INTEGRATING LEAN VISUAL MANAGEMENT IN FACILITIES MANAGEMENT SYSTEMS

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ABBREVIATIONS

AR	Action Research
BBC	British Broadcasting Corporation
BBW	Balfour Beatty Workplace
BICS	Bolton Improving Care System
BIFM	British Institute of Facilities Management
BSI	British Standard Institute
CEN	European Committee for Standardisation
DSR	Design Science Research
E&PS	Estates and Property Services
FF&E	Furniture, Fixtures & Equipment
FM	Facilities Management
FMI	Facility Management Institute
FMs	Facility Managers
HE	Higher Education
IFMA	International Facilities Management Association
KPI's	Key Performance Indicators
MIS	Management Information Systems
O&M	Operations and Maintenance
PDCA	Plan, Do, Check, Act
PI's	Performance Indicators
PM	Preventive Maintenance
RBHNFT	Royal Bolton Hospital NHS Foundation Trust
SLA	Service Level Agreements
TPS	Toyota Production System
UK	United Kingdom
WO	Work Order or Work Orders

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DECLARATION

This thesis is submitted under The University of Salford's regulations for the award of a PhD degree by research. The researcher declares that no portion of the work denoted in the thesis has been submitted in support of an application for another degree of qualification of this or any other university or other institute of learning. The central case university and names of individual participants are not disclosed due to privacy requested by the research participants.

This thesis embodies the word 'organisation' as denoting the parent company, the entire enterprise. This refers to as the employer of the facilities management department and is considered a customer or end-user of the services provided by the facilities management department. The abbreviation FM denotes 'facilities management' industry as a whole. It references the FM department, meaning the facilities management department or division within an organisation. Additional abbreviations are used throughout, a list is provided following the table of contents.

ABSTRACT

This thesis explores lean principles and visual management technology integration in facilities management systems. At the very core of the facilities management industry is the perception of strategically linking the facilities management department with the enterprise holistically. This has been an on-going development through recent years. The global recession of 2008 brought about socio-economic, socio-political and socio-technical constraints prompting world governments to establish leaner more efficient, value added initiatives. This trickled down to governments, universities and organisations globally. By embracing lean principles, visual management technologies, and establishing a lean visual management workplace the facilities management department within these organisations will establish a more strategic alliance with executive leadership. In turn achieving their goal of offering value based facilities management services.

The overall aim of the research is to evaluate the potential of lean principles, specifically visual management technologies to improve efficiency, transparency, and value in developing a facilities management knowledge systems. A design science philosophy with an action research approach framework is presented. Combined with a Soft Systems Methodology approach applied to improve the case studies findings and establish the real life problem statement. The researcher applied Soft Systems Methodology 5E's of: efficacy, efficiency, effectiveness, ethically and elegantly, to the action learning curve. Qualitative research methods such as semi-structured and unstructured interviews, questionnaires, and field observation were conducted. The research case study is limited in scope to one UK university estates and property services departments' lean journey and their third party outsourced facilities management service provider.

The research acknowledged that a lean visual workplace management system could be introduced in a service industry such as facilities management. However, the findings suggest that greater emphasis should be placed on organisation change management issues such as lack of trust, and resistance to change, concurrently, as part of the lean visual management journey. Nevertheless, the foundation of a lean visual facilities management learning environment was established.

CHAPTER 1
INTRODUCTION

1.1 Prologue

The chapter establishes the research focus and the argument that a need for the research exploration exists. It outlines the development of an indication of the research problem and its context within current facilities management literature. The central constructs of facilities management, lean principles and concepts, visual management, and change management are introduced. Research aim and objectives are presented along with the research philosophy and methodology, followed by the thesis framework.

1.2 Research Background

It has taken a global recession, economic constraints, and severe cuts in government funding for leadership to except the concept of facilities management as a strategic entity in organisational success. Furthermore, it is essential for organisational leadership to seek leaner, more efficient value added strategies that meet budget constraints, investment decisions, develop best practices and gain the attention of potential clients and real estate (RE) investors. The fundamental framework of the facilities management industry (Rondeau, Brown & Lapides, 2006; Moore & Sonsino, 2013; Wiggins, 2010) was aimed at establishing a more innovative "management science and professional activity" (Wiggins, 2010, p.2) that would link facilities management (FM) strategically to the organisation holistically. This has not always been the case.

The International Facilities Management Association (IFMA), affirms that it is more vital today than ever before for FM to embrace organisational transformation and to align themselves and their departments with the perpetually changing enterprise (Moore & Sonsino, 2013). Consecutively, IFMA partnered with CBRE to compose a FM industry trend report contending that the facility manager of today must be able to "provide leadership to the entire organisation" (IFMA & CRBE, 2014, p.11) strategically. They have a duty to "align the facility's strategic requirements with the entire organisation's requirements and develop and assess what services are needed to meet organisational (business) requirements" (IFMA & CBRE, 2014, p.12).

There are many components influencing the continued development of the FM industry. Globalization is at the core of change and expansion (Wiggins, 2010; Myerson, 2012; IFMA & CBRE, 2014; IFMA, 2011). FM companies are becoming more competitive and reaching in to newer markets, many larger companies are seeking contracts in other countries. This development brings about strategic management plans that aim to reengineer core business objectives to include the mission, vision and delivery of how FM services are provided. Organisations are paying more attention to efficiency gains in the workplace. With the high cost of real estate, leases and aging buildings in major cities across the globe, the cost of leasing and owning real estate is at the forefront of an organisation's expense next to employee salaries (Wiggins, 2010).

