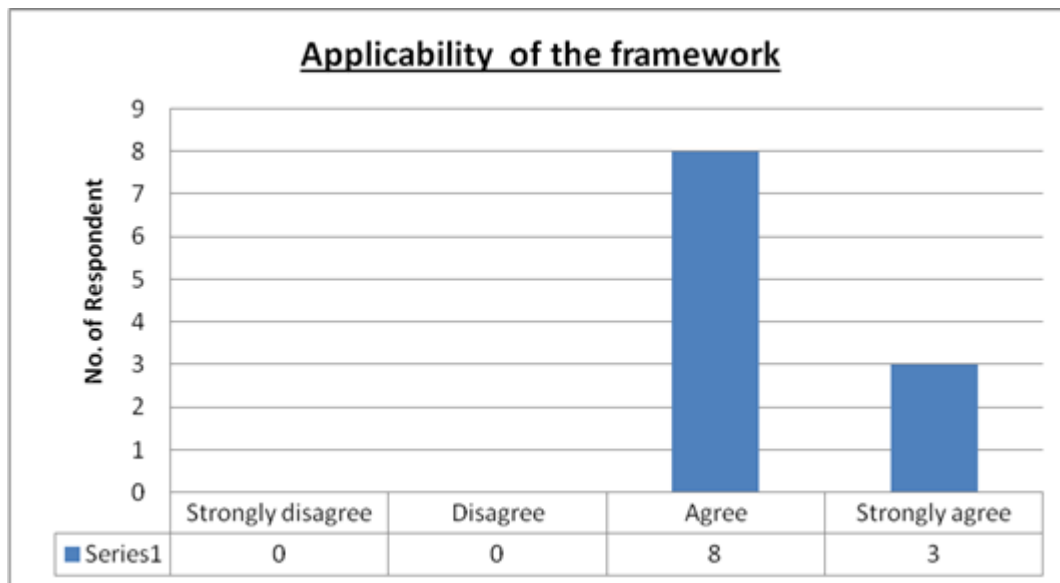
Figure 8.8:   Ratings of the applicability of the framework

The analysis of the results shows that eight of the respondents, representing 73% of the total, agreed that the framework applies appropriately to the delivery of hospital cleaning services, while three strongly agreed (see Figure 8.8). This criterion has a mean value of 4.27. This suggests that respondents perceived the elements of the framework to be appropriate for use in the control of exogenous HCAIs in facilities management cleaning service delivery.
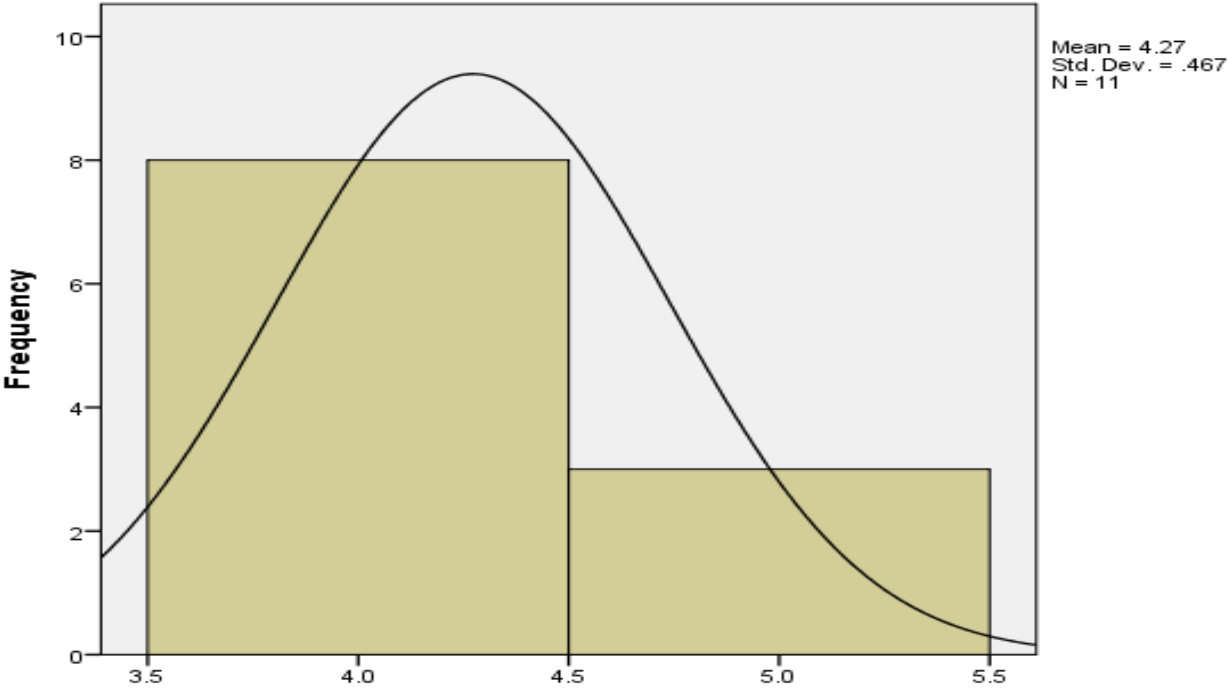
Figure 8.9:   Applicability criterion: histogram

The final analytical (scientific) criterion focused on the consistency of the structure of the framework. This criterion was designed to evaluate how consistent the structure of the framework was in combatting exogenous HCAIs in hospitals.
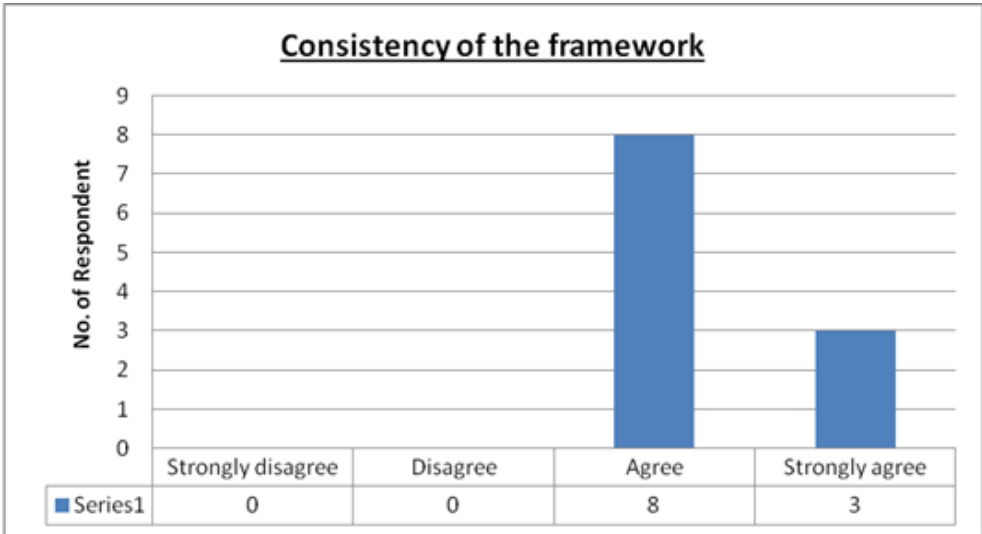
Figure 8.10:   Ratings of the consistency of the framework

Findings from the analysis of the results showed that eight of the respondents, representing 73% of the total, agreed that the structure of the framework was consistent in solving the problem of infections acquired from the hospital environment, while three of the respondents strongly agreed (see Figure 8.10). This criterion has a mean value of 4.27. These responses suggest that respondents perceived the elements of the knowledge management framework as well structured for use in the control of exogenous HCAIs in facilities management cleaning service delivery practice.
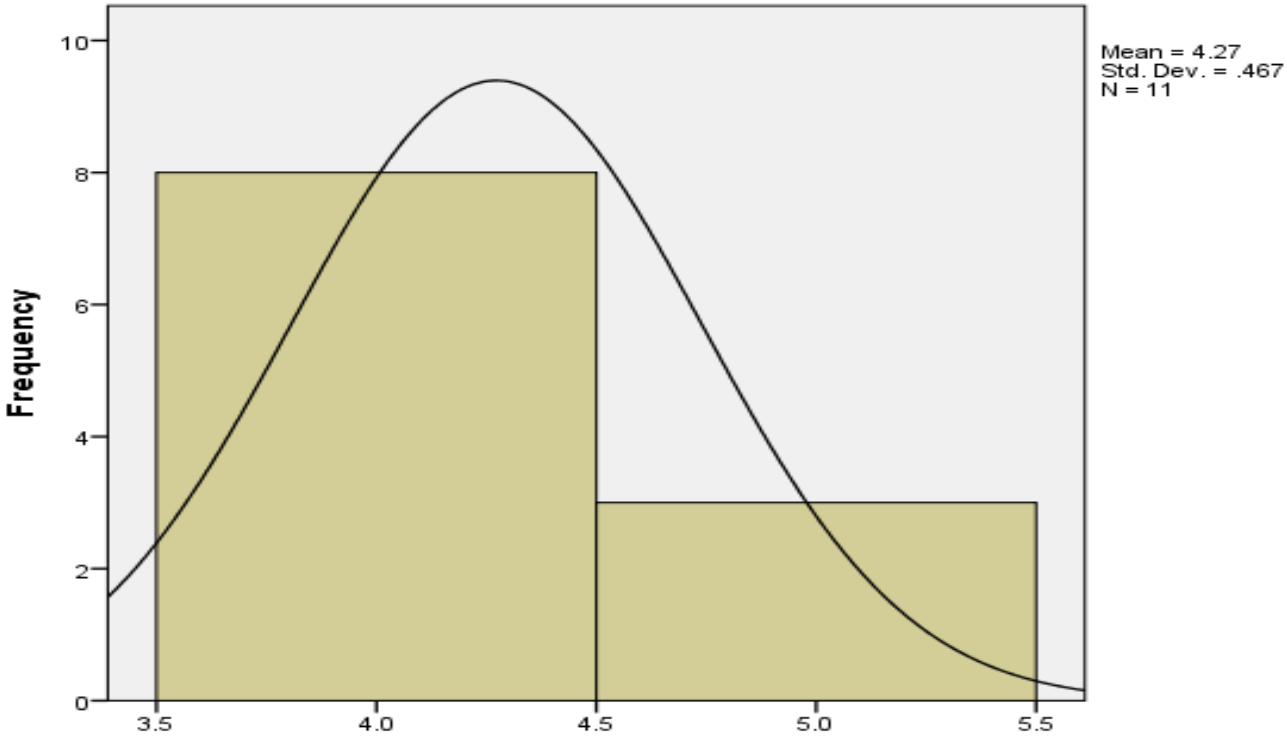
Figure 8.11:   Framework consistency criterion: histogram

The first of the pragmatic (operational) criteria to be evaluated in the validation process was the conciseness of the structure and content of the framework.
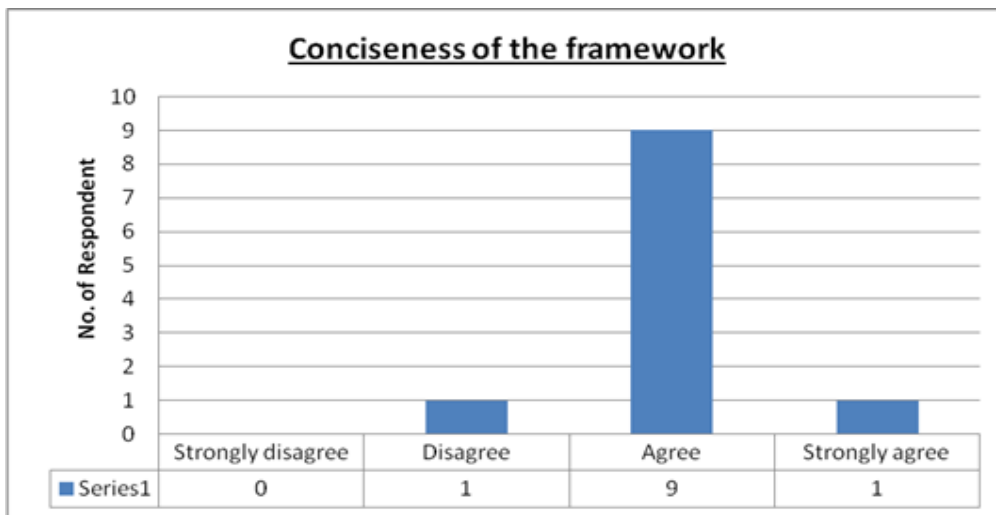
Figure 8.12: Ratings of the conciseness of the framework

Respondents were asked to rate how far they agreed that the scope and content of the framework was appropriate to the delivery of hospital cleaning services for the control of exogenous HCAIs. Analysis of the responses indicated that nine of the 11 respondents, representing 82% of the total, agreed that the scope and content of the framework was sufficient for the control of exogenous HCAIs in facilities management cleaning services, while two respondents, each representing 9% of the total, disagreed or strongly agreed (see Figure 8.12). However, the overall result suggests that the scope and content of the framework is appropriate for the control of exogenous HCAIs in facilities management cleaning service delivery practice, with a mean value of 4 (see Figure 8.13).
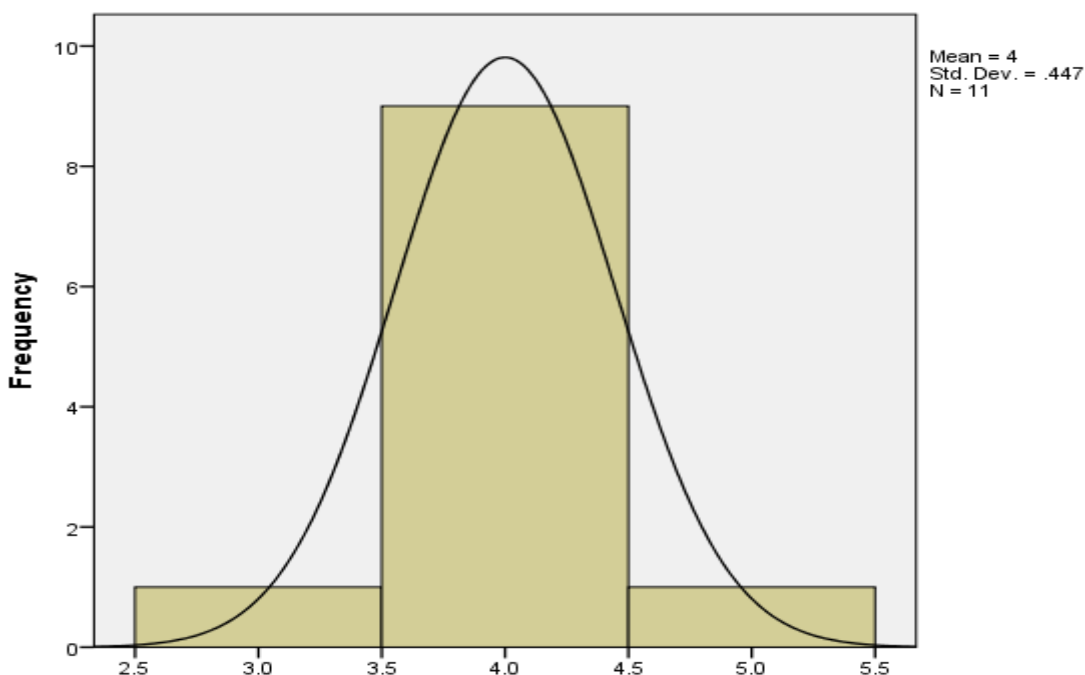
Figure 8.13: Conciseness criterion: histogram

Following the conciseness criterion was the evaluation of the framework illustration criterion (Figure 8.14).