Other factors effecting global change in the FM industry according to Wiggins (2010) is the health and safety of our workplace. The evolution of IT is changing the process, procedures and design of the future office, contributing to the necessity of globalisation. The cost of inefficiencies in workflows can influence an organisations bottom line and employee motivation. Furthermore, there is a constant flux of new policies in the public sector; while government agencies look at leaner more efficient workplace initiatives such as procurement regulations, private financing, and value added initiatives. Additionally, sustainability has been at the forefront of change in the built environment (Wiggins, 2010; IFMA, 2011; IFMA & CBRE, 2014).

All these factors contribute to the success of the organisation holistically. The FM department has a greater opportunity today to align themselves more strategically with company leadership and the executive board, and need to have a better understanding of the organisations core business values, mission, and vision. Facility managers should become more of an organisation partner making a value based contribution to the companies' bottom line by reducing facilities cost, becoming more efficient, embracing corporate image, and transforming in to a profit centre within the organisation (IFMA, 2011).

1.2.1 Trends in the International Facilities Management Community

Recent trends in the FM global community aim at linking FM activities to the organisations strategic plan. This occurs through encouraging collaboration between the different services such as finance department, human resources (HR), procurement

department and security services. Additional research trends in FM continue to look at key performance indicators, workplace design and collaboration, organisational ecologies, global innovations, management of information technology, and creating value in the workplace (Alexander and Price, 2012).

In brief, numerous trends emerged from the research as governments, public and private sector organisations seek ‘leaner’ methodologies that ‘reduce waste’, produce ‘efficiencies’ and ‘quality’ in the ‘workplace’, providing ‘value’ to the ‘enterprise holistically’ (Comm & Mathaisel, 2005; Hoffmann, Munthe-Kaas, & Elle, 2012; IFMA, 2011; More & Sonsino 2013; United Nations, 2008). While reflecting on these trends it was noted that; reduced waste, efficiencies, quality and value in the workplace, linked to the organisation as a whole; characterized the emergence of lean and visual management integration.

1.3 Research Concept

“Lean is an improvement system” (Mann, 2010, p.54) that establishes quality of workflows, continuous improvement, appreciation for co-workers and elimination of inefficiencies. The intent of a lean enterprise is to embrace a lean philosophy that enhances customer value, improves process driven efficiencies and reduces wasted efforts within an organisation. To include interpersonal affiliations, human resources, supply chain relationships, materials, inventory and technology.

Lean has taken many forms since its conception in the car manufacturing industry and has been implemented successfully across the aerospace industry, construction, service industries such as finance, insurance, healthcare, pharmaceutical, and the government/public sector. The latest industry to consider a lean approach is information systems (IS)/information technology (IT) industry; then again, what about the facilities management industry? A limited approach to lean implementation in the FM industry is noted. Literature suggests that any service industry, to include facilities management, seeking “administrative, technical, and professional (office) process” (Mann, 2010, p.105) change and process improvement could benefit greatly from a lean focus. Nonetheless, there is insufficient research and evidence that lean principles or visual management have been applied in FM systems, most specifically an estates department in higher education at a UK University.

The findings to date yields that lean theory, additionally labelled lean production, (Dahlgaard & Dahlgaard-Park, 2006; Koskela, 2004; Liker, 2004) originates from the car manufacturing industry (Liker, 2004; Shigeo, 2005; Womack, Jones, & Roos, 2007; Womack & Jones 2003). Lean theory has been linked to lean construction (Howell, 1999; Howell & Ballard, 1998; Koskela, 1997), healthcare (Aronsson, Abrahamsson, & Spens, 2011; Kohlberg, Dahlgaard & Per-Olaf, 2007; Sharma, Abel, Al-Hussein, Lennerts, & Pfründer, 2007), IT (Eriksson, 2010; Waterhouse, 2008), and public sector organisations (Abdullah, Razak, & Pikar, 2011; Furterer & Elshennawy, 2005; LERC, 2010; Radnor, 2010; Radnor & Walley, 2008; Suárez-Barraza & Ramis-Pujol, 2010). Thus far has limited application in the facilities management industry.

Waterhouse (2008) attests that wasteful activities in the workplace deplete the value of products or services provided. Engaging the FM department in lean philosophy and concepts establishes a more creative integrated approach that will enhance the culture, productivity, profitability and success of the physical workplace. This in turn links the FM department to the enterprise strategically through the elimination of inefficiencies, minimal waste, customer flow, and cost and resources across department workflows (Kangan Institute, 2010).

1.4 Research Aim and Objectives

The overall aim of the research is to conceptualise the theoretical and practical understanding of introducing lean principles, particularly visual management technologies, into facilities management systems. In pursuit of the research aim the research objectives below will validate the research challenge and seek to define the philosophy, methodology and research approach that will construct the investigation and develop the framework for this thesis. The research objectives (RO) are as follows:

RO1: To identify current academic research and professional practices of lean principles and visual management in facilities management.

RO2: To conceptualize the theoretical framework of assessing the leanness of a facilities management department.

RO3: To develop, co-create and implement visual artefacts within a facilities management workplace.

RO4: To evaluate the benefits of lean principles and visual management technology integration in facilities management systems.

RO5: To make recommendations of lean principles and visual management technologies in facilities management system.

1.5 Research Exploration

An initial exemplary case study was established for the potential in the study area. Combined with a second case study picking up various complementary aspects based on exemplary case study one such as:

- Identify the problem.
- Create an intervention.
- Design the artefact.
- Implement, if possible.
- Reflect.

This formed a 1-2-1s research exploration arrangement, this can be explained as follows: One is for the first exemplary case study investigating a lean outsourced third party facilities management services provider. Two is for the second exploratory case study that had two parts. First part was assessing the leanness of a university facilities management department, the second part consisted of an artefact development and implementation. A third case action and artefact development was planned and hindered by research operatives. Resulting in the third part labeled as (1s), the (s) equals stopped, the research exploration came to a halt. The case studies were followed by a cross case analysis of learning from action.

1.6 Research Philosophy and Methodology Undertaken

Research has been undertaken in the facilities management industry since its conception in the 1970's. Individual researchers and professional organisations have established their own methods of inquiry. Thus far, facilities management research has no specific research philosophy or methodology framework. The discipline of management research has a "serious utilisation problem" (van Aken, 2004, p.119). Most conventional research is descriptive in nature and linked to the explanatory sciences of "physics and sociology", which is labelled "Organisation Theory" (van Aken, 2004, p.219).

Van Aken (2004) argues that management research should embrace both a "prescriptive-driven research" coupled with "descriptive-driven research" grounded on the design science archetype, ensuing a "Management Theory" (van Aken, 2004, p.219, p.241) research enquiry. Subsequently, the research methodology selected for this thesis, design science research is about creating "knowledge through design and realisation of artefacts, i.e. to solve *construction problems*, or used in improvement of the performance of existing entities, i.e. to solve *improvement problems"* (van Aken, 2004, p.224). In management research a framework to combine research methods is vague. This thesis explores a triangulation of research methods. It merges design science with an action research approach and soft systems methodology model of learning for action. Focusing on the collaboration of both professional practice and the researcher to provide solutions to existing organisational problems, and design visual artefacts that will improve current conditions.

Together, design science and action research have similar reflective cycles, both consider resolving organisational problems. Whereas in design science you create an actual "construct, model, method, or instantiation" (Järvinen, 2007, p.45), in action research the researcher becomes a facilitator immersing themselves as a member of the organisation and seeking inquiry and changes to the system (Burns, 2007). The action learning cycles are formulated using a complimentary soft systems methodology (SSM) model. Through the use of SSM's 5E's: efficacy, efficiency, effectiveness, ethically and elegantly, the thesis journey is formulated. The literature concedes that lean visual management, design science research (DSR) philosophy combined with an action research (AR) approach and soft system methodology (SSM) action learning cycles within facilities management (FM) has been greatly under investigated. This establishes a greater opportunity for the research study and methodology chosen.

1.6.1 Research Framework Clarified

Design Science research framework selected for this study, has a three phase research process (Offerman, et al, 2009, Article 7; Holmstrom, Ketokivi, & Hameri, 2009). In phase one the researcher identifies a real life organisation problem; phase two a solution to the problem statement is constructed in to an artefact of some sort. The designed artefact is implemented in to the system and evaluated in phase three. The evaluation of the artefact is "achieved by means of a case study and, or action research" (Offerman, et

al, 2009, Article 7, 2.3). The artefact is implemented and tested through action research cycles. The action research cycles chosen for this thesis are: observation, planned, intervention, and reflection. Action research reflection cycles are exercised throughout the case study exploration. The action research reflection (ARR) cycles are used as an additional learning enquiry tool where the literature gathered may not validate the occurrence that transpired. Therefore, an additional reflection and grasp of what recently materialised is warranted. When researching in action, extra literature review cycles are conducted while the exploratory research and problem is formulated. Finally, the outcomes are summarised at the culmination of the study and the researcher cycles back to revaluate the research aims, objectives, and assumptions.

1.7 Thesis Structure

The structure of the thesis, regarding the remaining chapters, is presented below and described thereafter. The various research elements are connected thorough a rigorous literature review, identifying the main constructs (facilities management, lean principles and concepts, visual management, and change management), and developing the research aim, objectives, framework, instantiations, artefacts and findings throughout the research journey. The following is a synopsis of the layered thesis exploration.

Chapter Two Literature Review

This chapter introduces the facilities management industry. An interpretation of lean and the five lean principles are presented, along with the theory of systems thinking, systems integration and lean project delivery systems. An overview and understanding of visuality, visual communications and visual management is introduced and a visual workplace management system is formulised. Followed by a literature exploration of evidence if lean visual management exists in facilities management sectors. The relevant theoretical conjectures of what a lean visual management workplace might look like is presented. A brief overview of change management, cultural and behaviour issues is presented. The four main bodies of knowledge; facilities management, lean, visual management, and organisational change management is discussed together with the epistemological constructs.

Chapter Three Research Philosophy, Theory and Methodology

This chapter establishes the research philosophy, methodology and approach that formulates the research inquiry. The central research theories, approach to research and research induction theory is introduced. Aspects of epistemology, ontology, and axiology are discussed. The chosen design science research philosophy with an action research cycle approach is formulated. A soft systems methodology model of action learning cycles using the 5E's: efficacy, efficiency, effectiveness, ethically and elegantly, are established. Finally, data collection and research techniques are outlined.

Chapter Four Exemplary Case Study One: Outsourced Lean Facilities Management Service Provider

This chapter explores a lean third party outsourced facilities management department and seeks to understand the leanness of their facilities operation. The research logic of inquiry compares the elements developed in the visual workplace management building system in chapter two. The findings validated in this exemplary case study will be further investigated and compared to the second case study exploration in chapter five.