Illustration of the framework

	Strongly disagree	Disagree	Agree	Strongly agree
Series1	0	1	8	2
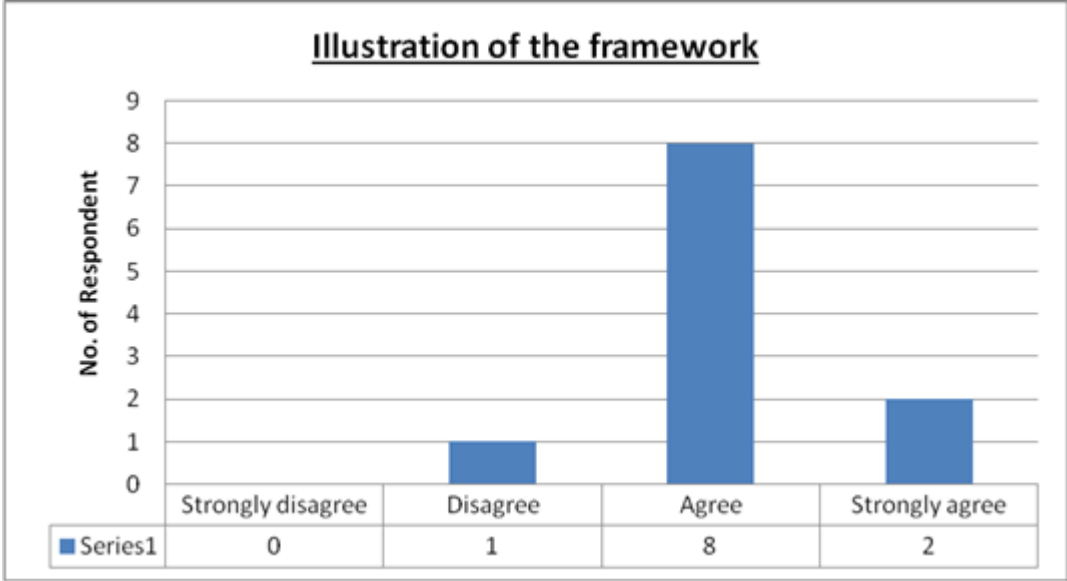
Figure 8.14:   Ratings of the illustration of the framework

This criterion was used to determine the ease with which the framework could be illustrated through presentations, training or references for other stakeholders in control of exogenous HCAIs in facilities management cleaning service delivery. Analysis of the results showed that eight of the 11 respondents (representing 73% of the total) agreed that the framework could easily be illustrated, while two (2 of the respondents representing 18%) strongly agreed and one (9%) disagreed. This criteria had a mean value of 4.09 (Figure 8.15). The findings on this criterion suggested that the framework could be illustrated through presentations and training. However, it requires further simplification, as observed from the responses to the conciseness criteria.
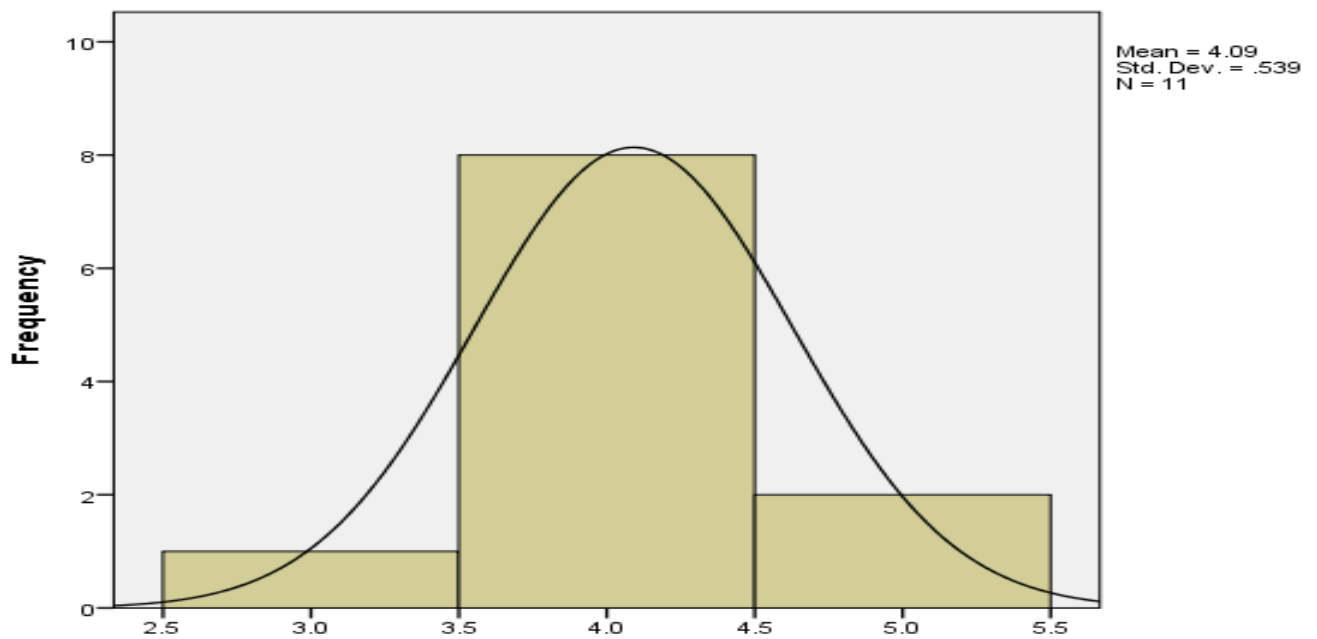
Figure 8.15: Framework illustration criterion: histogram

The last criterion assessed was the practicality of the framework for solving real-life problems (Eppler & Wittig, 2000). This criterion was centred on the evaluation of the practical usefulness of the framework for managing everyday aspects of the knowledge process elements of knowledge creation, storing, sharing and usage in hospital facilities cleaning services for the control of exogenous HCAIs from the perspective of the hospital knowledge infrastructure capabilities, consisting of the prevailing culture, structure and technological capabilities. In order to capture the full scope of the criterion, the question was worded: *"Can the framework be used as a tool to improve good practice knowledge management process in the control of exogenous healthcare associated infection through facilities management cleaning services in hospital?"*.
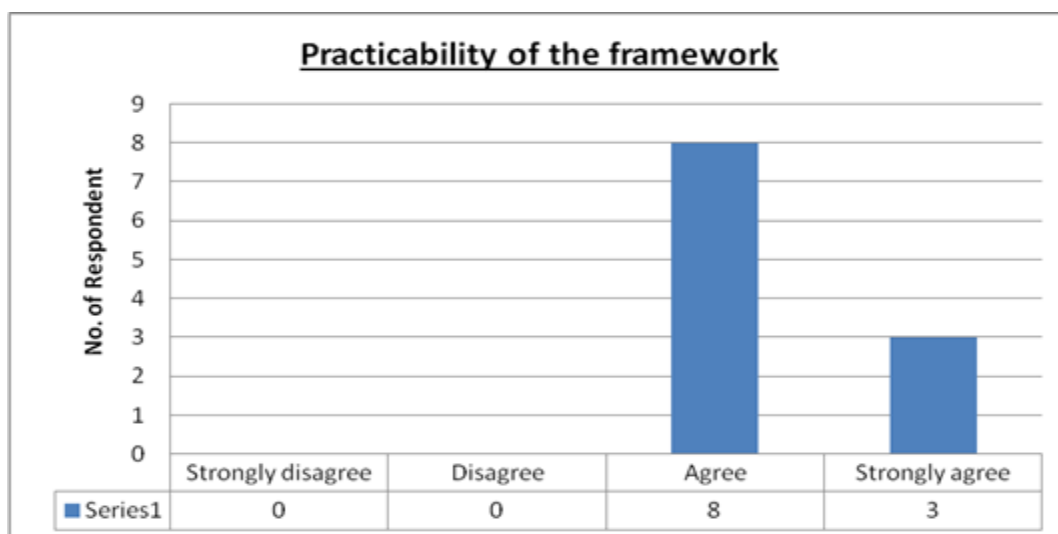
Figure 8.16: Ratings of the practicality of the framework

Analysis of the results showed that eight of the 11 respondents, representing 73% of the total, agreed, while three, representing 27%, strongly agreed that the framework could be used as a tool for improving the good practice knowledge management process in the control of exogenous healthcare-associated infections through facilities management cleaning services in hospitals (Figure 8.16). This criterion achieved a mean value of 4.27 (Figure 8.17). It was thus shown that the framework could be applied as a tool to solving real-life problems in the context of the control of exogenous HCAIs in facilities management cleaning services.
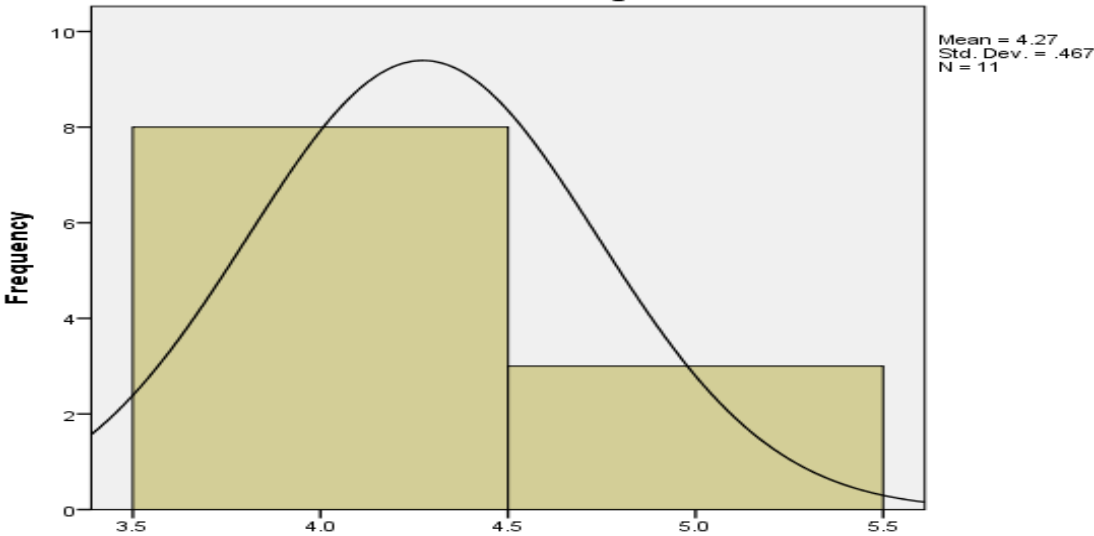
Figure 8.17:   Framework practicality criterion: histogram

8.2.3. **Validation summary**

From the analysis of the criterion mean scores, the application of the framework in the delivery of hospital cleaning services, together with the consistency and practicality of the framework as a tool to improve the good practice knowledge management process in the control of exogenous HCAIs has a joint mean score of 4.27 (Figure 8.18). This was followed closely by a consensus that the framework can easily be illustrated through presentations and training, with a mean value of 4.09. Respondents do not agree completely about the conciseness of the framework and the definition of terms in the framework. These criteria have mean values of 4.00 and 3.92 respectively.

Evaluation Criteria	Focus	Evaluation Questions (questions used in questionnaire)	Mean Value
Analytical (scientific)	Definition	*How well defined are the terms and concepts of the framework in the control of exogenous healthcare associated infection through facilities management cleaning service delivery?*	*3.92*
	Positioning	How well does the framework apply to the delivery of the hospital cleaning service delivery?	*4.27*
	Consistency	*How well do you feel the framework is consistent in solving infection acquire from the hospital environment problem?*	*4.27*
Pragmatic (operational)	Conciseness	Do you feel there are too many elements in the framework?	4.00
	Illustration	*Can the framework be demonstrated easily to others?*	*4.09*
	Practicality	Can the framework be used as a tool to improve good practice knowledge management process in the control of exogenous healthcare associated infection through facilities management cleaning services in hospital?	*4.27*

Figure 8.18:   Analysis of mean scores

8.3. **Chapter summary**

This chapter presents the process used for the modification of the good practice knowledge management framework for the control of exogenous HCAIs in facilities management cleaning service delivery practice in hospitals. The modification of the framework was facilitated by key findings from the literature review and an analysis of the findings from the questionnaire survey and the face-to-face interviews (see Chapters 2, 5 and 6). The framework covers the knowledge management process elements of knowledge creation, storing, sharing and usage in hospital facilities cleaning services for the control of exogenous HCAIs. These were evaluated within the context of the hospital knowledge infrastructure capabilities, consisting of the prevailing culture, structure and technological capabilities. The framework was validated by means of a questionnaire survey of expert opinion (NHS hospital facilities managers) in NHS hospitals in England using the guidance put forward by Eppler & Wittig (2000). This was to assess the framework against analytic (scientific) and pragmatic (operational) criteria (see Table 8.3). Findings from the validation questionnaire were analysed using SPSS Version 23 software and Microsoft Excel, and the results were presented both in histograms and figures. The analysis was based on frequency, percentages and mean values, which were used in the presentation of the findings. The analysis was prefaced by brief background details of the respondents to the questionnaire (see Table 8.2). The results from the questionnaire revealed some areas of concern in the framework at the analytical (scientific) level (see Figure 8.13). This concern relates to the

criteria with low mean scores compared to other criterioa (see Figure 8.18). It was suggested that a flowchart should be created to support the textual interpretation of the framework and facilitate understanding. This suggestion was considered important for the application of the framework as a tool for controlling the prevalence of exogenous HCAIs in facilities management service delivery practice. See Appendix G for details of how this suggestion was implemented.

The next chapter presents overall conclusions and recommendations. This chapter will discuss the research findings in relation to the achievement of the research aim and objectives.

Chapter 9.   **CONCLUSIONS AND RECOMMENDATIONS**

9.1. **Introduction**

This chapter presents overall conclusions and recommendations arising from the research process and the achievement of the research aim and objectives presented in Chapter 1 (see Section 1.7). Chapter 2 discussed findings from the syntheses and review of the literature, which provided the theoretical basis for the overall research process. Following on from Chapter 2, Chapter 3 presented the conceptual framework for the research. This provided a roadmap for the achievement of the research aim and objectives. The research methodology used was discussed in Chapter 4, while Chapters 5 and 6 presented and discussed the findings from the questionnaire survey and the face-to-face interviews respectively. Chapter 7 presented findings from the amalgamation of the discussion in Chapters 5 and 6 within the context of the research aim and objectives. Chapter 7 built on this as a basis for modifying the conceptual framework already presented in Chapter 3. Chapter 8 presented the modified conceptual framework, which accommodates empirical findings from the questionnaire survey, literature review and the face-to-face interviews summarised in Chapter 7. Chapter 8 also presented the validation of the framework, and how it met both analytical (scientific) and pragmatic (operational) criteria as suggested by Eppler & Wittig (2000).

This chapter summarises the key conclusion and recomendations within the context of the achievement of the research aim and objectives. References are made to the relevant sections, tables, and figures in each chapter to support the presentation.

This chapter begins by revisiting the justification for the research and its aim and objectives. This is then followed by a discussion of the contribution made by this to knowledge in the context of both theory and practice, further to that which was demonstrated in the validation process. The chapter concludes with a presentation of the limitations of the research, a generalisation of the research findings, and recommendations for future research.

9.2. **Justification for the research, research aim and objectives**

The research began with the synthesis and review of literature relevant to the research subject area, leading to the development of the research aim, objectives and research questions. Research question 1 was designed to achieve research objective 1 (see Section 1.7.2 and 1.7.1 in Chapter 1). This question provided a basis for the remaining four research questions in achieving the

overall research aim. Research question 1 explored the many hospital infection control (HIC) guidance documents. This question was designed to achieve research objective 1 (see Section 1.7.2 and 1.7.1). Questions in this section investigated and identified the efficacy of the adopted infection control guidance documents, policies and strategies selected from the plethora of documents available to the hospital facilities manager in the delivery of hospital cleaning services. Findings from questions in this section also identified the considerations that informed the choice of a particular HIC document, which are presented in section 7.3.2. in Chapter 7.

To further advance the research process in achieving the overall research aim, research question 2 was designed to achieve research objective 2. It sought to ascertain the prevailing types of contract and the strategies adopted in the delivery of facilities management cleaning services in the control of exogenous HCAIs in NHS hospitals in England (see Section 5.6, 6.6, 6.6.1, 6.6.2, and 7.3). Considering that healthcare service delivery is provided using either directly employed staff, third party (agency) staff, or, as is often the case, a combination of both, it is imperative to ascertain what sort of working arrangement most favours effective good practice knowledge management in the control of exogenous HCAIs in facilities management cleaning services. Answers to this question provided insights into why a particular procurement strategy is adopted for the delivery of facilities management cleaning services, which include those presented in Table 7.4.

Conversely, research question 3 was designed to achieve research objective 3 (see Section 1.7.2, and 1.7.1). This question explored the prevailing level of the working relationship between hospital facilities managers and clinician members of staff in the control of exogenous HCAIs. Findings from this question (see Table 5.9) identified the prevailing level of collaborative practice involving hospital facilities managers in the control of exogenous HCAIs. These findings are further corroborated by findings from the amalgamation of outcomes across the data collected, which is presented in Table 7.10.

Research question 4 was designed to achieve research objective 4 (see Section 1.7.2. and 1.7.1). This question investigated and identified the significance of knowledge management processes, which include knowledge creation, storage, sharing and usage. This was investigated within the hospital knowledge infrastructure capabilities which include the prevailing culture, structure and technological capabilities in the control of exogenous HCAIs in facilities management cleaning services (see Section 2.10, 2.9, 5.7, and 6.7). Based on the perceptions of NHS hospital facilities managers in England, it was suggested that addressing the issues identified (see Table 7.10)

would improve the effective management of good practice knowledge in hospital cleaning services in the control of exogenous HCAIs.

The outcome of this research, captured in the research aim, is the development of an effective good practice knowledge management framework which would assist hospital facilities managers in the delivery of hospital cleaning services for the control of exogenous HCAIs. To achieve this outcome, the researcher structured the research process into five distinct sections, namely:

- ➢ Section 1 -   General information
- ➢ Section 2 -   Good practice guidance document/tools used for infection control
- ➢ Section 3 -   Facilities management procurement strategy
- ➢ Section 4 -   Knowledge management process and infrastructure capabilities protocol
- ➢ Section 5 -   Infection Control Team collaborative practice

These sections are matched with the research questions and objectives, thus enabling the work done in each section to assist in the accomplishment of the relevant objective, and ultimately to lead to the achievement of the overall research aim. Table 7.1 highlights the interface between the research sections and the research questions and objectives formulated in Chapter 1 (see Section 1.7).

The following section presents a summary of how each research objective was met and a brief outline of the research method used in achieving the objective.

9.3. **Objective One**

The second research objective was ***"to identify and evaluate the policies, guidance documents and strategies used in facilities management cleaning service delivery for the control of exogenous HCAIs, identifying the advantages and disadvantages."*** The achievement of this objective started with the syntheses of literature which provided an overview of the chronology of the Department of Health policies and guidance documents relating to cleaning standards since the publication of the NHS Plan (see Section 2.8.2.1. and 6.5). This also provides an insight into the thinking which influenced the revision of these documents, including the development of the role of the ward housekeeper, whose main task could be seen as that of an anchor person, or a bridge between the clinicians, non-clinicians and other stakeholders in the hospital ward environment. Hospital facilities managers were requested in the questionnaire survey to identify the good practice guidance documents they used in the delivery of hospital cleaning services, and to assess their effectiveness. Data obtained from the questionnaire were

first inputted into Microsoft Excel Spreadsheet and checked for possible errors and omissions (data cleaning) before being transferred to SPSS for analysis. The data generated from SPSS were subjected to further analysis using the Relative Importance Index (RII) analytic technique, and presented in graphs and tables using Microsoft Excel (see Chapter 5). In order to achieve the overall research objective, the findings were then explored in the second phase (i.e. the qualitative face-to-face interviews) among hospital facilities managers to ascertain the reasons for choosing the document. Data obtained from this phase of the research were thematically analysed using NVivo 2 and presented in graphs and tables. The findings from the questionnaire, face-to-face interviews and the literature provided a context for the achievement of this objective (see section 7.5.1). It was found that NHS hospital facilities managers in England often prefer to use their own bespoke good practice guidance document in the first instance (See Table 5.3) in the delivery of hospital cleaning services. One of the reasons for using a bespoke guidance document is for auditing ongoing practices to ensure that statutory KPIs against which annual inspections by the regulatory authority are benchmarked are met (see Section 6.5.2.1). In the analysis of the various guidance documents, it was noted that no one document encompass all the KPIs that hospitals are expected to achieve in order to demonstrate compliance with statutory safe and good practice standards. Bespoke guidance documents came top of the documents used in the findings from the face-to-face interviews. A further summary of key findings around this objective and how it was achieved within the context of the research aim is presented in Sections 7.3, and 7.3.2 in Chapter 7

9.4. **Objective Two**

The first objective of the research was *"to identify the prevailing procurement strategies in the delivery of hospital cleaning services, and the interface with effective knowledge management protocol for the control of exogenous HCAIs."* This objective involves investigating the current hospital cleaning procurement strategy in the delivery of hospital cleaning services in order to ascertain the extent to which a particular strategy is used in the delivery of hospital cleaning services in order to achieve the overall aim of the research. The investigation was centred on the three methods of sourcing services, i.e., outsourcing, in-housing or a combination of both. To ascertain the preferred option used by NHS hospitals, hospital facilities managers were requested to identify the method that best described their approach in the first phase of the research sequential explanatory mixed methodological strategy, which commenced with quantitative questionnaire survey (See Section 5.6.1). The data from the questionnaire were first inputted into

Microsoft Excel Spreadsheet and checked for possible errors and omissions (data cleaning) before been transferred to SPSS for analysis.