Chapter Five Exploratory Case Study Two: Assessing the Leanness of a University Estates Department

The chapter continues the research inquiry guided by a design science research framework with an action research cycle approach developed in chapter three. It continues the exemplary case study from chapter two and considers the exploratory main constructs of lean principles and concepts, visual management, and workplace barriers in facilities management systems. Phase one assesses the leanness of a UK university facilities management department and identifies the problem statement. Phase two a designed artefact is created for consideration of solving the problem statement. In phase three the designed artefact is integrated with in the facilities management system and the organisations participants evaluate the artefact. Action research cycles continue as the inquiry revisits the problem statement, literature analysis and designed artefact. Chapter four, exemplary case study one and chapter five exploratory case study two, are compared in chapter six.

Chapter Six Cross Analysis Discussion, Recommendations and Proposed Future Research

A cross analysis discussion evaluating the two case study outcomes of lean visual management in UK university facilities management practice is established. Reflective considerations are discussed for future initiatives. Research methodology used throughout the thesis is analysed and the thesis soft systems methodology model cycles of learning action using the 5E approach is presented and discussed. A proposal of continuing the central thesis research is recommended.

Chapter Seven Final Conclusion

The entire research thesis is revisited and the purpose, aim, and objectives are reflected upon. The contribution to knowledge, methodology, practice, policy, and limitations of the research, along with the final thesis conclusion is presented. The final thoughts and statement of the research journey is expressed.

1.8 Chapter Summary

In this chapter the argument that constructs the foundation of the thesis was presented. The research focus, problems and concepts were introduced. Justification of the research challenge and thesis were formulated. The research aim and objectives were established along with the fundamental conjectures. Lastly, the thesis structure is presented. Chapter two will provide an overview of the main literature considerations.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

In chapter one the research problem, aim and objectives where introduced. The beginning of a conceptual research framework was illustrated. The literature review chapter provides the continued research framework development and conceptualizes the theoretical constructs, knowledge, methods and theories. The five constructs that define this thesis and introduced in this chapter are: facilities management industry; lean principles, concepts, and project delivery systems; visual management and the visual workplace; and change management. Implementing new concepts in the workplace such as lean principles and concepts, and visual management brings about a shift and change in culture. This change that takes place should be an organised transformation that is structured similar to a project delivery system.

In order to explore lean and visual management in the FM workplace, one must first understand facilities management as an industry of practice. Secondly, the literature considers linking the FM workplace to the organisation using a systems thinking approach. Thirdly, an overview of lean philosophy, lean management systems, along with visuality, visual management and the concept of the visual workplace is defined. Further understanding of a lean framework and how it might be interpreted in FM ecologies is noted. Fourthly, evidence of lean principles and concepts, and visual management in facilities management is explored. Fifthly, visual workplace management as a project delivery method that can be implemented in FM ecologies is conceptualized. A visual workplace management building system that combines visuality, visual communication, lean principles and concepts, and visual management technologies is illustrated. When an organisation is going through strategic transformation or seeking to implement new workplace strategies, such as lean visual management systems, introducing change management approaches in to the organisation should be considered. The chapter ends with introducing organisational change management, cultural issues and behaviour conflicts.

2.2 Redefining the Facilities Management Industry

The founder of the U.S. Corporation Electronic Data Services (EDS), Ross Perot, introduced the development of "Facilities Management" in the US workplace in the 1960's (Wiggins, 2010, p.1). The next decade, brought about the integration of computers, the 1970's energy crisis, and the integration of technology management entered the workplace. An emphasis on designing the workplace to encompass furniture, fixtures and equipment (FF&E) started to take shape. It wasn't until the late 1970's when a key executive at the furniture manufacture Herman Miller conceptualized an industry for facility managers. He invited a group of property managers and likeminded professionals to a gathering, and hence, the Facility Management Institute (FMI) was established.

There have been various definitions of the facilities management industry; academics such as Alexander (2003), Becker (1990) and Nutt (2000) have developed their own theory about FM practice. Alexander (2003) suggests that facilities management can encourage employees by improving processes in the workplace that create a more positive work environment. As a result, employees will strongly embrace their individual work activities, this leads to a more cost-effective productive organisation. Alexander's theory is revisited in the cross analysis of the central case study in chapter six.

The British Institute of Facilities Management (BIFM) and the British Standard known as BSI, uses the term that the European Committee for Standardisation, abbreviated CEN embraces (Wiggins, 2010): "the integration of processes within an organisation to maintain and develop the agreed services which support and improve the effectiveness of its primary activities" (CEN EN 15221, 2009). The European definition of FM focuses on facility managers in the role of being service providers with the intention of supporting the customers. The CEN definition is a little vague, yet it does delineate integrating processes and maintaining effective services. It doesn't define the workplace or work environment. Hence, FM in the UK and Europe is interpreted purely as processes and effective services of the said organisation.

On the other hand, the Royal Institution of Chartered Surveyors (RICS) defines FM as: "Facilities Management (FM) involves the total management of all services that support the core business of an organisation. It deals with those areas that the managers of the

organisation consider to support their fundamental activities. FM focuses on the interaction between core business, the support functions, and the facilities throughout all sections of industry, commerce, and services" (Wiggins, 2010, p.5). The RICS description certainly engulfs the true essence of FM as managing all services that support the parent enterprise holistically, in all industries and commerce.