The results from the questionnaire survey were further explored in the second phase of the research methodological strategy, which was the qualitative face-to-face interviews. This was to further understand the extent to which a particular approach identified from the analysis of the questionnaire survey (see Table 5.5) could influence the effective knowledge management process within the prevailing hospital culture, structure and technological capabilities in the control of exogenous HCAIs. This was achieved by the use of semi-structured interview questions (see Appendix E). According to Creswell (2014), in the sequential explanatory mixed method strategy, the researcher starts with the collection of quantitative (survey) data, followed by the analysis of the results, and the findings are then used to plan (or are built into) the second (qualitative) phase. The author further states that the findings from the first phase should also inform the type of participants to be purposefully selected for the qualitative phase, as well as the type of question to be asked of the participants (see Section 4.4.7.3). The findings presented in Figure 6.3 from the face-to-face enquiry showed that 70% of the respondents reported using directly employed in-house staff in the delivery of their hospital cleaning services. This corroborates the results from the questionnaire survey, where 39% used this strategy for the provision of hospital cleaning services. Figure 6.4 presents the considerations which influenced the choice of a particular procurement strategy in the delivery of cleaning services in NHS hospitals in England as expressed by the interviewees. A discussion of this is presented in section 6.6.1.

Three theories, namely the Public Choice, Property Right and Industrial theories were used to interpret the emerging findings from across the data collection tools. It was observed that the same influencing considerations for the choice of providing hospital cleaning services using directly employed in-house staff identified by the interviewees contrast the basis under which the UK government has used over the years for advocating the outsourcing of hospital cleaning services. This suggests that effective good practice knowledge management for the control of exogenous HCAIs could be better achieved by using directly employed in-house staff in the delivery of hospital cleaning services. Other positive factors associated with the use of this procurement strategy to achieve the overall research aim include those listed in Figure 6.2.

9.5. Objective Three

The third objective of this research was to *"to critically evaluate the role of the facilities manager within the infection control team in the control of exogenous HCAIs."* This objective sought to evaluate the level of hospital facilities managers' involvement to ascertain the extent to which their expert opinion is taken into consideration by clinician members of the Infection Control Team when designing bespoke measures for the control of exogenous HCAIs. The achievement of this objective started with an extensive review of the literature to identify clinician and non-clinician members/stakeholders in the infection control team, and the role of the hospital facilities manager in the control of exogenous HCAIs (see Section 2.6. 2.6.1, 2.8, 2.8.1 and 2.8.2). Further exploration of the findings from the literature an d the questionnaire survey completed by NHS hospital facilities managers sought to get their perspectives in order to ascertain the extent of their involvement (see Section 5.8). Data obtained from the questionnaire were first inputted into Microsoft Excel Spreadsheet and checked for possible errors and omissions (data cleaning) before being transferred to SPSS for analysis. The data generated from SPSS were presented in a table using Microsoft Excel (see Section Table 5.9). This objective was achieved in the first phase of the research data collection. Findings from the data analysis pointed to a high level of involvement on the part of facilities manager (see Table 5.9). This could be perceived as an acceptance of the contribution of the care environment, and the facilities management practice especially in the area of soft FM role in the control of exogenous HCAI, which corroborates what is said in the literature (see Section 2.4.3). The overall achievement of this objective within the context of the discussion of findings across the data collection instruments is presented in Section 7.6.

9.6. Objective Four

The fourth objective of this research was to *"to critically investigate the challenges that inhibit effective knowledge management processes in hospital facilities cleaning services within the hospital structure, prevailing culture and technological capabilities."* This objective is the bedrock of this research. It requires the investigation of current issues relating to the process elements of knowledge creation, storing, sharing and usage in hospital facilities cleaning services for the control of exogenous HCAI from the perspective of the hospital knowledge infrastructure capabilities, consisting of the prevailing culture, structure and technological capabilities. The foundation on which this objective could be achieved is the fulfilment the first two objectives. The first of these was to ascertain the current procurement methods of hospital cleaning services, and the factors which influenced this choice, as well as to investigate other factors or

considerations which could impede or facilitate the adopted procurement strategy (see Section 5.6.4, 5.6.5, 6.7.2 and 6.7.5). The second objective was to investigate the good practice guidance documents used in the delivery of hospital cleaning services in the control of exogenous HCAIs. As in the case of the first objective, factors underlying the choice of a particular guidance document were investigated (see Section 6.4.1, 6.5, 6.5.2 and 6.5.3). Sections 5.6 and 6.7 respectively present the achievement of this objective from the quantitative and the qualitative perspectives. Findings from this objective, which took into consideration objectives 1, 2 and 3, are presented in Tables 7.6, 7.7, 7.8 and 7.9. This objective was fully achieved in section 7.5, and is summarised in Table 7.10.

9.7. **Objective Five**

The fifth and final objective of the research was *"to develop and validate an effective knowledge management framework for the control of exogenous healthcare-associated infections (HCAIs) in facilities management cleaning services."* The conceptual framework was developed on the basis of the analysis of findings across the three data collection instruments summarised and presented in Chapter 7 (see Figure 4.14 and Table 7.10). The validation of the framework was based on the principles outlined by Eppler & Wittig, (2000), using a purposely sampling technique which solicited 23 expert opinions through a questionnaire survey using open and closed-ended questions (see Appendix F). 11 of the questionnaires were fully completed by hospital facilities managers in NHS hospitals in England (see Table 8.2). Data from the questionnaire was subjected to statistical analysis using SPSS Version 23 and further analysed using descriptive data analysis, and the results were presented in tables and figures. The result from the analysis of the questionnaire indicated that the framework met both the analytical (scientific) and pragmatic (operational) criteria proposed by Eppler & Wittig (2000) (see Figures 8.5, 8.7, 8.9, 8.11, 8.13, 8.15 and 8.17). One of the respondents had difficulty in understanding some of the terms used in the framework, and suggested a clearer process which gave definitions of some of the terms. This observation and suggestion were considered significant for the successful adoption of the framework for effective knowledge management of good practice within the hospital knowledge infrastructure capabilities in the control of exogenous HCAIs in facilities management cleaning service delivery. The suggestion was taken into consideration, and an improvement to support the element of the framework explained in section 8.1.2 was made to accommodate it to improve the understandability, adaptability and usability of the framework (see Appendix G).

9.8. Contribution to knowledge

The research has examined and provided insights into the interface of knowledge process elements of knowledge creation, storing, sharing and usage in hospital facilities cleaning services for the control of exogenous HCAIs from the perspective of the hospital knowledge infrastructure capabilities, consisting of the prevailing culture, structure and technological capabilities. It can therefore be claimed that the following contributions have been made in this research:

9.8.1. Contribution to practice

The research has developed an evidenced-based framework which encapsulates a process that will enable the the adoption of an effective, adaptable and understandable management of good practice knowledge within the hospital knowledge infrastructure capabilities for the control of exogenous HCAIs in facilities management cleaning service delivery. It has therefore provided:

➢ A systematic and concise set of indicative criteria for the development of good practice knowledge in the control of exogenous HCAIs through the procurement strategy used in the delivery of hospital facilities management cleaning services;

➢ A contemporary and novel evidence-based framework for evaluating and improving the interface between the hospital knowledge infrastructure capabilities and the knowledge management process used in the control of exogenous HCAIs;

➢ A basis for a proactive good practice knowledge management process within the prevailing hospital culture, structure and technological capabilities in the control of exogenous HCAIs in facilities management cleaning services;

➢ A clear understanding of the various components and of how their interrelationship facilitates the enhancement of good practice knowledge processes (see Section 2.9 and 2.10) within the adopted/adapted good practice guidance documents.

9.8.2. Contribution to theory

The research has contributed to theory by identifying gaps and strengths and weaknesses in the good practice guidance documents currently and previously used in the delivery of hospital cleaning services in the control of exogenous HCAIs. This is an area that the researcher had previously (May 2013) recommended for further study.

This research has also provided hospital infection control teams and the research community as a whole with a conceptual map that can be used to structure the good practice knowledge

management processes within prevailing hospital knowledge infrastructure capabilities for the control of exogenous HCAIs in facilities management cleaning services.

9.9. **Generalisation**

This research has been carried out in the context of the healthcare sector, and specifically within facilities management service delivery practice in the control of exogenous healthcare-associated infections in NHS hospitals in England. The interpretation of the results and the framework has also been carried out within these boundaries on the basis of a particular sample size and using a particular research strategy. Therefore, the applicability of the output may not be expressly guaranteed in other fields but should be tested rigorously to validate its usefulness.

9.10. **Limitations of this study**

Limitations are an inevitable part of the research process, and the researcher's ability to deal with limitations appropriately during the research process improves the researcher's proficiency and experience for future research. Limitations affect the degree to which the findings and conclusions can be said to be the truth (Saunders et al., 2012). This study adopts an interpretivist philosophical stance, so findings are coloured by the researcher's interpretation of the perceptions of the social actors, which in this case are NHS hospital facilities managers. This approach is based on the interpretivist axiological stance, which cannot be divorced from the researcher's own values. To mitigate this bias, the researcher has adopted a mixed method strategy, where findings from the literature were used to support the findings from both the questionnaire survey and the face-to-face interviews. This approach has added rigour and validity to the framework developed.

Another limitation of the research was presented by the difficulty of getting the targeted respondents to complete and return the research questionnaire. Unfortunately, this phase of the research happened to coincide with a period of flooding across the UK, which impacted all NHS hospitals in England, some of which were directly affected by the flooding. The questionnaires thus added to the demands on the targeted respondents, additional to those made by an influx of patients affected by the flooding. This natural disaster made the completion of the questionnaire less of a priority for them. In response to this, the researcher used all possible tactics, including follow-up phone calls and an email reminder to encourage the respondents to complete and return the questionnaire. The 41% response rate was thus considered very significant for research within healthcare, which is traditionally a "confidentiality"-driven sector.

In relation to the analysis of the questionnaire data, getting an appointment for the face-to-face interviews to further explore and explain the data presented a further challenge, as the people contacted were not readily available. The approach the researcher eventually used to overcome this challenge was to contact NHS hospital facilities managers at random across England, using the contact details in Binleys online repository (see Section 4.8.2). This eventually led to the researcher having to travel as far as hospitals in London and other parts of England to meet some of the interviewees. After conducting the interview, the researcher then asked the interviewee to recommend another colleague whom the researcher could contact for an interview. This approach led to the researcher being able to conduct a total of 10 interviews.

9.11. Recommendations and conclusion

9.11.1. Recommendations for practitioners

It is recommended that hospitals should focus on the key issues identified in Tables 7.3, 7.4 and 7.7, including:

➢ Developing a culture which places a high value on directly employing competent staff or on engaging skilled contract staff, and which creates and effectively communicates good practice knowledge in the control of exogenous healthcare-associated infections in line with the hospital policies and procedures embodied in the hospital value statement;

➢ The contracted (agency) staff should be committed to the delivery of services in line with hospital policies and procedures;

➢ Developing a departmental structure that comprises separate sectional heads with responsibility for managing key service functions and service level agreements (SLAs) to ensure compliance with standards and that, acquired good practice knowledge is adequately utilized;

➢ Developing a technological interface which facilitates the communication of good practice knowledge in the control of exogenous healthcare-associated infections to all stakeholders;

➢ Bespoke compliance monitoring audit tools developed by the hospital infection control team should have the flexibility to accommodate cultural challenges particular to the region where the hospital is situated. This is because the research showed that hospitals often prefer to use their own guidance tools based on national mandatory guidance documents (see Table 7.2).

9.11.2. Recommendations for academics

➢ An in-depth evaluation of the framework presented here should be undertaken to identify areas of improvement, probably using an increased sample size;

➢ The framework should be extended to enable it to be used as a tool to explore clinician service delivery practice in the control of exogenous HCAIs;

➢ This research should be replicated in other NHS contexts in the UK (e.g, Scotland NHS).

9.12. Concluding observations

This research has examined the knowledge management process elements of knowledge creation, storing, sharing and usage in hospital facilities management cleaning services for the control of exogenous HCAIs from the perspective of the hospital knowledge infrastructure capabilities, consisting of the prevailing culture, structure and technologyical capabilities. The outcome of this research is the development of an effective good practice knowledge management framework (see Figure 8.3). Despite the exhaustive and methodical approach used in this research, it is acknowledged that certain limitations apply.

This chapter has provided an account of how the research objectives were achieved. The chapter also provides a description of the contribution made by this research to the body of knowledge in the context of both practice and theory in the delivery of facilities management cleaning services in NHS hospitals in England (see Section 9.7). .The limitations of this research and how they were overcome by the researcher were also presented in this chapter. Finally, recommendations are made for practitioners and academics in relation to this research for the effective management of good practice knowledge in the control of exogenous HCAIs in facilities management cleaning service delivery.

References

Abidi, S. S. R. (2008). Healthcare knowledge management: The art of the possible. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* (Vol. 4924 LNAI, pp. 1–20). http://doi.org/10.1007/978-3-540-78624-5_1

Adzroe, E. K. (2015). *A Study of E-Business Technology Transfer Via Foreign Direct Investment in The Ghanian Construction Industry*. The University of Salford, England, United Kingdom.

Ahmad, R., & Ali, N. A. (2003). The use of cognitive mapping technique in management research: theory and practice. *Management Research News*, *26*(7), 1–16. http://doi.org/10.1108/01409170310783556

Albaum, G. (1997). The Likert scale revisited : An alternate version. *Journal of the Market Research Society*, *331*(2), 1–12. http://doi.org/DOI:

Alexander, K. (2005). *Facilities Management*. (A. Keith, Ed.). London. Blenheim Business Publications. http://doi.org/10.1007/978-1-4471-4781-7

Alexander, K. (2007). The emergence of facilities management in the United Kingdom National Health Service. *Property Management*, *11*(1), 31–41. http://doi.org/10.1108/EUM0000000003392

Allen, M. (2011). All Wales Monitoring Tool for Cleanliness - Credits 4 Cleaning. *Welsh Health Estate*. Retrieved from http://www.wales.nhs.uk/sites3/Documents/254/2011 Issue 12 FM 02.pdf

Amaratunga, D., Haigh, R., Sarshar, M., & Baldry, D. (2002). Assessment of facilities management process capability: a NHS facilities case study. *International Journal of Health Care Quality Assurance Incorporating Leadership in Health Services*, *15*(6–7), 277–288. http://doi.org/10.1108/09526860210442047

Andrew, S., & Halcomb, E. (2009). *Mixed Methods Research for Nursing and the Health Sciences*. Chichester, England: John Wiley & Sons, Ltd.

Andrew, S. J., & Streifel, A. J. (2007). Hospital facility management in preparation for emerging infectious disease events. *Hospital Engineering & Facilities Management*. Retrieved from http://www.em-online.com/news/article.asp?id=36258

Arksey, H., & Knight, P. T. (1999). Interviewing for Social Scientists: An Introductory Resource

with Examples. *Interviewing for Social Scientists: An Introductory Resource with Examples*. Retrieved from http://books.google.com/books?id=sqckq71cBs0C&pgis=1

Association of Healthcare Cleaning Professionals. (2009). Revised healthcare cleaning manual. *National Patient Safety Agency (NPSA), Association of Healthcare Cleaning Professionals (AHCP), National Reporting and Learning System (NRLS)*, (June 2009). Retrieved (01/07/2013) from http://www.ahcp.co.uk/resources/healthcare-cleaning-manual.html%5Cnhttp://www.ahcp.co.uk/images/stories/pdf-nat-manual/revised-healthcare-cleaning-manual-2009-06-v2.pdf

Atkin, B., & Brooks, A. (2002). *Total facilities management* (3rd ed.). Oxford, England: Blackwell Science.

Auditor General of Scotland. (2000). *A clean bill of Health? A review of domestic services in Scottish hospitals*. Retrieved from http://www.audit-scotland.gov.uk/docs/health/2000/nr_000407_domestic_services_hospitals.pdf

Ayliffe, G. a. (2009). *Ayliffe's control of healthcare-associated infection: A practical handbook.* (P. F. Adam & B. Christina, Eds.) (5th ed). Kent, England. Edward Arnold, UK. Retrieved from http://libcat.uhi.ac.uk/record=b1661563~S18

Ayliffe, G. A. ., Babb, J. ., & Taylor, L. . (1999). *Hospital acquired infection. Principles and prevention* (3rd. ed). Oxford, Egland. Elsevier Butterworth-Heinemann.

Ayliffe, G. A. J. (1992). *Control of hospital infection : a practical handbook* (3rd. ed). London, England. Chapman & Hall.

Azen, R., & Budescu, D. V. (2003). The dominance analysis approach for comparing predictors in multiple regression. *Psychological Methods*, *8*(2), 129–148. http://doi.org/10.1037/1082-989X.8.2.129

Baillie, J. (2009). FM "in fashion" now and for the future. *Health Estate*, *63*, 45–49.

Barlow, J., O'Sullivan, J., & Bora Trimçev. (2011). Global health infrastructure – challenges for the next decade. Delivering innovation, demonstrating the benefits. In *HaCIRIC INTERNATIONAL CONFERENCE 2011* (pp. 1–304).