While the International Facilities Management Association (IFMA) posted three definitions of the term *facility management* on their website under FM Glossary resources. IFMA first defines the wording, *facilities management*, in the same context as BIFM and CEN definition. IFMA further defines *Facility Management* (capital F and M) as: "The practice of coordinating the physical workplace with the people and work of the organisation; integrates the principles of business administration, architecture and the behavioural and engineering sciences" (IFMA, n.d.). Furthermore, IFMA continues to define *Facility Management 1* (capital F and M with a '1' after it) as "A profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology" (IFMA, n.d.). This is one of the most popular terms used while discussing the FM industry. It encompasses the built environment, the entire workplace, integrating people, place, processes and technology (Cotts, Roper, & Payant, 2010; Hodges, 2004; Rondeau, Brown, & Lapides, 2006).

Alternatively, Barrett and Baldry (2003, p.xiii) defines FM as "an integrated approach" of the built environment that "creates" and "supports the primary objectives of" the enterprise. IFMA's definition captures the essence of facility management as a discipline within the workplace environment and Barrett and Baldry (2003) capture the linkage of FM to the parent organisation. RICS connects FM to core business and embraces the idea of a cross industry service function.

Furthermore, Price and Akhlaghi (1999) contends that FM has evolved from managing facilities to managing people and place which they label as third generation FM. In their 1999 paper, "New patterns in facilities management industry best practice and new organisational theory", Price and Akhlaghi (1999) allege that first generation or traditional facilities management grew out of managing building assets. Second generation encompasses the IFMA translation of FM as managing people, process and places. Than third generation FM "might be seen as more concerned with the creation of

space which enables different levels and forms of performance" (Price & Akhlaghi, 1999, p.164). Price and Akhlaghi (1999) reference their theory is in line with Becker and Steele's (1995) adaption of organisational ecologies in the workplace. It is the ecologies, or space that the FM's manage that make up part of the organisation as a whole. These interactions of ecologies within the organisation cultivate a more chaotic enterprise that produces diverse performance levels among the different end users (Price and Akhlaghi, 1999). This in turn leaves room for third generation facility managers to develop new artefacts that will influence FM to link more adhesively to the organisation strategically.

There is inadequate literature on the concept of FM's responsibility to manage a healthy and safe workplace. The accrediting body of FM education, IFMA Foundation now called the Facility Management Accreditation Commission or FMAC, benchmarks 12 areas of knowledge as a framework for accrediting university FM programs internationally. In February 2013, the Foundation revised the accreditation degree program (ADP) requirements. Leadership, sustainability and stewardship and a healthy safe environment through business continuity planning and emergency preparedness were added (IFMA Foundation, 2013).

As facility managers become leaders of the workplace, health and safety must be at the forefront of daily responsibilities, therefore fires like the recent Pakistani factory catastrophe do not happen again. Over 300 garment factory workers in Karachi and Lahore, Pakistan fires were either killed or injured due to unsafe working conditions. Doors were locked; there were bars on windows to deter employee theft and no standard fire exits for employees to escape (New York Times, 2012). Almost one hundred years previously, the 1911 Triangle Shirt Waist Company factory fire in Greenwich Village, New York sored through factory buildings killing 146 immigrant workers, mostly females, due to the same unsafe working conditions. Fire and safety standards in the US where introduced in to the workplace as a result of the Triangle Shirt Waist factory incident (DOL, OSHA, n.d.).

Based on IFMA foundations emergency preparedness initiative for the workplace; health and safety legislation (or lack thereof) throughout the years in England, the UK, US and Pakistan; in addition to a lack of health and safety mentioned in FM definitions; along with the 2012 devastating fires in Pakistan factories, the researcher has combined FM

definitions and developed their own interpretation of what FM means today. The following definition of facilities management practice is presented and applied throughout this thesis:

> *Facilities Management is a profession that integrates a variety of disciplines and industries in order to manage, maintain, operate and ensure functionality of a sustainable built environment by integrating people, place, processes, and technology to encompass a healthy, safe and efficient, value driven workplace aligning the FM function to enterprise initiatives holistically.* Audrey Schultz (2016)

Facilities Management as a practice is considered a service industry where administration functions have in depth process, procedures and systems in place. For FM the main task is to engage in value-adding activities that support and improve the effectiveness of the core business (EN 15222-1:2006). FM adds value to the organisation by the performance of workflow activities and safeguarding the workplace accordingly. While keeping the employees' health, safety and welfare in mind linking productivity in the workplace with organisations core goals, missions and visions (Wiggins, 2010). It is the holistic view of FM as a systems process approach of ecologies that influences the internal and external customers as well as core organisational initiatives resulting in the greatest value.

2.3 Linking Facilities Management to the Organisation Holistically

There are numerous definitions linking FM to the overall enterprise. Each organisation develops their own unique description of how internal facilities activities link to organisational strategies based on market segment, products and services provided (Wiggins, 2010; Barrett & Baldry, 2003; Loosemore & Hsin, 2001). "Facility management by definition covers such a wide array of capabilities that its meaningful impact becomes difficult to succinctly define" (IFMA & CBRE, 2014, p.5). This stems from a "poor understanding of the relationship between facilities and the core business objectives of the organisation" (Loosemore & Hsin, 2001, p.464). According to a recent IFMA and CBRE report (IFMA & CBRE, 2014, p.5) "Without clear definition, successes are reported in tactical, individual ways that offer no connection to greater business implications, or to the body delivering the effort, thus creating an 'invisible' team and organisation".

Hence the FM department becomes a second thought in the eyes of leadership who tend to look at the overall profits and success of the enterprise. Not specifically to the workplace managed by facility managers and their team. The role of FM is so varied depending on the market sector, responsibilities and parent organisation acknowledgement of the industry. According to Amaratunga, and Baldry, (2003) an array of internal financial and economic performance metrics such as cultural diversity, delivery of services, how the supply chain is managed, resource management and change management can assist organisational leadership in acknowledging facilities contribution. Steven EE (2015) suggests that it is critical that executive leadership realize that FM adds value by contributing to the bottom line and profitability of the overall enterprise.