Barrett, P., Stanley, C., Atkin, B., Brooks, A., & Alexander, K. (2005). *Facilities Management*. (A. Keith, Ed.)*Facilities Management* (2nd ed.). London. Blenheim Business Publications. http://doi.org/10.1007/978-1-4471-4781-7

Barton, A. (2009). Patient Safety and Quality: An Evidence-Based Handbook for Nurses. *AORN Journal*. http://doi.org/10.1016/j.aorn.2009.09.014

Bazeley, P. (2013). *Qualitative Data Analysis: Practical Strategies*. London, England. Sage Publication, Inc.

Bean, S. (2013). Bringing Facilities Management Expertise into Hospital Design. *British Institute of Facilities Management*, *10*(22), 18–21.

Becker, F. (1990). *The Total Workplace*. New York, USA. Van Nostrand Reinhold.

Belcourt, M. (2006). Outsourcing - The benefits and the risks. *Human Resource Management Review*, *16*(2), 269–279. http://doi.org/10.1016/j.hrmr.2006.03.011

Bergeron, B. (2003). *Essentials of knowledge management*. New Jersey. John Wiley & Sons.

Berwick, D. (2013). A promise to learn – a commitment to act Improving the Safety of Patients in England. Retrieved August 15, 2015, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/226703/Berwick_Report.pdf

Bigliardi, B., & Dormio, A. I. (2010). A balanced scorecard approach for R&D: evidence from a case study. *Facilities*, *28*(5/6), 278–289. http://doi.org/10.1108/02632771011031510

Blaikie, N. (2000). *Designing Social Research* (2nd ed.). Stockport, England: MPG Books Group.

Blaikie, N. (2010). *Research Methods for Business Students,* (2nd ed.). Stockport, England: MPG Books Group.

Bland, J. M., & Altman, D. G. (1997). Cronbach's alpha. *BMJ (Clinical Research Ed.).* http://doi.org/10.1136/bmj.314.7080.572

Bordoloi, P., & Islam, N. (2012). Knowledge Management Practices and Healthcare Delivery : A Contingency Framework. *Electronic Journal of Knowledge Management*, *10*(2), 110–120.

British Broadcasting Corporation. (2008). End private cleaning in NHS call. Retrieved from http://news.bbc.co.uk/1/hi/health/7372992.stm

British Broadcasting Corporation. (2013). The changing NHS: The NHS in England is in the middle of the biggest reorganisation since its creation. Retrieved August 10, 2015, from http://www.bbc.co.uk/news/health-19674838

British Institute of Facilities Management. (2004). *Rethinking Facilities management: Accelerating change through best practice*. England. Retrieved from http://bse.sagepub.com/content/27/2/153.short%5Cnwww.bifm.org.uk/bifm/filegrab/1RethinkingFMSurveyReport.pdf?

British Institute of Facilities Management. (2014). What is Facilities Management. *British Institute of Facilities Management*.

British Institute of Facilities Management. (2015). NHS Property Services partner with BIFM for professional development and membership for FM employees. *British Institute of Facilities Management*, *14*(1). Retrieved from http://www.bifm.org.uk/bifm/news/7335

British Institute of Facilities Management. (2016). NHS trust raises cleaning issues with G4S. *British Institute of Facilities Management*, *13*(1), 7.

British Medical Association. (2015). The structure of the new NHS. Retrieved August 10, 2015, from http://bma.org.uk/working-for-change/doctors-in-the-nhs/nhs-structure-new

British Standards Institution. (2014). Standard for providing a clean and safe hospital environment is revised. Retrieved from http://www.bsigroup.com/en-GB/about-bsi/media-centre/press-releases/2014/December-2014/Standard-for-providing-a-clean-and-safe-hospital-environment-is-revised/#.V4fmtvm-1cZ

Britten, N. (1995). Qualitative interviews in medical research. *BMJ (Clinical Research Ed.)*, *311*(6999), 251–253. http://doi.org/10.1136/bmj.311.6999.251

Brooker, C., & Gould, D. (2008). *Infection Prevention and Control* (2nd.ed). London, England. Palgrave Macmillan.

Bryman, A. (2012). *Social Research Methods*. *Social Research Methods*.

Burgess, T. F. (2001). A general introduction to the design of questionnaires for survey research. *Information Systems Services*.

Burnham, M. J. (1994). *Integrated Facilities Management*. New York, USA. Irwin Professional Publishing.

Cameron, D. (2014). Resistance to Antibiotics is "a very real and worrying threat. Retrieved from http://www.bbc.co.uk/news/health-28098838

Cantrell, S. (2010). INFECTION PREVENTION. Wiping out the bugs with environmental cleaning. *Healthcare Purchasing News*, *34*, 24–30. Retrieved (17/08/2013) from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=55215443&site=bsi-live

Care Quality Commission. (2010). *Essential Standards of Quality and Safety*. Retrieved from http://www.cqc.org.uk/sites/default/files/documents/guidance_about_compliance_summary.pdf

Care Quality Commission. (2015). *Guidance for providers on meeting the regulations*. Retrieved 07/02/2014) from http://www.cqc.org.uk/sites/default/files/20150324_guidance_providers_meeting_regulations_01.pdf

Carley, N. (2012). *Strategic outsourcing in the NHS: Beyond ideology and money?* Retrieved from http://www.synergyhealthplc.com/sites/default/files/Strategic outsourcing in the NHS-beyond ideology and money.pdf

Carling, P. C., Parry, M. M., Rupp, M. E., Po, J. L., Dick, B., & Von Beheren, S. (2008). Improving cleaning of the environment surrounding patients in 36 acute care hospitals. *Infection Control and Hospital Epidemiology : The Official Journal of the Society of Hospital Epidemiologists of America*, *29*(11), 1035–1041. http://doi.org/10.1086/591940

Chotipanich, S. (2004). Positioning facility management. *Facilities*, *22*(13/14), 364–372. http://doi.org/10.1108/02632770410563086

Clancy, C. (2013). Creating a Healing Environment. *Health Environment Research and Design*, *7*, 5. Retrieved from http://digimags.vendomegrp.com/html/HERD-Supplement/HERD_Special.pdf

Codinhoto, R., Aouad, G., Kagioglou, M., Tzortzopoulos, P., & Cooper, R. (2009). Evidence-based design of health care facilities. *Journal of Health Services Research and Policy*, *14*(4), 194–196. http://doi.org/10.1258/jhsrp.2009.009094

Collis, J., & Hussey, R. (2014). *Business Research: a practical guide for undergraduate and postgraduate students* (4th ed.). Basingstoke, England. Palgrave Macmillan.

Conservative Party. (1983). *The Challenge of our Times: Conservative Party Manifesto*. London: Conservative Party. Retrieved from http://www.conservativemanifesto.com/1983/1983-conservative-manifesto.shtml

Creswell, J. W. (2013). *Qualitative Inquiry & Research Design: Choosing Among Five Approached. Qualitative Inquiry and Research Design*. London, England. Sage Publication, Inc.

Creswell, W. J. (2014). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches,* (3rd ed.). London, England. Sage Publication, Inc.

Creswell, W. J., & Plano Clark, V. (2008). *The Mixed Methods Research*. London, England. Sage Publication, Inc.

Crossan, F. (2003). Research Philosophy: Towards an Understanding, *Nursing Research*, *11*(1), 46–55. http://doi.org/10.7748/nr2003.10.11.1.46.c5914

Crotty, M. (2003). *The Foundations of Social Research: Meaning and Perspective in the Research Process*. London, England. Sage Publication, Inc.

Curtis, L. T. (2008). Prevention of hospital-acquired infections: review of non-pharmacological interventions. *Journal of Hospital Infection*, *69*(3), 204–219. http://doi.org/10.1016/j.jhin.2008.03.018

Dancer, S., J. (2009). The role of environmental cleaning in the control of hospital-acquired infection. *Journal of Hospital Infection*, *73*(4), 378–385. http://doi.org/10.1016/j.jhin.2009.03.030

Dancer, S. . (2004). How do we assess hospital cleaning? A proposal for microbiological standards for surface hygiene in hospitals. *Journal of Hospital Infection*, *56*(1), 10–15. http://doi.org/10.1016/j.jhin.2003.09.017

Dancer, S. J. (1999). Mopping up hospital infection. *Journal of Hospital Infection*, *43*(2), 85–100. http://doi.org/10.1053/jhin.1999.0616

Dancer, S. J. (2011). Hospital cleaning in the 21st century. *European Journal of Clinical Microbiology and Infectious Diseases*, *30*(12), 1473–1481. http://doi.org/10.1007/s10096-011-1250-x

Davies, S. (2005). *Hospital contract cleaning and infection control*. Retrieved from http://www.newunionism.net/library/member contributions/Davies - Hospital Contract Cleaning and Infection Control - 2005.pdf

Davies, S. (2010). Fragmented management, hospital contract cleaning and infection control. *Policy & Politics*, *38*(3), 445–463. http://doi.org/10.1332/030557310X488493

Davis, K., Schoen, C., & Stremikis, K. (2014). *How the Performance of the U.S. Health Care System Compares Internationally*. *Commonwealth Fund*.

Dawson, C. (2007). *A Practical Guide to Research Methods* (3rd. ed). Oxford, England: How To Content.

Day, P., & Klein, R. (2004). *The NHS Improvers A study of the Commission for Health Improvement*. Retrieved from file:///C:/Users/pxp892/Dropbox/All Salford PhD resources/Govt. Reports/nhs-improvers-study-commission-health-improvement-day-klein-feb04.pdf

De Angelis, G., Murthy, A., Beyersmann, J., & Harbarth, S. (2010). Estimating the impact of healthcare-associated infections on length of stay and costs. *Clinical Microbiology and Infection : The Official Publication of the European Society of Clinical Microbiology and Infectious Diseases*, *16*(12), 1729–35. http://doi.org/10.1111/j.1469-0691.2010.03332.x

De Toni, F. A., Ferri, A., & Montagner, M. (2009). *Open Facilities Management: A Successful Implementation in A Public Administration*. Milan, Italy. IFMA.

Dell, C. O., Grayson, C. J., & O'Dell, C. (1998). If only we knew what we know: Identification and transfer of internal best practices. *California Management Review*, *40*(3), 154–175. http://doi.org/10.2307/41165948

Denscombe, M. (2010). *The Good Researcher Guide for small-scale social research projects* (4th ed.). Maidenhead, England. Open University Press.

Department of Health. (1998). *Resistance to Antibiotics and other Antimicrobial agents*. Retrieved (02/03/2014) from https://www.gov.uk/government/publications/resistance-to-antibiotics-and-other-antimicrobial-agents

Department of Health. (2000). *The NHS plan*. *HMSO* (Vol. 321). Retrieved (26/08/2013) from http://www.bmj.com/content/321/7257/315.short

Department of Health. (2002). *Getting ahead of the curve: a strategy for combating infectious diseases (including other aspects of health protection)*. Retrieved (06/06/2013) from http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4060875.pdf%5Cnhttp://webarchive.nationalarchives.gov.uk/+/dh.gov.uk/en/consultations/closedconsultations/

Department of Health. (2003a). *Standards of Cleanliness in the NHS: A framework in which to Measure Performance Outcomes*. HMSO London.

Department of Health. (2003b). *Working together to reduce Healthcare Associated Infection in England* (Vol. 2014). Retrieved (12/08/2013) from http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4064689.pdf

Department of Health. (2004a). *A Matron ' s Charter : An Action Plan for Cleaner Hospitals*. Retrieved (01/12/2013) from http://www.rdehospital.nhs.uk/docs/patients/services/housekeeping_services/Matrons charter doc.pdf

Department of Health. (2004b). Winning ways. *Journal of Hospital Infection*, *58*(4), 245–246. http://doi.org/10.1016/j.jhin.2004.09.001

Department of Health. (2005a). *Commission for Healthcare Audit and Inspection (CHAI) and Healthcare Commission*. Retrieved 17/12/2013) from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/235211/0373 .pdf

Department of Health. (2005b). *Saving Lives: a delivery programme to reduce healthcare associated infection including MRSA.*

Department of Health. (2006a). *Code of Practice for the Prevention and Control of Health Care Associated Infections*. Retrieved from http://webarchive.nationalarchives.gov.uk/20130107105354/http:/www.dh.gov.uk/prod_con sum_dh/groups/dh_digitalassets/@dh/@en/@ps/documents/digitalasset/dh_133495.pdf

Department of Health. (2006b). *Essential steps to safe, clean care: reducing healthcare-associated infections*. Retrieved (13/02/2014) from http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Publicationsandstatistics/P ublications/PublicationsPolicyAndGuidance/DH_4136212

Department of Health. (2008a). Board to Ward: How to embed a culture of HCAI prevention in acute trusts. London, Department of Health. Retrieved from www.orderline.dh.gov.uk

Department of Health. (2008b). *Clean , safe care Reducing infections and saving lives*. *09 Jan 2008*. Retrieved (13/02/2014) from http://antibiotic-action.com/wp-content/uploads/2011/07/DH-Clean-safe-care-v2007.pdf

Department of Health. (2009). *NHS Health and Well-being*. *British Journal of Cancer* (Vol. 105 Suppl). Retrieved (13/02/2014) from http://www.ncbi.nlm.nih.gov/pubmed/21218363

Department of Health. (2011). *prevention and control of healthcare-associated infections (HCAI) in secondary care settings.*

Department of Health. (2012). The Winterbourne View Review: Good practice examples. Retrieved August 15, 2015, from

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213219/good
-practice-examples.pdf

Department of Health. (2013a). *Environment and sustainability Health Technical Memorandum 07-01: Safe management of healthcare waste*. Retrieved (12/02/2014) from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/167976/HTM_07-01_Final.pdf

Department of Health. (2013b). Health Building Note 00-01: General design principles. Retrieved June 25, 2014, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/147842/HBN_00-01_Final.pdf

Department of Health. (2013c). *Hospital Estates and Facilities Statistics 2012 to 2013*. Retrieved from https://www.gov.uk/government/publications/report-on-hospital-estates-and-facilities-statistics-2012-to-2013

Department of Health. (2013d). The NHS Constitution: the NHS belongs to us all. *www.nhs.uk/choiceintheNHS/Rightsandpledges/NHSConstitution*, (March), 1–16. http://doi.org/26 March 2013

Department of Health. (2014a). Hard Truths: The Journey to Putting Patients First - Volume One of the Government Response to the Mid Staffordshire NHS Foundation Trust Public Inquiry. Retrieved August 15, 2015, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/270368/34658_Cm_8777_Vol_1_accessible.pdf

Department of Health. (2014b). HBN 00-01: General Design Guidance for Healthcare Buildings. *2013*, (March). Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/316247/HBN_00-01-2.pdf

Department of Health. (2014c). *The NHS Premises Assurance Model (NHS PAM)*. Retrieved (14/02/2014) from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/226721/August_2013_NHS_PAM_Guidance_FINAL.pdf

Department of Health. (2016). *The NHS Premises Assurance Model (NHS PAM)*. Retrieved (13/12/2016) from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/496362/NHS _Premises_Assurance_Model_guidance_2016_A.pdf

Department of Health and Social Security. (1983). *Competitive tendering in the provision of domestic, catering and laundry services, Circular HC (83) 18 (applicable to England and Wales)*. London: HMSO.

Dixon, J., Dewar, S., & Department of Health. (2000). *The NHS plan*. *HMSO* (Vol. 321). Retrieved (29/04/2014) from http://www.bmj.com/content/321/7257/315.short

Doloi, H., Sawhney, A., Iyer, K. C., & Rentala, S. (2012). Analysing factors affecting delays in Indian construction projects. *International Journal of Project Management*, *30*(4), 479–489. http://doi.org/10.1016/j.ijproman.2011.10.004

Domberger, S., & Rimmer, S. (1994). Competitive Tendering and Contracting in the Public Sector: A Survey. *International Journal of the Economics of Business*, *1*(3), 439–453. http://doi.org/10.1080/758536232

Donahue, J. (1989). *The Privatization Decision: public ends private means*. New York: Basic Books.

Duffy, J. (2000). Knowledge management: to be or Not to be? *Information Systems Management*, *34*(1), 64. http://doi.org/10.1146/annurev.polisci.11.060606.135342

Easterby-Smith, M. (2015). The SAGE Dictionary of Qualitative Management Research. *The SAGE Dictionary of Qualitative Management Research*, 44–46. http://doi.org/10.4135/9780857020109

Easterby-Smith, M., Thorpe, R., & Jackson, P. (2012). *Management Research* (4th ed.). London, England. Sage Publication, Inc.

Edwards, V., & Ellison, L. (2004). *Corporate Property Management: Aligning real estate with business strategy*. Oxford, England: Blackwell Science.

England, I., & Stewart, D. (2007). Executive management and IT innovation in health: identifying the barriers to adoption. *Health Informatics Journal*, *13*(2), 75–87. http://doi.org/10.1177/1460458207076462

Eppler, M. J., & Wittig, D. (2000). Conceptualizing Information Quality : A Review of Information Quality Frameworks from the Last Ten Years Goals of an Information Quality Framework. *Proceedings of the 2000 Conference on Information Quality*, 1–14.

European Centre For Disease Prevention and Control. (2012). *Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. Protocol 4.3*. Stockholm. Retrieved (08/09/2015) from http://www.ecdc.europa.eu/en/publications/_layouts/forms/Publication_DispForm.aspx?ID =865&List=4f55ad51-4aed-4d32-b960-af70113dbb90

European Commission. (2014). Quality of healthcare in Europe. Retrieved (17/02/2015) from http://ec.europa.eu/unitedkingdom/press/frontpage/2014/14_58_en.htm

Fellows, R., & Liu, A. (2003). *Research Methods for Construction* (2nd ed.). Oxford, England: Blackwell Publishing.

Fink, A. (2003). *How to Manage, Analyze, and Interpret Survey Data* (2nd ed.). London, England. Sage Publication, Inc.