2.3.1 Introducing Facilities Management Ecologies

FM ecologies (FM systems) are a vital link to the organisation as a whole; whole interpreted throughout this thesis in terms of 'holistically', 'the whole system'. FM ecologies are systems that form the workplace, processes, procedures (the workflow), and people that form an organisational system. Precisely what do we mean by FM ecologies? The term "organisational ecology" was conceptualized by Becker (1981, in Alexander & Price, 2012, p.3) and interpreted as complex networks of processes and procedures in the physical workplaces conceived of socio-technical intricacies; demographics, physical design layout and function that forms a system within an organisation. Price (2012) argues that Becker's theory is not unlike Darwin's teachings and "schools of human ecology, scholars of population ecology and the more recent resurgence in ecological interpretations of socially constructed modes of thought" (Alexander & Price, 2012, p.4).

Hence, the FM workplace is viewed as ecologies (systems) of core processes and business functions such as customer service activities, procurement, marketing, research, product development, and distribution activities (Anderson, et al., 2006). Furthermore, Anderson (et al, 2006) contends that implementing core FM processes delivers day-to-day FM outputs such as safe buildings, comfortable sustainable built environments and business continuity planning. Additionally, the facility manager can have a greater influence on organisational ecologies by implementing initiatives in "sustainability, productivity, risk mitigation, business continuity and employee wellbeing" (IFMA & CBRE, 2014, p.7).

In 1995, Barrett and Baldry (2003) first published the findings of a collaborative research study on the premise of linking operations and maintenance of buildings and their performance to the organisations initiatives. They conducted case studies on eight different FM sector organisations: a small manufacturing firm; an independent day school; a commercial headquarters building; an FM professional group; a private healthcare group; historic property group; National Health Services (NHS) health care trust; and a North East England University (Barrett & Baldry, 2003, p.3-8). Each case study demonstrated how the facilities management structure and services provided contributed to core organisational goals, reviewing external factors and strategic considerations.

Barrett and Baldry's (2003) research concluded that there is not one specific way to organise and manage a facilities department. There are many factors involved, such as location, size of FM department and organisation, clients and services provided. Several trends emerged from their research, such as what is the facilities management department responsible for, and should a company outsource FM services or keep them in house. As for the facility manager, are they experienced in the FM field and do they possess the technical skills, and FM education needed in order to maintain and operate the facilities assets. Barrett and Baldry (2003) conceded that there is a lack of individuals who have actual FM qualifications. This is becoming a hot topic in the facilities management industry today (IFMA, 2011; IFMA & CBRE, 2014).

An interpretation of facility management functions based on Barrett and Baldry's (2003) research is illustrated in Table 1. What is presented in Table 1 does not summarize every function that a facilities manager actually manages. When providing FM services Wiggins (2010) contends that strategically understanding the organisations market place, culture, missions and visions, real estate portfolio, business plans and management structure is fundamental. The FM department should not be isolated from organisational success. Wiggins (2010) expands on Barrett and Baldry's (2003) research and categorises FM services into three areas: support services, information services and premises (building) services, this is further illustrated in Table 2.

Table 1: Facilities Management Functions
(Interpreted from Barrett & Baldry, 2003, p.48)

Facility Management Planning	Operations and Maintenance of Buildings
Strategic Space Planning.	Run and Maintain Plant.
Corporate Planning Standards and Guidelines.	Maintain Building Fabric.
Identify End User Needs.	Manage and Undertake Adaptation.
Furniture Specifications and Layout.	Energy Management.
Monitor Space Allocation.	Security.
Define Performance Measurements.	Voice and Data Communications.
Computer Aided Facility Management (CAFM).	Control Operating Budget.
	Monitor Performance of Building Systems.
	Manage Janitorial/Cleaning Function.
	Waste Management and Recycling.
Real Estate and Building Construction	**General Office Administration Services**
New Building Design/Interior Renovation and Construction Management.	Provide and Manage Support Services.
Acquisition and disposal of new or existing Sites and Buildings.	Procurement of Office Supplies, to include FF&E (furniture, fixtures & equipment).
Lease Negotiation and Management.	Manage Non-building Services, such as catering, food services, and transportation.
Real Estate Property Consulting.	Reprographic Services.
Management of Capital Budget.	Move Management and Relocation Services.
	Manage Cleaning/Housekeeping Services.
	Manage Health and Safety in the Workplace.

Table 2: Facilities Management Services
(Interpreted from Wiggins, 2010, p.24)

Support Services	
Mail & Shipping Services.	Refuse Disposal.
Vehicle Fleet.	Reprographics.
Catering.	Security.
Reception.	Stationery.
Housekeeping.	Travel.
Office Administration.	Vending.
FF&E (furniture, fixtures, & equipment).	Document Management.
Information Services	
Network Management.	Cable and Wiring Installation.
Voice & Data Network.	Planning and Design Feasibility Studies.
Systems Integration.	Software Development.
Building Services (Premises Services)	
Asset and Property Management.	Lease Negotiations & Management.
Site Selection.	Move Management & Relocation Services.
Acquisition & Disposal of Facilities.	Structure & Fabric Maintenance.
Energy Management.	Infrastructure Management.
Security Infrastructure.	M&E Service Maintenance.
Space Management.	Capital Planning & Budgeting Projects.
Project Management.	Property Development.