Flick, U. (2014). *An introduction to qualitative research*. London: Sage Publication Ltd.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*. http://doi.org/10.1177/1077800405284363

Fugar, F., & Agyakwah-Baah, A. (2010). Delays in Building Construction Projects in Ghana. *Australasian Journal of Construction Economics and Building*, *10*(2), 103–116. Retrieved from http://search.informit.com.au/documentSummary;dn=308134427310874;res=IELENG

Gans, D. N. (2012). Getting ahead of the cost curve. *MGMA Connexion / Medical Group Management Association*, *12*(2), 17–8. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24735028

George, S. Z., Coronado, R. a, Beneciuk, J. M., Valencia, C., Werneke, M. W., & Hart, D. L. (2011). Depressive symptoms, anatomical region, and clinical outcomes for patients seeking outpatient physical therapy for musculoskeletal pain. *Physical Therapy*, *91*(3), 358–72. http://doi.org/10.2522/ptj.20100192

Ghosh, B., & Scott, J. E. (2006). Effective Knowledge Management Systems for a Clinical Nursing Setting. *Information Systems Management*, *24*(1), 73–84. http://doi.org/10.1080/10580530601038188

Ghosh, B., Scott, J. E., Judy, S., & Ghosh, B. (2006). Effective Knowledge Management Systems for a Clinical Nursing Setting. *Information Systems Management*, *24*(1), 73–84. http://doi.org/10.1080/10580530601038188

Gibson, W., & Brown, A. (2009). Working with Qualitative Data. In *Working with Qualitative Data* (pp. 15–33). http://doi.org/10.4135/9780857029041

Gillespie, E. E., Scott, C., Wilson, J., & Stuart, R. (2012). Pilot study to measure cleaning effectiveness in health care. *American Journal of Infection Control*, *40*(5), 477–478. http://doi.org/10.1016/j.ajic.2011.06.010

Gillespie, E., Wilson, J., Lovegrove, A., Scott, C., Abernethy, M., Kotsanas, D., & Stuart, R. L. (2013). Environment cleaning without chemicals in clinical settings. *American Journal of Infection Control*, *41*(5), 461–463. http://doi.org/10.1016/j.ajic.2012.07.003

Girard, R., Perraud, M., Pruss, A., Savey, A., Tikhomirov, E., Thuriaux, M., & Vanhems, P. (2002). *Prevention of hospital-acquired infections: A practical guide*. *World Health*. Retrieved from http://apps.who.int/medicinedocs/documents/s16355e/s16355e.pdf

Gold, A., Malhotra, A., & Segars, A. (2001). Knowledge management: An organizational capabilities perspective. *JOURNAL OF MANAGEMENT INFORMATION SYSTEMS*, *18*(1), 185–214. http://doi.org/10.1002/ceat.201000522

Gorelick, C., Milton, N., & April, K. (2004). *Performance through learning: Knowledge management in practice*. Oxford, Egland. Elsevier Butterworth-Heinnemann.

Görg, H., & Hanley, A. (2004). Does outsourcing increase profitability? *Economic and Social Review*, *35*(3), 267–288.

Gosling, J. ., Naim, M. ., Fearne, A. ., & Fowler, N. (2007). Defining the lean and agile characteristics of engineer-to-order construction projects. In *CME 2007 Conference - Construction Management and Economics: "Past, Present and Future"* (Vol. 1, pp. 773–785). Reading, UK. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-84877592573&partnerID=40&md5=526172bddf7a94f969a5728473db7f03

Gould, D. (2007). The challenge of healthcare-associated infection outside hospital. *British Journal of Community Nursing*, *12*(5), 212–5. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17551454

Gould, D. J., Drey, N. S., Millar, M., Wilks, M., & Chamney, M. (2009). Patients and the public: knowledge, sources of information and perceptions about healthcare-associated infection. *The Journal of Hospital Infection*, *72*(1), 1–8. http://doi.org/10.1016/j.jhin.2009.01.024

Gray, P. H. (2001). A problem-solving perspective on knowledge management practices. *Decision Support Systems*, *31*(1), 87–102. http://doi.org/10.1016/S0167-9236(00)00121-4

Grayson, R. (2012). If only we knew what we know ! In *Knowledge Management* (p. 47). http://doi.org/10.2307/2295469

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a Conceptual Framework for Mixed-Method Evaluation Designs. *Educational Evaluation and Policy Analysis*, *11*(3), 255–274. http://doi.org/10.3102/01623737011003255

Griffiths, P., Renz, A., Hughes, J., & Rafferty, A. M. (2009). Impact of organisation and management factors on infection control in hospitals: a scoping review. *Journal of Hospital Infection*, *73*(1), 1–14. http://doi.org/10.1016/j.jhin.2009.05.003

Guba, E. G., & Lincoln, S. Y. (1994). *Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (pp. 105-117).* London: Sage Publication.

Gündüz, M., Nielsen, Y., & Özdemir, M. (2013). Quantification of Delay Factors Using the Relative Importance Index Method for Construction Projects in Turkey. *Journal of Management in Engineering*, *29*(April), 133–139. http://doi.org/10.1061/(ASCE)ME.1943-5479.0000129.

Haggard, L., & Hosking, S. (2002). *Healing the Hospital Environment: Design, Management and Maintenance of Healthcare Premises (Google eBook)*. London, England, E & FN SPON. Retrieved from http://books.google.com/books?id=xo5WGzOQPYAC&pgis=1

Handley, S. M., & Benton, W. C. (2009). Unlocking the business outsourcing process model. *Journal of Operations Management*, *27*(5), 344–361. http://doi.org/10.1016/j.jom.2008.11.002

Hannagan, T. (1997). *Mastering Statistics* (3rd ed.). London, England. Palgrave Macmillan.

Hantikainen, V. (2001). Nursing staff perceptions of the behaviour of older nursing home residents and decision making on restraint use: a qualitative and interpretative study. *Journal of Clinical Nursing*, *10*(2), 246–56. http://doi.org/10.1046/j.1365-2702.2001.00468.x

Health Estate. (2015). Ensuring cleaning's effectiveness. *Health Estate*, *59*(3), 41–43.

Health Protection Agency. (2008). *Trends in rates of Healthcare Associated Infection in England 2004 to 2008. Healthcare Protection Agency*. London, England.

Health Protection Agency. (2012a). *Guidelines for the management of norovirus outbreaks in acute and community health and social care settings*.

Health Protection Agency. (2012b). Health Care Associated Infection Operational Guidance and Standards for Health Protection Units. Retrieved (21/05/2015) from http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317134940540

Health Protection Agency. (2012c). Healthcare-Associated Infection and Antimicrobial Resistance : 2010 / 11. *HPA UK*. Retrieved from http://www.hpa.org.uk/Publications/InfectiousDiseases/Antimicrobial And Healthcare Associated Infections/1208HCAIantimicrobialresistance20102011/

Health Protection Agency. (2014). Healthcare Associated Infections (HCAI). Health Protection Agency, 151 Buckingham Palace Road, London, SW1W 9SZ, 020 7811 7000, webteam@hpa.org.uk. Retrieved (12/11/2015) from http://www.hpa.org.uk/infections/topics_az/hai/mandatory_results.htm

Healthcare Commission. (2006). *Investigation into outbreaks of Clostridium difficile at Stoke Mandeville Hospital, Buckinghamshire Hospitals NHS Trust*. Retrieved (13/10/2015) from http://www.buckshealthcare.nhs.uk/Downloads/healthcarecommision/HCC-Investigation-into-the-Outbreak-of-Clostridium-Difficile.pdf

Healthcare Commission. (2007). *Healthcare associated infection: What else can the NHS do? NHS Commission for Healthcare Audit and Inspection*. England, UK; Commission for Health Audit and Inspection Report. Retrieved (09/08/2014) from http://archive.cqc.org.uk/_db/_documents/HCAI_Report_2_200801223430.pdf

Healthcare Protection Agency. (2011). *Healthcare associated Infections in the North West: Quarterly Report* (Vol. 2011). London, UK. Retrieved from http://www.hpa.org.uk/Publications/LaRS/NorthWestPublications/

Healthcare Protection Agency. (2013). Infection Prevention and Control, (April), 1–5.

Hopkins, S., Karen, S., & Lisa, S. (2012). *Healthcare Protection Agency (2012) English National Point Prevalence Survey on Healthcare-associated Infections and Antimicrobial Use , 2011: Preliminary data*. Retrieved (14/06/2014) from http://www.hpa.org.uk/Publications/InfectiousDiseases/AntimicrobialAndHealthcareAssociatedInfections/1205HCAIEnglishPPSforhcaiandamu2011prelim/

Hou, H.-T. (Ed.). (2012). *New Research on Knowledge Management Models and Methods*. Janeza, Croatia: Intech.

House of Commons Public Accounts Committee. (2009). *Public Accounts Committee Reducing Healthcare Associated Infection in Hospitals in England*. England, UK. Retrieved (01/02/2015) from http://www.publications.parliament.uk/pa/cm200809/cmselect/cmpubacc/812/812.pdf

House of Parliament. (2005). Infection Control in Healthcare Settings. *Parliamentary Office of Science and Technology Postnote*, (247), 1–4. Retrieved (18/08/2013) from http://www.parliament.uk/documents/post/postpn247.pdf%5Cnwww.parliament.uk/parliamentary_offices/post/pubs2005.cfm

IFMA. (2003). Brief History of Facilities Management. Retrieved January 7, 2015, from http://www.ifma.org/about/about-ifma/history

Ikram, A., & Satti, L. (2009). Healthcare Associated Infections: Nuisance in the Modern Medical Epoch. *Interchopen*. Pakistan. Retrieved from www.interchopen.com

Infection Control Nurses Association. (2005). Audit Tools for Monitoring Infection Control Guidelines Within the Community Setting 2005. *Infection Control Nurses Association*. Retrieved (11/06/2013) from http://www.healthcareinformed.com/ufiles/5dbcd95a47c5/AuditTools2005.pdf%5Cn

Jabareen, Y. (2009). Building a Conceptual Framework : Philosophy , Definitions , and Procedure, 49–62.

Jacob, T., J., Kasali, A., Steinberg, P., J., Zimring, C., & Denham, M. (2013). The Role of the Hospital Environment in Preventing Healthcare-Associated Infections Caused by Pathogens Transmitted through the Air. *Health Environment Research and Design*. Retrieved from https://www.herdjournal.com/article/role-hospital-environment-preventing-healthcare-associated-infections-caused-pathogens-trans

Jankowicz, A. D. (2005). *Business Research Project* (4th ed.). London, England. Thomson Learning.

Jasimuddin, S. M. (2005). Storage of Transferred Knowledge or Transfer of Stored Knowledge: Which Direction? If Both, Then How? *Proceedings of the 38th Annual Hawaii International Conference on System Sciences*, *0*(C), 1–6. http://doi.org/10.1109/HICSS.2005.557

Jeanes, A. (2005). Keeping hospitals clean: how nurses can reduce health-care-associated infection. *Professional Nurse (London, England)*, *20*(6), 35–37.

Jenner, E., & Wilson, J. (2000). Educating the infection control team - past, present and future. A British perspective. *The Journal of Hospital Infection*, *46*(2), 96–105. http://doi.org/10.1053/jhin.2000.0822

Jensen, H., P., & Stonecash, E., R. (2005). Incentives and the Efficiency of Public Sector-outsourcing Contracts. *Economic Surveys*, *19*(5), 767–787. http://doi.org/10.1111/j.0950-0804.2005.00267.x

John Orzano, A., McInerney, C. R., Scharf, D., Tallia, A. F., & Crabtree, B. F. (2008). A knowledge management model: Implications for enhancing quality in health care. *Journal of the American Society for Information Science and Technology*, *59*(3), 489–505. http://doi.org/10.1002/asi.20763

Johnson, J. W., & LeBreton, J. M. (2004). History and Use of Relative Importance Indices in Organizational Research. *Organizational Research Methods*, *7*(3), 238–257. http://doi.org/10.1177/1094428104266510

Kagioglou, M., Cooper, R., Aouad, G., & Sexton, M. (2000). Rethinking construction: the generic design and construction process protocol. *Engineering Construction and Architectural Management*, *7*(2), 141–153. http://doi.org/10.1108/eb021139

Kakabadse, N. K., Kakabadse, A., & Kouzmin, A. (2003). Reviewing the knowledge management literature: towards a taxonomy. *Journal of Knowledge Management*, *7*(4), 75–91. http://doi.org/10.1108/13673270310492967

Karagiannidis, A. (2012). Waste management in. Retrieved August 11, 2014, from http://www.audit-scotland.gov.uk/docs/health/2000/nr_010131_waste_management.pdf

Keogh, B. (2013). *Review into the quality of care and treatment provided by 14 hospital trusts in England: overview report*. *NHS England*. Retrieved (06/10/2015) from papers2://publication/uuid/AD320413-4F8D-4D2A-9A8A-58FC08A18766

Kim, H. K., & Bernard, B. (2011). "Does Hospital Infection Reporting Affect Actual Infection Rates, Reported Rates, or Both? A case study of Pennsylvania." Retrieved (09/08/2014) from http://www.academyhealth.org/files/2011/saturday/black.pdf

King, S. (1998). *Putting people at the heart of the learning process*. *Education and Training* (Vol. 40). Retrieved from c:%5CDocuments and Settings%5Ce8902872%5CDesktop%5Cdata disk%5CLibrary%5CCURRENT%5CEndNote%5CCATALOGUED + LINKED%5C%5C00440dl2.pdf

King, W. R. (2004). Outsourcing and the future of IT. *Information Systems Management*, *21*(4), 83–84. http://doi.org/10.1201/1078/44705.21.4.20040901/84192.11

Kosinski, A. S. (2013). A weighted generalized score statistic for comparison of predictive values of diagnostic tests. *Statistics in Medicine*, *32*(6), 964–977. http://doi.org/10.1002/sim.5587

Kudzma, E. C. (2006). Florence Nightingale and healthcare reform. *Nursing Science Quarterly*, *19*, 61–64. http://doi.org/10.1177/0894318405283556

Kumar, R. (2011). *Research Methodology: A Step-by-step Guide for Beginners* (3rd ed.). London, England. Sage Publication, Inc.

Lacobucci, G. (2015). Outsourcing in the NHS. *British Medical Journal*. http://doi.org/http://dx.doi.org/10.1136/bmj.h875

Langford, M. (2014). Why did ISO 9001-2008 system fail to deliver? *Institute of Healthcare Engineering and Estate Management*, *68*(2).

Lichtig, W. A. (2010). *Improving Healthcare through Built Environment Infrastructure*. (M. Kagioglou & P. Tzortzopoulos, Eds.) *Improving Healthcare through Built Environment Infrastructure*. Oxford, England: Willey-Blackwell. http://doi.org/10.1002/9781444319675.ch6

Liyanage, C. (2006). *The role of facilities management in the control of healthcare associated infections*. Glasgow Caledonian University. Retrieved from http://clok.uclan.ac.uk/11997/1/Champika thesis.pdf

Liyanage, C., & Egbu, C. (2005). Controlling healthcare associated infections (HAI) and the role of facilities management in achieving "quality" in healthcare: a three-dimensional view . *Facilities*, *23*(5/6), 194–215. http://doi.org/10.1108/02632770510588619

Liyanage, C., & Egbu, O. C. (2004). The Role of the "Built Environment" in the control of healthcare associated infection: A non-clinical Perspective. In E. Robert & B. Malcolm (Eds.), *Cobra - 2004;* (pp. 1–14). Leeds, England: RICS.

Liyanage, C. L., & Egbu, C. (2006). Knowledge Management in the Control of Healthcare Associated Infections in Facilities Management Services in Hospitals - its Practices and Challenges. In *Proceeding of the annual research conference of the Royal Institution of Chartered Surveyors* (pp. 7–8). London: RICS. Retrieved from http://usir.salford.ac.uk/2949/1/2006_Cobra.pdf

Macdonald, R., Price, I., & Askham, P. (2009). Excellent patient environments within acute NHS trusts: External influences and trust characteristics. *Journal of Facilities Management*, *7*(1), 7–23. http://doi.org/10.1108/14725960910929538

Maier D., Kalus W., Wolff M., Kalko S.G., Roca J., Marin de Mas I., Losko S. (2011). Knowledge management for systems biology a general and visually driven framework applied to translational medicine. *BMC Systems Biology*, *5*((Maier D.) Biomax Informatics AG, Planegg, Germany.), 38. http://doi.org/10.1186/1752-0509-5-38

Mattner, F., Mattner, C., Zhang, I., & Gastmeier, P. (2006). Knowledge of nosocomial infections and multiresistant bacteria in the general population: results of a street interview. *Journal of Hospital Infection*, *62*(4), 524–525. http://doi.org/doi:10.1016/j.jhin.2005.09.027

Maxwell, J. a. (2009). Designing a Qualitative Study. *The SAGE Handbook of Applied Social Research Methods*, 214–253. http://doi.org/10.1111/1467-9299.00177

May, D. (2013). *Ward housekeepers in healthcare: An exploratory review of the role of the ward housekeeper*. University College London. Retrieved from http://discovery.ucl.ac.uk/1396245/

May, D., & Pitt, M. (2012). Environmental cleaning in UK healthcare since the NHS Plan: A policy and evidence based context. *Facilities*, *30*(1/2), 6–22. http://doi.org/10.1108/02632771211194248

May, D., & Smith, L. (2003). Evaluation of the new ward housekeeper role in UK NHS Trusts, 168–174. http://doi.org/10.1108/02632770310489909

McLeod, S. (2014). The Interview Method. Retrieved (11/10/2015) from http://www.simplypsychology.org/interviews.html

McMaster, R. (2007). Competitive tendering in UK healthcare and Local Authorities: What happens to the Quality of Services? *Scottish Journal of Political Economic*, *42*(4), 409–427. http://doi.org/10.1111/j.1467-9485.1995.tb01167.

Memarzadeh, F. (2011a). The Environment of care and healthcare associated infection: An Engineering Perspective. Facilities Guidelines Institute. Retrieved from http://www.fgiguidelines.org/pdfs/ASHE-FGI_Monograph-EOC_and_HAIs.pdf

Memarzadeh, F. (2011b). *The Environment of Care and Healthcare associated infections: An Engineering Perspective*. Retrieved (05/04/2014) from http://www.fgiguidelines.org/pdfs/ASHE-FGI_Monograph-EOC_and_HAIs.pdf

Miles, M., & Huberman, A. (1994). *Miles and Huberman Chapter 2*. *Qualitative Data Analysis* (2nd ed.). London, England. Sage Publication, Inc.

Miller, B. K., Konopaske, R., & Byrne, Z. S. (2012). Dominance analysis of two measures of organizational justice. *Journal of Managerial Psychology*, *27*(3), 264–282. http://doi.org/10.1108/02683941211205817

Miller, J. P., & Farr, M. B. (2006). Survey of patients' knowledge of nosocomial infections. *American Journal of Infection Control*, *17*(1). http://doi.org/doi:10.1016/S0196-6553(89)80010-0

Moen, R., & Norman, C. (2009). Evolution of the PDCA Cycle. *Society*, 1–11.

Moule, P., & Hek, G. (2011). *Making Sense of Research: An introduction for Health and Social Care Practitioners*. London, England. Sage Publication, Inc.

Muhwezi, L., Acai, J., & Ottim, G. (2014). An Assessment of the Factors Causing Delays on Building Construction Projects in Uganda. *International Journal of Construction Engineering and Management*, *3*(1), 13–23. http://doi.org/DOI: 10.5923/j.ijcem.20140301.02

Muir Gray, J. A., & de Lusignan, S. (1999). National electronic Library for Health (NeLH). *BMJ (Clinical Research Ed.)*, *319*(7223), 1476–1479. http://doi.org/10.1136/bmj.319.7223.1476

Naoum, S. G. (2013). *Dissertation Research and Writing for Construction Students*. Oxford, Egland. Elsevier Butterworth-Heinnemann.

Nardi, P. (2006). *Doing Survey Research: A guide to quantitative methods*. London, England. Pearson.

National Audit Office. (2000). *The management and control of Hospital Acquired infection in Acute NHS Trust in England*. *National Audit Office*. London, UK. Retrieved (12/05/2013) from http://www.nao.org.uk/wp-content/uploads/2000/02/9900230.pdf

National Audit Office. (2004). *Improving patient care by reducing the risk of hospital acquired infection : A progress report*. London, UK. Retrieved from http://antibiotic-action.com/wp-content/uploads/2011/07/NAO-Improving-patient-care-by-reducing-the-risk-of-hospital-acquired-infection-2004.pdf

National Audit Office. (2009). *Reducing Healthcare Associated Infections in Hospitals in England*. *National Audit Office*. London, UK. Retrieved (12/05/2013) from http://www.nao.org.uk/wp-content/uploads/2009/06/0809560.pdf%5Cnhttp://www.nao.org.uk/report/reducing-healthcare-associated-infections-in-hospitals-in-england/

National Health Service England. (2012). *Patient Environmental Action Team (PEAT)*. Retrieved (08/07/2014) from https://catalogue.ic.nhs.uk/publications/patient/facilities/pat-envi-acti-team-res-eng-2012/pat-envi-acti-team-res-eng-2012-rep.pdf

National Health Service Wales. (2010). *ASSURANCE FRAMEWORK A framework to assure the Board that it is delivering the best possible service for its citizens*. Retrieved (14/07/2015) from http://www.wales.nhs.uk/sitesplus/documents/862/ASSURANCE FRAMEWORK v 3 draft 22 09 10.pdf

National Healthcare Safety Network. (2013). *CDC/NHSN Surveillance Definitions for Specific Types of Infections: CDC/NHSN Protocol Clarifications*. Retrieved (19/02/2015) from http://www.cdc.gov/nhsn/pdf/pscmanual/protocol-clarification.pd

National Institute for Health and Clinical Excellence. (2011). *Prevention and control of healthcare- associated infections Costing report*. *Nice*. Manchester, England. Retrieved (22/08/2014) from http://www.nice.org.uk/nicemedia/live/13763/59587/59587.pdf%5Cnwww.nice.org.uk/guidance/PH36).

National Patient Safety Agency. (2007). *National specifications for cleanliness in the NHS: A Framework for Setting and Measuring Performance Outcomes*. *National Patient Safety Agency*. London. Retrieved (27/02/2015) from http://www.nrls.npsa.nhs.uk/resources/patient-safety-topics/environment/?entryid45=59818

NHS Commissioning Board. (2013). Everyone counts - improving outcomes for patients. *www.England.Nhs.Uk/Everyonecounts/*, *June*.

NHS Commissioning Board. (2014). *Everyone counts: Planning for Patients 2013/14*. Retrieved (30/08/2015) from http://www.england.nhs.uk/everyonecounts/

NHS England. (2012). *Patient Environment Action Team (PEAT) - England, 2012, Results. Health & Social Care Information Centre*. Retrieved (25/08/2013) from http://www.hscic.gov.uk/searchcatalogue?productid=7897&q=PEAT&sort=Relevance&size=10&page=1#top

NHS England. (2013a). Patient-Led Assessments of the Care Environment (PLACE). Retrieved July 29, 2014, from http://www.england.nhs.uk/wp-content/uploads/2013/02/place-letter.pdf

NHS England. (2013b). The NHS Constitution.

NHS England. (2013c). *The NHS Constitution: The NHS belong to us all*. Retrieved (05/02/2015) from http://www.nhs.uk/choiceintheNHS/Rightsandpledges/NHSConstitution/Documents/2013/the-nhs-constitution-for-england-2013.pdf

NHS England. (2014a). Understanding The New NHS, 15. Retrieved 05/02/2015) from http://www.england.nhs.uk/wp-content/uploads/2014/06/simple-nhs-guide.pdf

NHS England. (2014b). *Understanding the New NHS: A guide for everyone working and training within the NHS*. Retrieved (05/02/2015) from http://www.nhs.uk/NHSEngland/thenhs/about/Documents/simple-nhs-guide.pdf

NHS Estate. (2001). Housekeeping: A first guide to new, modern and dependable ward housekeeping services in the NHS. Retrieved July 29, 2014, from file:///C:/Users/Arigo 1/Downloads/nhs_housekeeping_services.pdf

NHS Estate. (2002). Infection Control in the built environment: Design and Planning.

NHS Estate. (2010). Hospital Estates and Facilities Statistics 2010-11 Main Findings, 2009–2010.

NHS Estate England. (2001). Sustainable development in the NHS. london, England, The Stationary Office.

NHS Estate England. (2004). *A risk-based methodology for establishing and managing backlog*. london, England, The Stationary Office.

NHS Estate England. (2005). *NHS Estate Annual Report 2004 - 2005*.

NHS Estate, NHS Estates, & NHS Estate. (2002). *Infection Control in the Built environment*. Retrieved (12/04/2013) from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/170705/HBN _00-09_infection_control.pdf

Nicolini, D., Powell, J., Conville, P., & Martinez-Solano, L. (2008). Managing knowledge in the healthcare sector. A review. *International Journal of Management Reviews*. http://doi.org/10.1111/j.1468-2370.2007.00219.x

Nilakanta, S., Miller, L., & Peer, A. (2009). Contribution of Knowledge and Knowledge Management Capability on Business Processes among Healthcare Organizations. *Business*, 1–9.

Niskanen, A, W. J. (1971). *Bureaucracy and representative government*. Chicago, IL, USA: Aldine.

Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, *5*(1), 14–37. http://doi.org/10.1287/orsc.5.1.14

Nonaka, I., & Takeuchi, H. (1995). *Knowledge-Creating Company. Knowledge-Creating Company*. Retrieved (10/06/2013) from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=16017288&site=bsi-live

Nonaka, I., & von Krogh, G. (2009). Perspective--Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory. *Organization Science*, *20*(3), 635–652. http://doi.org/10.1287/orsc.1080.0412

Nunnington, N., & Haynes, P., B. (2010). *Corporate Real Estate Asset Management: Strategy and Implementation*. London, England. Routledge.

Olesen, D., & Hood, R. (2003). *Health Facility Planning - An Infection Control Perspective*.

Oppenheim, A. N. (2003). *Questionnaire Design, Interviewing and Attitude Measurement*. London: Continuum.

Osváth, Z. (1970). Florence Nightingale (1820-1910). *Orvosi Hetilap*, *111*, 455–457. http://doi.org/10.1007/BF02737786

Oxford English Dictionary. (2014). Oxford English Dictionary Online.

Pallant, J. (2013). *SPSS survival manual: a step by step guide to data analysis using SPSS* (4th ed.). Maidenhead, England.McGraw-Hill.

Parahoo, K. (2014). *Nursing research : principles, process, and issues* (3rd ed.). Basingstoke, England. Palgrave Macmillan.

Payne, T., & Rees, D. (1999). NHS facilities management: a prescription for change. *Facilities*, *17*(7/8), 1–121. http://doi.org/10.1108/02632779910270159

Petty, N. J., Thomson, O. P., & Stew, G. (2012). Ready for a paradigm shift? Part 2: Introducing qualitative research methodologies and methods. *Manual Therapy*, *17*(5), 378–384. http://doi.org/10.1016/j.math.2012.03.004

Petty, R., & Guthrie, J. (2000). Intellectual capital literature review: Measurement, reporting and management. *Journal of Intellectual Capital*. http://doi.org/10.1108/14691930010348731

Pheysey, D. (1993). *Organizational Cultures: Types and transformations*. New York, USA. Routledge.

Polgar, S., & Thomas, S. (1995). *Introduction to Research in the Health Sciences* (3rd ed.). Edingburgh, Scotland, UK: Longman Group.

Pratt, R. J., Petlowe, C. M., Wilson, J. A., Loveday, H. P., Harper, P. J., Jones, S. R. L. J., Wilcox, M. H. (2007). epic2: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. *JOURNAL OF HOSPITAL INFECTION*, *65*(1), S1–S64. http://doi.org/10.1016/S0195-6701(07)60002-4

Pratt, R. J., Petlowe, C. M., Wilson, J. A., Loveday, H. P., Harper, P. J., Jones, S. R. L. J., … Wilcox, M. H. (2014). Epic3: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. *Journal of Hospital Infection*, *86*(S1). http://doi.org/10.1016/S0195-6701(13)60012-2

Qu, S. Q., & Dumay, J. (2011). The qualitative research interview. *Qualitative Research in Accounting & Management*, *8*(3), 238–264. http://doi.org/10.1108/11766091111162070

Rattray, J., & Jones, M. C. (2007). Essential elements of questionnaire design and development. *Journal of Clinical Nursing*. http://doi.org/10.1111/j.1365-2702.2006.01573.x

Ravitch, S., & Riggan, M. (2012). Introduction and Why conceptual frameworks? In *Reason and rigor: How conceptual frameworks guide research* (pp. 1–27).

Rebar, C., & Macnee, C. (2010). *Understanding Nursing Research, Reading and Using Research in Evidence-Based Practice*. London: Lippincott Williams & Wilkins.

Reis, P., & Levin, D. (2009). Planning, Design and Construction of Health Care Facilities. Retrieved June 25, 2014, from http://es.jointcommissioninternational.org/assets/1/14/PDC09_Sample_Pages.pdf

Remenyi, D., Williams, B., Money, A., & Swartz, E. (2005). *Doing Research in Business and Management: An Introduction to Process and Method*. London, England. Sage Publication, Inc.

Report, M. W. (2007). Contribution of occupational Physical activity toward meeting recommended physical activity guideline. *Mortality*, *60*(20), 656–660.

Riano, D. (Ed.). (2008). *Knowledge management for healthcare procedures*. Berlin: Springer-Verlag.

Roberts, S., & Watson, D. (2014). *Infection Prevention and Control: Annual Report 2014-2015*.

Royal College of Nursing, Fanning, M., Lynas, C., Gallagher, R., & Sunley, K. (2014). The Management of Waste from Health, Social and Personal care. Retrieved (09/08/2015) from http://www.rcn.org.uk/__data/assets/pdf_file/0003/572079/RCN_waste_guidance_2014.pdf

Rutala, W., & Weber, D. (2008). *Guideline for disinfection and sterilization in healthcare facilities, 2008. Centre for Disease Prevention and Control (CDC) USA*. Retrieved (24/09/2014) from http://stacks.cdc.gov/view/cdc/11560/

Ruth, R., Sonola, L., Honeyman, M., Brooke, B., & Kothari, S. (2014). *Specialists in out-of-hospital settings*. London, The King's Fund.

Saldana, J. (2009). The Coding Manual for Qualitative Researchers. *The Coding Manual for Qualitative Researchers*. http://doi.org/10.1109/TEST.2002.1041893

Santos, A., & Reynaldo, J. (2013). Cronbach â€™ s Alpha : A Tool for Assessing the Reliability of Scales. *Journal of Extension*, *37*, 6–9. Retrieved (19/06/2014) from http://www.joe.org/joe/1999april/tt3.php

Sarantakos, S. (2013). *Social Research* (4th ed.). Basingstoke, England. Palgrave Macmillan.

Saunders, M., Lewis, P., & Thornhill, A. (2012). *Research Methods for Business Students* (6th ed.). Essex, England. Pearson.

Scarrett, D. (1995). *Property Asset Management* (2nd ed.). London, England, E & FN SPON.

Schultz, A., Essiet, M., Souza, D., Kapogiannis, G., & Les Ruddock. (2013). *The Economics of BIM and Added Value of BIM to the Construction Sector and Society*. Salford, UK.

Scotland, J. (2012). Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms, *English Language Teaching, 5*(9). Retrieved (29/07/2015) from www.ccsenet.org/journal/index.php/elt/article/download/19183/12667?Cached

Scott, R. D. (2009). *The direct medical costs of healthcare-associated infections in U.S. hospitals and the benefits of prevention. Centre for Disease Prevention and Control*. Retrieved (02/04/2014) from http://www.cdc.gov/hai/pdfs/hai/scott_costpaper.pdf

Sehulster, L., & Chinn, R. Y. W. (2003). Guidelines for environmental infection control in health-care facilities. *Morbidity and Mortality Weekly Report*, *52*(RR10), 1–42. Retrieved (07/11/2014) from http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm

Selanders, L. C. (1998). The power of environmental adaptation. *Journal of Holistic Nursing : Official Journal of the American Holistic Nurses' Association*, *16*, 247-263-266. http://doi.org/10.1177/089801019801600213

Selanders, L. C., & Crane, P. C. (2012). The Voice of Florence Nightingale on Advocacy. *American Nurses Association*, *17*(1). Retrieved from http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Vol-17-2012/No1-Jan-2012/Florence-Nightingale-on-Advocacy.html

Serban, A. M., & Luan, J. (2004). Overview of Knowledge Management. *American Productivity and Quality Center, 2002*(113), 5–16. http://doi.org/10.1002/ir.34

Sexton, M. G., & Lu, S. (1990). Appropriate Research Design for Investigating Innovation in small knowledge-Intensive Professional Service Firms, Retrieved (11/04/2013) from http://www.arcom.ac.uk/-docs/proceedings/ar2004-0733-0739_Lu_and_Sexton.pdf

Shah, H. N., & Gharbia, S. E. (2006). The Impact of the Environment on Human Infections. *Microbial Ecology in Health and Disease*, *11*(4), 248–254. http://doi.org/10.1080/08910609908540835

Sheffield, J. (2008). Inquiry in health knowledge management. *Journal of Knowledge Management*, *12*(4), 160–172. http://doi.org/10.1108/13673270810884327

Sheffield, J. (2008). Inquiry in health knowledge management. *Journal of Knowledge Management*, *12*(4), 160–172. Retrieved (22/03/2014) from http://www.scopus.com/scopus/inward/record.url?eid=2-s2.0-47349115979&partnerID=40&rel=R8.2.0

Shleifer, A. (1998). State versus Private Ownership. *The Journal of Economic Perspectives*, *12*(4), 133. http://doi.org/10.1257/jep.12.4.133

Silverman, D. (2011). *Interpreting Qualitative Data: A Guide to the Principles of Qualitative Research* (4th ed.). London, England. Sage Publication, Inc.

Smyth, E. T. M., McIlvenny, G., Enstone, J. E., Emmerson, a M., Humphreys, H., Fitzpatrick, F., … Spencer, R. C. (2008). Four country healthcare associated infection prevalence survey 2006: overview of the results. *The Journal of Hospital Infection*, *69*(3), 230–48. http://doi.org/10.1016/j.jhin.2008.04.020

Sokovic, M., Pavletic, D., & Pipan, K. (2010). Quality improvement methodologies–PDCA cycle, RADAR matrix, DMAIC and DFSS. *Journal of Achievements in, 43*(1), 476–483. Retrieved from http://w.journalamme.org/papers_vol43_1/43155.pdf

Southgate, A. (2007). Outsourcing Professional Services. In *Outsourcing: Is your business focussed:* London, England: British Institute of Facilities Management (BIFM).

Staiger, J. (1997). Hybrid or Inbred: The Purity Hypothesis and Hollywood Genre History. *Film Criticism*. http://doi.org/Article

Stark, M., & Macdonald, C. (1979). *Florence Nightingale*. Feminist Press at CUNY. Retrieved from http://books.google.com/books?id=lTOeD4P2DQcC&pgis=1

Stichler, J. J. F. (2013). Healthcare-Associated Infections: The Nursing Perspective. *Health Environment Research and Design*, *7*, 8. Retrieved (28/06/2014) from http://digimags.vendomegrp.com/html/HERD-Supplement/HERD_Special.pdf

Stone, P. W., Braccia, D., & Larson, E. (2005). Systematic review of economic analyses of health care-associated infections. *American Journal of Infection Control*, *33*(9), 501–9. http://doi.org/10.1016/j.ajic.2005.04.246

Storga, M., Mostashari, A., & Stankovic, T. (2013). visualisation of the organisation knowledge structure evolution. *Knowledge Management*, *17*(5). http://doi.org/http://www.emeraldinsight.com/doi/pdfplus/10.1108/JKM-02-2013-0058

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. http://doi.org/10.5116/ijme.4dfb.8dfd

Teddlie, C., & Yu, F. (2007). Mixed Methods Sampling: A Typology With Examples. *Journal of Mixed Methods Research*, *1*(1), 77–100. http://doi.org/10.1177/2345678906292430

The Centre for Health and the Public Interest. (2015). *The contracting NHS – can the NHS handle the outsourcing of clinical services?* Retrieved (21/12/2015) from http://chpi.org.uk/wp-content/uploads/2015/04/CHPI-ContractingNHS-Mar-final.pdf

The National Health Service. (2015). The National Health Service: The NHS structure explained. Retrieved August 10, 2015, from http://www.nhs.uk/NHSEngland/thenhs/about/Pages/nhsstructure.aspx

Thomson, T. (1990). The Essence of Facilities Management. *Facilities*, *8*(8), 8–12. http://doi.org/10.1108/EUM0000000002119

Tonidandel, S., & LeBreton, J. M. (2011). Relative importance analysis: A useful supplement to regression analysis. *Journal of Business and Psychology*, *26*(1), 1–9. http://doi.org/10.1007/s10869-010-9204-3

Transport for London. (2010). *Efficient and Effective Management of Deliveries*. Retrieved from http://www.freightbestpractice.org.uk/products/3705_6575_the-efficient-and-effective-management-of-deliveries.aspx.