Far too often departments within organisations become silos following their own initiatives, converting into individual profit centres, and not linking successes and strategies holistically. Hence, facility managers need to think more strategically defining long and short-term initiatives and level of FM services to deliver in order to meet department and organisation strategic vision, mission and goals. Facility managers should foster a systems thinking approach by developing their own internal strategic plan that links tactically with the parent organisations strategic plan. French author, Alexandre Dumas's proverb implies a systems thinking aphorism that can define the relationship between FM and its parent organisation, '*one for all and all for one*'. It seems so simple, except when people, places, technology, business and profitability are involved.

2.3.2 Systems Approach to Facilities Management

Scientific organisational research prior to the mid 1900's reduced systems in to smaller parts and researched each part as separate entities. This reductionist approach considered "that the whole is no more than the total sum of its parts" (LERC, 2010, p.5). Nonetheless, according to LERC (2010, p.5) researchers such as "von Bertalanffy (1940, 1950), Wiener (1948), and Fries (1948)," conceptualised that in order to look at an entire system you need a more holistic approach that links the larger system together forming a multitude of relationships within. According to Meadows (2008, 2011) there are three attributes to a system: there has to be components, each system must have a function or purpose, and the parts are interconnected. "The systems-thinking lens allows us to reclaim our intuition about whole systems and (Meadows, 2008, 2011, p.7):

- Hone our abilities to understand the parts,
- See, to visualize the interconnections,
- Ask 'what if' questions about possible future behaviours, and,
- Be creative and courageous about system redesign.

At its simplest form, a system is composed of many unique elements, these segments link together forming larger entities. An organisation is a system, as are marketplaces, both are subsystems of an even larger system; the global economy (LERC, 2010; Coenen & von Felton, 2012; Seddon & Caulkin, 2007). A system thinking approach is the foundation of organisation ecologies; it leads to the development of improvements and changes in the system (LERC, 2010). Consequently systems' thinking is about

cohesiveness and from this interconnectedness flow several important consequences. One should consider the many parts as a holistic system, not individually (Seddon & Caulkin, 2007).

A systems approach to facilities management is represented in Table 3. The input of people, places, processes and technology is measured against the eleven core competencies of facilities management developed by the International Facilities Management Association. The output is represented based on the services provided through the core competencies. FM services classified as output are health and safety in the workplace; human comfort; sustainability and regulatory compliance; value in terms of the triple bottom line and return on assets, capital assets and operating cost. Budgets for FF&E (furniture, fixtures and equipment) and performance standards are developed and monitored.

Table 3: Systems Approach to Facilities Management
(Source: Interpretation from Anderson, *et al*, 2006)

Holistic Systems Approach to FM	
Input People Process/Business Requirements Technology	**Output** Facilities Human Comfort Health and Safety Performance against Standards Sustainability Regulatory Compliance Return on Assets/Capital Asset Value Furniture/Fixtures/Equipment = (FF&E) Budgets Total Operating Cost Site Specific Standards
Throughput *The effective implementation of the FM Competencies:* Communication Real Estate Sustainability Technology Human and Environmental Factors Operations & Maintenance Planning and Project Management Finance and Business Essentials Leadership and Strategy Essentials Quality Assessment and Innovation	

FM should not only be thought of as its own individual profit centre, it needs to be linked to the organisations strategic plan and share in the efficiency and effectiveness of the organisation and its profitability. This can be done through a holistic systems approach incorporating a lean philosophy and visual management technologies to further develop a value based FM department.

2.4 Lean Philosophy Overview

The philosophical foundation, tools, techniques and theory of a total quality management system, labelled TQM, was developed by an industrial engineer Shigeo Shingo who presented his concepts of production, waste, "Just in Case" philosophy for the "Just-in-time (JIT) system" also referred to as Fordism (Krafcik, 1988, p.43), SMED and identified batch production as the main source of delays (Bicheno, 2000; Bicheno & Holweg, 2009; Shingo, 1989, republished 2005). Shigeo Shingo's original theory behind TQM was the "absolute elimination of waste" (Shingo, 1990, p.67). In 1950 after WWII while Japan was re-establishing their infrastructure after a war torn society, Taachi Ohno began to develop the Toyota Production System, known as TPS and the foundation of a lean production system was born (Liker, 2004). The philosophical foundation of TPS, its tools, techniques and theory of lean systems emerged from the car manufacturing industry.

It was John Krafcik, the "first American engineer hired at a Toyota-General Motors joint venture, NUMMI plant" (Womack, Jones, & Roos, 2007, p.3) and a researcher at Massachusetts Institute of Technology's (MIT) International Motor Vehicle Program, who introduced the term 'lean' (LERC, 2010; Womack, Jones, & Roos, 2007) and 'lean production system' in a 1988 article titled, *Triumph of the Lean Production System* (Graban, 2013; Krafcik, 1988). Krafcik's lean production theory was considered lean "because it uses less of everything, half the human effort, half the space, half the investment in tools, half the hours, half the time. Also, it requires far less than half the inventory on site" (Womack, Jones, & Roos, 2007, p.11). Furthermore, Krafcik's (1988) buffered lean production system is based solely on production and manufacturing of automobiles, lean production vs. typical mass production, and Toyota vs. Fordism.