Tyson, A. (2002). The Clean Hospitals Programme and infection control. *British Journal of Infection Control*, *3*(1). Retrieved from http://bji.sagepub.com/content/3/1/17.full.pdf

Unison. (2004). *Cleaners' voices /Interviews with hospital cleaning staff*. (D. Prentis, Ed.). Retrieved from http://www.healthemergency.org.uk/pdf/CleanersVoices.pdf

Varadarajan, R. (2009). Outsourcing: Think more expansively. *Journal of Business Research*, *62*(11), 1165–1172. http://doi.org/10.1016/j.jbusres.2008.09.006

Vishwanath, A., & Scamurra, S. D. (2007). Barriers to the adoption of electronic health records: using concept mapping to develop a comprehensive empirical model. *Health Informatics J*, *13*(2), 119–134. http://doi.org/13/2/119 [pii]\r10.1177/1460458207076468

Wainwright, P. S. (1997). A new paradigm for nursing: the potential of realism, *Journal of Advanced Nursing, 26*(6), 1262–1271. Retrieved (18/05/2013) from http://onlinelibrary.wiley.com/doi/10.1046/j.1365-2648.1997.00429.x/pdf

Walker, H., Knight, L., & Harland, C. (2006). Outsourced Services and "Imbalanced" Supply Markets. *European Management Journal*, *24*(1), 95–105. http://doi.org/doi:10.1016/j.emj.2005.12.011

Walliman, N. (2006). *Social Research Methods*. London, England. Sage Publication, Inc.

Walsh, F. (2014). Antibiotic resistance: Cameron warns of medical "dark ages." Retrieved July 2, 2014, from http://www.bbc.co.uk/news/health-28098838

Walter, P. (2013). Cleaning - On the way to evidence-base knowledge. *Healthcare Infection*, *33*(10), 1039–42. http://doi.org/10.1086/667730

Webb, P. S. (1998). *Knowledge management: Linchpin of change*. London: Association for Information Management.

Weber, R. (2004). The Rhetoric of Positivism Versus Interpretivism: A Personal View. *MIS Quarterly*, *28*, iii–xii. http://doi.org/Editorial

Weston, D. (2008). *Infection Prevention and Control Theory and Clinical Practice for Healthcare Professionals*. West Sussex, England: John Wiley & Sons Ltd,

White, M., & Calvel, H. (2004). Reid seeks to rekindle the Nightingale philosophy.

Whittaker, A. (2009). *Research Skills for Social Worker*. Exeter: Learning Matters Ltd.

Wiggins, J. (2010). *Facilities Manager's Desk Reference*. Oxford, England: Willey-Blackwell.

Williams, L., & Dickinson, H. (2010). Can knowledge management enhance technology adoption in healthcare? A review of the literature. *Evidence and Policy*. http://doi.org/10.1332/174426410X524811

World Health Organisation. (2010a). *Health care-associated infections fact sheet*.

World Health Organisation. (2010b). *Healthcare Associated infection fact sheet*. WHO.

World Health Organisation. (2011). *Report on the Burden of Endemic Health Care-Associated Infection Worldwide*. WHO. Retrieved (12/12/2013) from http://whqlibdoc.who.int/publications/2011/9789241501507_eng.pdf

World Health Organisation. (2015). Hospital. Retrieved August 14, 2015, from http://www.who.int/topics/hospitals/en/

World Health Organisation, Emmanuel, J., Pieper, U., Rushbrook, P., Stringer, R., Townend, W., … Zghondi, R. (2014). Safe management of wastes from health-care activities, 329. Retrieved from http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf

Wright, D. (2014). Infection control throughout history. *The Lancet Infectious Diseases*, *14*(4), 280. http://doi.org/10.1016/S1473-3099(14)70726-1

Wright, R., & Milne, R. (2004). Competition and cost: Evidence from competitive tendering in the Scottish National Health Service. *Scottish Journal of Political Economic*, *51*(1).

Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.0036-
9292.2004.05101001.x/epdf

Wysocki, R. (Ed.). (2004). *Project Management Process Improvement*. London,
England.ARTECH HOUSE, INC.

Yin, K. R. (2014). *Case Study Research: Design and Methods* (5th ed.). London, England. Sage
Publication, Inc.

Zack, M. H. (1999). Managing Codified Knowledge. (cover story). *Sloan Management Review*,
40(4), 45–58. http://doi.org/Article

Zhang, Y., & Wildemuth, B. M. (2006). Unstructured interviews. *Applications of Social
Research Methods to Questions in Information and Library Science*, (1998), 222–231.
Retrieved from http://hsmi.psu.ac.th/upload/forum/Unstructured_interviews.pdf

APPENDICES

MEMORANDUM

Academic Audit and Governance Committee

College of Science and Technology Research Ethics Panel

(CST)

To	**Christopher Ejeh (and David Baldry)**
cc:	**Prof Charles Egbu, Acting Head of School of SOBE**
From	**Nathalie Audren Howarth**, **College Research Support Officer**
Date	27 January 2014

Subject: **Approval of your Project by CST**

Project Title: **Knowledge Management in Facilities Management service delivery practices for the control of Healthcare Associated Infection (HCAI) in NHS hospitals**

REP Reference: **CST 13/111**

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project as long as you follow the code of ethics of participating NHS hospitals.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

Nathalie Audren Howarth

College Research Support Officer

APPENDIX B – Questionnaire survey information sheet

Dear ▮▮▮▮▮▮

INVITATION TO PARTICIPATE IN A DOCTORAL (PhD) RESEARCH INTERVIEW

My name is Christopher Ejeh, and I am a PhD candidate at the School of the Built Environment, University of Salford. I am currently carrying out a research on effective knowledge management in facilities management cleaning service delivery in the control of exogenous healthcare associated infection in NHS hospitals in England. This is an introduction to my research.

The research examines the interface of knowledge process elements of knowledge creation, storing, sharing and usage in hospital facilities cleaning services for the control of exogenous HCAI from the perspective of the hospital knowledge infrastructure capabilities. This consists of the prevailing culture, structure, and technological capabilities.

The aim of this research is to develop a good practice knowledge management framework in the control of exogenous healthcare associated infections (HCAI) through facilities management service delivery practices in NHS hospitals.

Scope of Research: This research is focus on the soft facilities management domain of **_"cleaning services"_** in **acute and non-acute** NHS hospitals in England.

The entire interview is expected to last between 30-45 minutes. The interviewee shall be allowed to withdraw their participation from this research at any time they wish to do so. Any information provided prior to withdrawal from the interview process shall immediately be destroyed.

Confidentiality: All information provided will be treated with complete confidentiality, and findings from this research will be use for the sole purpose of this research and for academic publications. The findings will not be attributed to any specific personnel or their hospital.

Your email address was obtained from "Binleysonline" (NHS key contact database www.binleysonline.com), as the Head of facilities management of Royal ▮▮▮▮▮▮ hospital.

For further clarification or information, please do not hesitate to contact me or my research supervisor via our below email address.

 I hereby agree to participate in the research:

Name of participant………………………………………..Date……………..………Signature………..………..

Yours faithfully

Name of Researcher   **Research Supervisors**

Christopher Ejeh   Mr. David Baldry

Email : **_C.ejeh@edu.salford.ac.uk_**   Email: **_d.baldry@salford.ac.uk_**

APPENDIX C – Research Questionnaire

Section One: **General information**

Q1. What is your present job role?

    a. Facilities manager   **[ ]**   **b**. Head of Estate/Director of Facilities   **[ ]**

    c. Domestic service manager **[ ]**   **d**. Works Manager   **[ ]**

    e. Others……………………..

Q2. Which of the following best describe the type of your NHS hospital?

    a. Mental health Hospital   **[ ]**   **b**. Acute Hospital   **[ ]**

    c. Mental Health & Non-acute Hospital **[ ]**   **e**. Nursing homes   **[ ]**

    d. Community hospital   **[ ]**

Q3. How many years of experience do you have in the healthcare sector?

    a. Up-to 5 years   **[ ]**   **b**. 6 – 10 years **[ ]**   **c**. 11 – 15 years   **[ ]**

    d. 16 – 20 years   **[ ]**   **e**. Over 20 years **[ ]**

Q4. What is your length of experience in the control of healthcare associated infection Control?

    a. Up-to 5 years   **[ ]**   **b**. 6 – 10 years **[ ]**   **c**. 11 – 15 years   **[ ]**

    d. 16 – 20 years   **[ ]**   **e**. Over 20 years **[ ]**

Q6. Please select the adopted good practice guidance document/tools use in monitoring compliance to good practice in FM cleaning service delivery practice in the control of exogenous HCAI in your hospital.

	Compliance management documents/tools:	
1	Bespoke environmental audit tools developed by the Infection Control Team (ICT)	
2	NHS National Specification for Cleanliness, developed by National Patient Safety Agency (NPSA) only	
3	Patient-Led Assessment of the Care Environmental (PLACE) audit tools only	
4	NHS Premises Assurance Model (NHS PAM)	
5	A combination of ICT Audit tools and PLACE	
6	Facilities management bespoke audit tools for (checklist and tick box)	
7	All of the above	
8	Others (Please specify):	

Q7. On a scale of 1-5 with 5 being the highest, please indicate the level of effectiveness of the adopted good practice guidance document/tools use in monitoring compliance to good practice in FM cleaning service delivery practice in the control of exogenous HCAI in your hospital.

Meaning of scale:

1= Don't Know.   2. = Not effective.   3. = Less effective.   4. = Effective.   5. = Very effective

	Guidance documents	1	2	3	4	5
1	Bespoke environmental audit tools developed by the Infection Control Team (ICT)					
2	National Specification for Cleanliness, by National Patient Safety Agency (NPSA) only					
3	Patient-Led Assessment of the Care Environmental (PLACE) audit tools only					
4	NHS Environment assessment tools (NEAT) developed by the NHS Estate					
5	A combination of ICT Audit tools and PLACE					
6	Facilities management bespoke audit tools for cleaners for healthcare environmental cleanliness (checklist and tick box)					
7	All of the above					
8	Others (Please specify):					

Q8. On a scale of 1-5 with 5 being the highest, please select the level of effectiveness of the method employed to ensure compliance to good practice guidance document in FM cleaning service delivery in the control of exogenous HCAI in your hospital.

Meaning of scale:

1= Don't Know.   2. = Not effective.   3. = Less effective.   4. = Effective.   5. = Very effective

	Method/approaches	1	2	3	4	5
1	Electronic tools					
2	Surveys					
3	Checklist					
4	Routine infection control team inspection					
	Individual ward/unit inspection					

Q9. How frequently do you monitor the result produced by the adopted FM compliance monitoring tools? **Please tick the most appropriate box.**

Compliance monitoring frequency	
Daily Report	
Weekly Report	
Monthly Report	
Others (Please specify).	

Q10. On a scale of 1-5 with 5 being the highest, please select the key driver for monitoring compliance in FM cleaning service delivery in the control of exogenous HCAI in your hospital.

Meaning of scale:

1. = Don't know   2. = Not influential.   3. = Less Influential.   4. = Moderately Influential.
5. = Most influential

	Key driver for monitoring compliance	1	2	3	4	5
1	Meeting NHS set target					
2	Avoiding extra cost to the hospital					
3	Better service delivery					
4	Concern of being label as a failed hospital					
5	Avoidance of NHS penalty					
6	Patient satisfaction & safety					
7	To check the effectiveness of the adopted good practice compliance tools					
8	Other (please specify)					

Section Three: **Facilities management cleaning service procurement strategy**

This section is focused on identifying the types of facilities management-cleaning service contract, as well as the adopted NHS good practice compliance guidance documents, policies, and systems including local bespoke approaches in the control of exogenous HCAI from facilities management cleaning service perspective.

Q5. Please select the appropriate box that best describes the adopted procurement method in the delivery of FM cleaning services in your hospital.

	Types of procurement method in the delivery of FM cleaning services	
1	All facilities management services are delivered and managed **in-house**	
2	All facilities management services are **_outsourced_** to one external FM service provider.	
3	All facilities management services are split between in-house and outsource Facilities management service provider?	
4	All facilities management services are procured through PFI approach, with an appointed internal manager acting on behalf of the hospital.	
5	Others (Please specify):	

Section Four: **Hospital Knowledge management process and knowledge infrastructure capabilities**

This section is focused on identifying and evaluating influencing factors that may enhance or constrain effective knowledge management process (knowledge creation, storing, sharing and usage) in the control of exogenous HCAI, within the hospital knowledge infrastructure capabilities in FM cleaning service delivery practice for the control of exogenous HCAI.

Q11. On a scale of 1-5, with 5 being the highest please select your level of agreement with the following considerations as it influences good practice knowledge management in the control of exogenous HCAI in FM cleaning services

Meaning of scale:

1= Don't know   2. = Strongly disagree   3. = Disagree   4. = Agree   5. = Strongly agree

	Influencing factors	*1*	*2*	*3*	*4*	*5*
1	Keeping all FM cleaning services In-house					
2	Involving of FMgrs in the development of cleaning services bespoke guidelines or standard for the control of exogenous HCAI					
3	Communicating good practice knowledge, using the right language and explicit print medium to create better awareness of the control of HCAI protocols.					
4	Increasing IT/computer literacy level of cleaning staffs to access online good practice resources					
5	Outsourcing all FM cleaning services to one external contractor					
6	Others (Please specify):					

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Q12. **Knowledge infrastructure capabilities drivers:**

On a scale of 1-5, with 5 being the highest, please select your level of agreement to your hospital knowledge infrastructure capabilities' support for initiatives that promote effective good practice knowledge creation, storing, sharing and usage in the control of exogenous HCAI.

Meaning of scale:

1= Don't know   2. = Strongly disagree   3. = Disagree   4. = Agree   5. = Strongly agree

12a	Hospital Culture	1	2	3	4	5
1	My hospital has a culture that encourages clinician and non-clinician employees to discuss good practice knowledge in the control of healthcare associated infection (HCAI).					
2	My hospital has a culture that encourages clinician and non- clinician's employees at all level to attend infection control training?					
12b	Hospital Structure					
1	My hospital departmental structure facilitates interaction and sharing of good practice knowledge for the control of HCAI in facilities management services.					
12c	Hospital Technology					
1	My hospital has the technological system with the capacity of storing adequate good practice knowledge resources in facilities management centered services for the control of HCAI.					
2	Employees have adequate training in the use of these technology and devices.					

Q13. **Knowledge management process elements:**

On a scale of 1-5, with 5 being the highest, please select your level of agreement with your hospital knowledge infrastructure capabilities support for effective knowledge management process (Knowledge creation, storage, sharing and usage process) in the control of exogenous HCAI in FM cleaning services.

Meaning of scale:

1= Don't know   2. = Strongly disagree   3. = Disagree   4. = Agree   5. = Strongly agree

13a	Knowledge Creation Processes	1	2	3	4	5
1	My hospital has processes for the creation of new knowledge from existing good practice knowledge in facilities management centred services for the control of healthcare associated infection.					
13b	Knowledge Storage Processes					
1	My hospital has manual processes for storing good practice knowledge resources in facilities management centred services for the control of HCAI.					
2	My hospital only has technological systems/devices for storing good practice knowledge resources in facilities management centred services for the control of HCAI.					
3	My hospital has both manual and technological systems for storing good practice knowledge resources in facilities management centred services for the control of HCAI.					
4	My hospital employees often reference non-technological systems for good practice knowledge resources in facilities management centred services for the control of HCAI.					
5	My hospital employees often reference technological systems for good practice knowledge resources in facilities management centred services for the control of HCAI.					
13c	Knowledge Sharing Processes					
4	My hospital has adequate processes for sharing good practice knowledge in facilities management centred services for the control of healthcare associated infection by both clinicians and non- clinician's employees.					
13d	Knowledge Usage Processes					
1	My hospital has adequate processes in-place for monitoring compliance with good practices in the control of HCAI in facilities management services.					
2	Others (Please specify)					

Section Five: <u>**Clinicians and Non-clinicians Infection control team collaborative practice**</u>

Q14.   On a scale of 1-5, please select the level of facilities manager's involvement among infection control team in the development of bespoke tools used in the control of exogenous healthcare associated infections in hospital.

1. = *Not involve at all*   *2.* = *Very low level* *3.* = *Low level*   *4.* = *High Level*   *5.* = *Very high level*

THANK YOU FOR YOUR TIME, AND FOR SHARING YOUR EXPERIENCE.

Researcher

Christopher Ejeh

School of the Built Environment

Room 401 - Maxwell building

The University of Salford – Manchester

Email : *C.ejeh@edu.salford.ac.uk*

Research Supervisors

David Baldry

Email: *d.baldry@salford.ac.uk*

APPENDIX D – Invitation to participate in a Face to face interview

Research Title: ***Knowledge management framework for facilities management services for the control of exogenous healthcare associated infections (HCAI) in hospitals***

Dear ▓▓▓▓▓▓

INVITATION TO PARTICIPATE IN A DOCTORAL (PhD) RESEARCH INTERVIEW

My name is Christopher Ejeh, and I am a PhD candidate at the School of the Built Environment, University of Salford. I am currently carrying out a research on effective knowledge management in facilities management cleaning service delivery in the control of exogenous healthcare associated infection in NHS hospitals in England. The research examines the interface between knowledge management process which consists of knowledge creation, storing, sharing and usage, within the hospital knowledge infrastructure capabilities. These capabilities consist of the prevailing culture, structure and technological capabilities in facilities management service delivery practice for the control of exogenous healthcare associated infections (HCAI).

The aim of this research is to develop a good practice knowledge management framework in the control of exogenous healthcare associated infections (HCAI) through facilities management service delivery practices in NHS hospitals.

Scope of Research: This research is focus on the soft facilities management domain of ***"cleaning services"*** in **acute and non-acute** NHS hospitals in England.

The entire interview is expected to last between 30-45 minutes. The interviewee shall be allowed to withdraw their participation from this research at any time they wish to do so. Any information provided prior to withdrawal from the interview process shall immediately be destroyed.

Confidentiality: All information provided will be treated with complete confidentiality, and findings from this research will be use for the sole purpose of this research and for academic publications. The findings will not be attributed to any specific personnel or their hospital.

I hereby agree to participate in the research:

Name of participant…………………………………..Date……………..………Signature………..……..

Yours faithfully

Name of Researcher	**Research Supervisors**
Christopher Ejeh	Mr. David Baldry
Email : *C.ejeh@edu.salford.ac.uk*	Email: *d.baldry@salford.ac.uk*

APPENDIX E – Interview guide

RIQ1:   General information

Q1.   What is your present job role?

   A. Facilities manager   **[   ]**   **B**. Head of Estate/Director of Facilities   **[   ]**

   C. Domestic service manager **[   ]**   **D**. Works Manager   **[   ]**

   E. Others……………………..

Q2.   Which of the following best describe the type of your NHS hospital?

   A. Mental health Hospital   **[   ]**   **B**. Acute Hospital   **[   ]**

   C. Mental Health & Non-acute Hospital   **[   ]**   **E**. Nursing homes   **[   ]**

   D. Community hospital   **[   ]**

Q3.   How many years of experience do you have in the healthcare sector?

   A. Up-to 5 years   **[   ].**   **B.**. 6 – 10 years   **[   ]**   **C.** 11 – 15 years   **[   ]**

   D. 16 – 20 years   **[   ]**   **E.**. Over 20 years **[   ]**

Q4.   What is your length of experience in the control of healthcare associated infection Control?

   A. Up-to 5 years   **[   ]**   **B**. 6 – 10 years   **[   ]**   **C.** 11 – 15 years   **[   ]**

   D. 16 – 20 years   **[   ]**   **E**. Over 20 years **[   ]**

RIQ2:   Adopted procurement system

1. Please describe the adopted procurement strategy in the delivery of hospital cleaning services?

2. In your opinion, what are the reasons for the choice of a particular procurement strategy in the delivery of the hospital cleaning services?

3. Please identify areas that could be improved in your adopted procurement strategy in hospital cleaning services to optimise efficiency in the control of exogenous HCAI hospital?

RIQ3:   Adopted Guidance document (policies/guidelines/spec/system)

1. Which of the available guidance document is the hospital using for monitoring compliance to good practice in facilities management cleaning services for the control of exogenous HCAI?

2. Please describe the reasons for the choice of this particular guidance document?

RIQ4:   Knowledge management Processes and infrastructure capabilities

1. How would you describe the culture of good practice knowledge collaboration in the control of healthcare associated infection between clinicians and non-clinicians (facilities management staffs) employees in your hospital?

2. How does the hospital departmental structure facilitate the creation of good practice knowledge in the control of exogenous HCAI in FM cleaning services

3. What is the hospital adopted technology for storing and sharing good practice knowledge in the control of exogenous HCAI

4. How does the hospital ensure that employees have adequate knowledge of the adopted technological system used in storing and sharing good practice knowledge resources in FM services for the control of HCAI?

5. Please describe the process for the creation of new knowledge from existing guidance document in FM cleaning services in the control of exogenous HCAI

RIQ5:   Conceptual Good practice knowledge management framework

1. Please describe the benefits of having a good practice knowledge management framework in facilities management service delivery practice in the control of HCAI in your hospital?

Many thanks for making out time for this interview. Is there any question that you would like me to answer concerning my research?

APPENDIX F – Framework validation questionnaire

Dear ▮

An Invitation to participate in the validation of an effective knowledge management framework for the control of exogenous healthcare associated infection in NHS hospitals

My name is Christopher Ejeh, and I am a PhD candidate at the School of the Built Environment, University of Salford. I am currently carrying out a research on effective knowledge management in facilities management cleaning service delivery in the control of exogenous healthcare associated infection in NHS hospitals in England.

This validation questionnaire seeks to obtain relevant and objective opinion on the functionality of the attached "*Knowledge management framework for facilities management service delivery practice for the control of exogenous healthcare associated infection*". The framework is the outcome of the findings from a PhD research across 85 acute and non-acute hospitals in England using a mixed methodology research approach. This approach consists of a questionnaire survey and semi-structured face-to-face interviews.

The questionnaire consists of four (4) sections. The first section presents the aim and objectives of the research. The second section presents the overview of the framework. The third section is about the respondent information, and the fourth section presents the relevant questions for assessing the framework. The validation process is considered as a significant process in achieving the aim of this research.

Confidentiality: All information provided will be treated with complete confidentiality. Feedback will not be attributed to any specific personnel or their hospital.

For further clarification or information, please do not hesitate to contact me or my research supervisor via our below email address.

Name of Researcher

Christopher Ejeh

Email : ***C.ejeh@edu.salford.ac.uk***

Research Supervisor

Mr. David Baldry

Email: ***d.baldry@salford.ac.uk***

1.1:   Research Aim

The aim of this research is to critically investigate the interface between a knowledge management process and the hospital knowledge infrastructure capabilities in order to develop an effective knowledge management framework to assist in the control of exogenous healthcare associated infections (HCAI) through facilities management service delivery practices in NHS hospitals.

1.2:   Research Objectives

The following five objectives have been formulated to achieve the research aim:

1. To identify in-use policies, guidance document, and strategies used in facilities management cleaning services delivery for the control of exogenous HCAI, identifying the pros and cons.
2. To identify the prevailing procurement strategies in the delivery of hospital cleaning services and their interface with effective knowledge management protocols for the control of exogenous HCAI in hospital.
3. To critically investigate the challenges that inhibit effective knowledge management processes in hospital facilities cleaning services within the hospital prevailing culture, structure and technological capabilities.
4. To evaluate the role of the facilities manager within the infection control team in the control of exogenous HCAI.
5. To develop and validate the effective knowledge management framework for the control of exogenous healthcare associated infections (HCAI) in facilities management cleaning services.

2.0:   Description of the Framework:

The research was conducted to ascertain the extent to which prevailing hospital management process elements of knowledge creation, storing, sharing and usage, along with hospital knowledge infrastructure capabilities consisting of the prevailing culture, structure and technology are essential hospital preconditions for effective knowledge management in facilities management cleaning service delivery for the control of exogenous HCAI.

Based on the findings from this research a conceptual framework was developed to include the opinions and perceptions of NHS hospital facilities managers on the research subject. This framework consists of the interface of hospital knowledge infrastructure capabilities and the hospital knowledge management processes.

The facilitation of **knowledge creation** in the control of exogenous HCAI is dependent on the prevailing hospital culture and structure. The context to be achieved within the prevailing hospital culture and structure respectively will include:

A). **Prevailing hospital culture**

➢ The employment of staff base on skills and experience, and not just those with academic certification only.

➢ Continuous initiative of good practice knowledge collaboration between clinicians and the FM team

➢ Regular updating of the good practice knowledge resources. The need for a culture of continuous communication of infection control good practice knowledge to cleaning staffs and other stakeholders is another consideration.

B).   Hospital structure:

➢ The hospital facilities manager should focus on the core function of the hospital facilities management, rather than "cross-management" of other services such as catering services, in addition to their cleaning, and other hard FM service responsibilities.

➢ Identification of the appropriate Service Level Agreement (SLA) requirement between external cleaning service providers prior to formalising any agreement.

➢ Support a culture that encourages individuals to share their tacit knowledge, rather than "hoarding" information which often inhibits effective knowledge management in the control of exogenous HCAI. This also include providing rewards and incentives for staff that generate and share new infection control good practice, as well as those that champion compliance to adopted good practice guidance protocols.

➢ A flexible rather than a rigid departmental structure that encourage good practice knowledge sharing, and collaborative initiative among clinician and the facilities management team in the control of exogenous HCAI.

The facilitation of **knowledge sharing** in the control of exogenous HCAI is dependent on the prevailing hospital culture and technological capabilities. The contexts to be achieved within these capabilities include:

➢ A culture of continuous communication of good practice knowledge to cleaning staffs and other stakeholders.

➢ Continuous training of staffs in the use of communication technological devices used in communication/storing good practice guidance

The facilitation of **knowledge usage** in the control of exogenous HCAI is dependent on the prevailing hospital structure whereby the tasks to be carried out include:

➢ Routine monitoring of compliance with good practice

➢ Observations and supervision of cleaning staffs

The areas ticked in figure 1 (below) did not emerge as core factors inhibiting the control of healthcare associated infections in facilities management cleaning services in NHS hospitals. Findings from the research evidenced that, NHS has adequate technological capabilities for the creation, storing and usage

of good practice knowledge. However, there is a need to train the staffs, especially cleaning staffs on the usage of the technological devices such as intranet, computer, IPad, etc., used in sharing and communicating the good practice knowledge guidance. The context could be achieved with having a departmental structure that focusses on routine monitoring of compliance to infection control good practice guidance in the control of exogenous healthcare associated infections (HCAI).
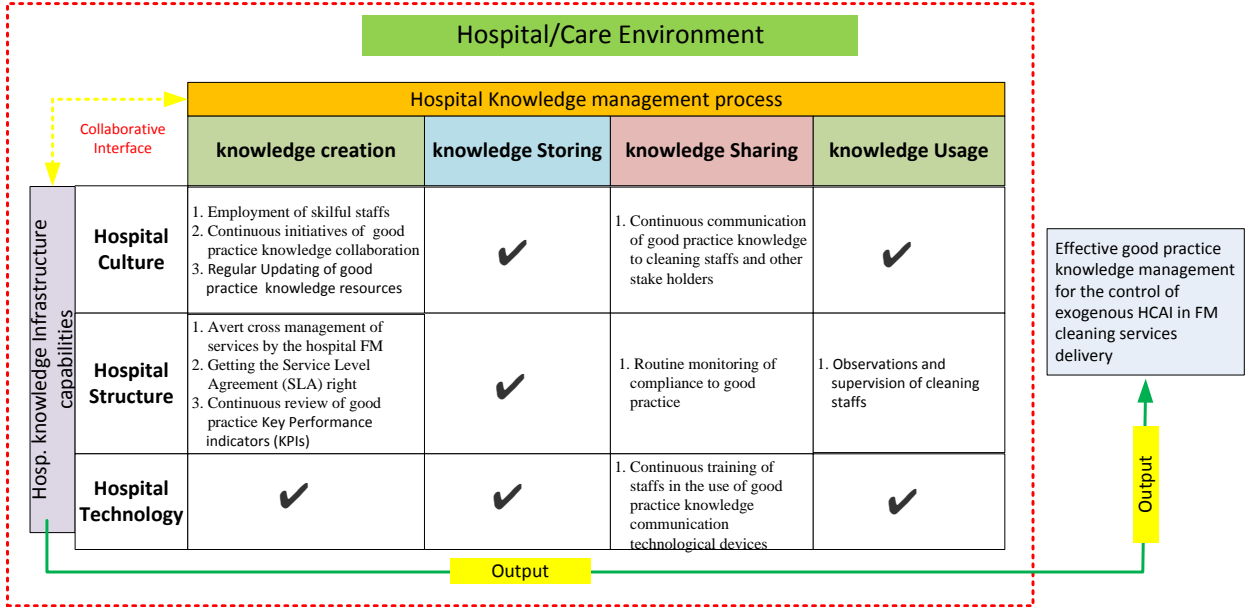
Figure 1:   Knowledge management framework for the control of exogenous HCAI in FM (KMFEIC)

Conclusion

It is anticipated that the framework will assist hospital facilities managers and infection control teams in formulating local bespoke infection control good practice protocols that target those infections acquired from the hospital environment. It is also anticipated that the framework will provide hospital infection control teams with the parameters within which informed judgments may be made in their investigation of outbreaks of infection incidence in their hospital.

The Validation Survey – (Refer to figure 1)

General information

Q1.   What is your present job role?

    a. Facilities manager   [ ]   b. Head of Estate/Director of Facilities   [ ]

    c. Domestic service manager   [ ]   d. Works Manager   [ ]

    e. Others……………………..

Q2.   What is your length of experience within the healthcare sector?

    a. Up-to 5 years   [ ]   b. 6 – 10 years   [ ] c. 11 – 15 years   [ ]

    d. 16 – 20 years   [ ]   e. Over 20 years [ ]

Q3.   What is your length of experience in the control of healthcare associated infection Control?

    a. Up-to 5 years   [ ]   b. 6 – 10 years   [ ]   c. 11 – 15 years   [ ]

    d. 16 – 20 years   [ ]   e. Over 20 years   [ ]

Validation Questions

On a scale of 1-5, with 5 being the highest, please express your level of agreement or disagreement to the following statements based on your perception of the framework.

Meaning of scale:

1= Don't know   2. = Strongly disagree   3. = Disagree   4. = Agree   5. = Strongly agree

Criteria	1	2	3	4	5
The terms and concepts of the framework in the control of exogenous healthcare associated infection through facilities management cleaning service delivery are well defined					
The framework applies appropriately to the delivery of hospital cleaning services					
The framework is consistent with solving infection acquired from the hospital environment problem.					
The scope and content of the framework is appropriate.					
The framework can be demonstrated easily to others.					
The framework can be used as a tool to improve good practice knowledge management process in the control of exogenous healthcare associated infection through facilities management cleaning services in hospitals					
Any other comment					

Many thanks for making out time to complete this framework validation questionnaire

The below framework activity schedule matrix is in line with the recommendations obtained from the validation of the

Phase 1: Hospital value Analysis **Parties Involve**: ICT	**Input:** This initial phase of the framework adoption involves a detail review of the hospital infection control policies and procedures as it relates to the control of exogenous HCAI within the context of the hospital Corporate values and vision. The review should also be carry out with a view of determining deliverable KPI's in line with the National Standards	**Output** ➢ Deliverable statement of the scope of Exogenous HCAI Control in FM services. An elaborate characteristic of services and expected result

Phase 2: Hospital Knowledge Process Analysis **Parties Involve**: ICT	**Input:** Ascertain the extent to which the hospital prevailing culture, departmental structure and technological systems facilitate of inhibit FM service delivery in the control of exogenous HCAI.	**Output** ➢ Collaborative practice ➢ Effective good practice knowledge initiative modalities ➢ Effective good practice knowledge creation and sharing modalities

ICT Consultations/documentations: Present the output before the ICT, giving them the opportunity to advise on any opinion that might otherwise be held back before final documentation and presentation to other stakeholders

Phase 3: Strategic FM process Analysis **Parties Involve**: ICT nominated person together with the Head of FM	**Input:** This involves the analysis of the interface of strategic facilities management index derived from the hospital knowledge process analysis (Phase 2) in the control of exogenous HCAI. The target at this phase is to optimise FM cleaning service delivery and spur innovations that is centred on how best to minimise the prevalence of the dynamics of exogenous infection causing bacterial in healthcare facilities. This is achieved through a focus on the following:	**Output** ➢ Optimised FM cleaning services ➢ Spur innovations ➢ Reduced prevalence of exogenous HCAI

Procurement Interface:
➢ Providing FM cleaning services using in-house staffs
➢ Explicitly detailing of the KPI's and standard to be met in the SLA

➢ Service discipline -
➢ Budget control
➢ Cost control
➢ Flexibility to respond to various needs
➢ Staff understand hospital policies and procedures
➢ Control of new ways of working to spur innovation and optimise efficiency Better collaborative working

Training Interface:
➢ Mandatory classroom based HCAI induction for all cleaning new starters
➢ Continuous classroom based refresher training
➢ Gradual introduction of E-learning as a core learning model

➢ Better awareness of HCAI
➢ Assessment of staff understanding of HCAI issues
➢ Enhanced competence
➢ Collaborative working
➢ Understanding of team dynamics

Communication Interface within this context: Are the processes required to ensure timely and appropriate creation, generation, collection, sharing, storage, retrieval and usage of good practice knowledge in the control of exogenous HCAI in facilities management cleaning services.

➢ Effective bridge between clinicians and the FM team
➢ Effective HCAI resource/documents update
➢ Better awareness of HCAI
➢ Assessment of staff understanding of HCAI

Reward and Incentives:

➢ Explore communication and sharing of tacit knowledge
➢ Spur innovation of good practice
➢ Promote collaborative working
➢ Encourage staff take responsibility
➢ Reduce the prevalence of exogenous HCAI

ICT Consultations/documentations: Present the output before the ICT, giving them the opportunity to advise on any opinion that might otherwise be held back. This is to ascertain if the activities in Phase 1-3 has answered the interface questions in phase 1 *(Where do we want to be and how do we get there?)* relative to "how would the hospital go about improving the knowledge management process in FM service delivery interface with the hospital prevailing culture, structure and communication capabilities in the control of exogenous HCAI".
Where are we?: The ICT and the Head of FM should review to ascertain if the activities from phase 1-3 has met set target. If Yes, then proceed to phase 4 (Control: Compliance and performance monitoring). If not review phase 1-3.

Phase 3: Control: Compliance monitoring: **Parties Involve**: Domestic staff line manager & Head of FM	**Input:** This phase of the framework entail the use of Key Performance Indicators (KPI) and benchmarking as a tool to monitor compliance to good practice in the control of exogenous HCAI in facilities management cleaning services against control assurance standard. It involve the use of such tools as tick-box, checklist, observation and documentations to measure ➢ Environmental cleanliness ➢ Staff compliance to cleaning standard ➢ Patient satisfaction ➢ Cost and expenditure	**Output** ➢ Identify key performance gap for each function ➢ Compare internal performance level ➢ Implement programme to close performance gap ➢ Service quality ➢ Assess scope of results according to relevant areas

Effective knowledge management framework activity schedule matrix