The conceptualization of a lean production system and lean thinking was further developed in 1990 with the world-renowned book, *The Machine that Changed the World*, authored by Womack, Jones and Roos (1990). In Womack and Jones 1996 book *Lean Thinking* (Dahlgaard & Dahlgaard-Park, 2006; Furterer & Elshennawy, 2005; Koskela, 2004; Kempton 2006; Parry & Turner, 2006; Radner, 2009; Terry & Smith, 2011) the term 'lean enterprise' was conceptualized along with lean principles (Furterer & Elshennawy, 2005; Womack & Jones, 1996). Womack and Jones (1996) categorised their lean thinking theory into a set of five lean principles:

1) **Specify Value**: The customer can only define value from their perspective. It is specified in terms of satisfying customers' needs by providing products and, or services with desired capabilities at a competitive price and lead-time.
2) **Identify the Value Stream**: The set of all of the actions required to bring a product through problem solving, information management, and physical transformation activities. Here, value refers to the nature of activity being carried out. The value stream is the set of actions that transform a product or service in to reality.
3) **Make the Value Flow**: By reducing cycle times and batch sizes to the absolute minimum, ensuring each operation is visible, defined, and has a visible status to eliminate possible stoppages in the production process. In the facility management system the value flow can be relayed to the cycle time of the work order process and work activities.
4) **Let the Customer Pull**: Processes or products are to be produced and delivered on-demand from the customers' needs.
5) **Pursue Perfection**: Even if the other four lean principles are followed, if the mind set for pursuing perfection has not been developed across the enterprise (system), any improvement will only deliver a one-off benefit. This is additionally referred to as continuous improvement.

Lean principles can be adapted in other industries besides car manufacturing successfully. According to Parry and Turner (2006) the five lean principles forms a framework that can be used to assess any organisation. Radnor's (2010) research adopted a lean approach established by an international logistics manufacturing organisation and implemented it in a UK Government agency. In the study Radnor (2006) compared Womack and Jones (1996) five lean principles against the logistics manufacturing organisations lean initiative. The study concluded that a lean approach is a good starting point for improving organisational expenditures, enhancing quality, value, and productivity.

Although Radnor (2010) concedes that Womack and Jones (1996) principles emphasize that organisations should determine value prior to implementing lean methods. The opposite was acknowledged by Radnor's study; it established that in the government service sector the main focus was on the value stream and proper workflow prior to determining value in the system. The same result was detected in the exploratory case

study in Chapter 5. In both cases value would then become the number three lean principle, not the first one as envisioned by Womack and Jones. Their research has been mainly in manufacturing, not government agencies, facilities management, and service industries.

On another note, Bhasin's (2011) study measured the leanness of 20 manufacturing organisations in the UK by developing a lean audit. Bhasin developed a framework of seven stages broken down in to twelve categories that an organisation might go through on their lean transformation journey. Though this study was done 15 years after Womack and Jones developed the five lean principles, it concluded that a lean journey is a very time consuming strategic initiative. The study concluded that the development of a lean audit framework "could be applied to any organisation on the lean journey" (Bhasin, 2011, p.68). Though, Bhasin (2011) devised an alternative audit framework with some success. Radnor (2010) sustained the original lean principles in her study of integrating lean from manufacturing to a UK Government agency. For this thesis, based on the literature, it is theorized that Womack and Jones's (1996) original and most commonly referred to five lean principles are an effective starting point to assessing lean in facilities management. The literature review will examine the theory behind the five lean principles and how they may or may not relate to facilities management ecologies.

It can be determined that twenty seven years after Krafcik (1988) introduced the terms 'lean production systems' and 'production management policies'; they are still as pertinent today as they were back then. According to both Krafcik (1988) and Bhasin (2011) careful consideration regarding management policies, culture and willingness of the organisation to change should be taken in to consideration for lean implementation to be successful (Krafcik, 1988; Bhasin, 2011). Managing the risk of a lean transformation takes a "great deal of discipline and skill" (Krafcik, 1988, p.51). The risk can be offset by "developing a well-trained, flexible workforce, high quality (product design) and a supportive high performance supplier network" (Krafcik, 1988, p.51). Literature concedes that this is as true today as it was back in 1988.

2.4.1 Defining Value from the Customers Perspective

According to Womack and Jones (2003) the customer is the only one that can define value based on the products, goods and or services provided by the organisation. Value

is specified in terms of satisfying customers' needs by providing products and, or services with desired capabilities at a competitive price and lead-time. That might be adequate in a manufacturing setting where actual merchandise and products are manufactured and produced. In facilities management, merchandise or an actual product is not produced; services to the end user of the workplace and organisation occur. The customer is the one that contemplates value through co-creating performance criteria to measure services rendered and time assigned for completion of activities and work order tickets.

2.4.1.1 Defining Value in Facilities Management

As quantified by Alexander (2012) value is essential to collaboration with FM workplace stakeholders. Workplace stakeholders in the FM enterprise as conceived by Coenen and von Felton (2012, p.119) are the "clients, customers, and, or end users". The "customer co-creates" value in the workplace by collaborating with the FM service provider to develop services, processes and procedures, and performance measures. An FM service can be hypothesised as an intangible act meaning it "cannot be seen, felt, tasted or touched" (Coenen & von Felton 2012, p.118) in the same way as a tangible product.

For instance, if a stakeholder is too hot or too cold, they are usually instructed to call the service desk to file a complaint. The mediation of this complaint cannot be seen or touched from the customer's perspective. How does the customer know if the work order (sometimes referred to as a work ticket) assigned is completed; how long it might have taken, and if there were any issues involved in mitigating the complaint. After the work order is rectified, the customer could possibly feel the aftermath of the intangible service by feeling more comfortable, or actually seeing that the issue was fixed. It can be surmised that the end user doesn't know how long it took to fix the issue, if there were any implications such as a part having to be reordered, or a valve replaced. Therefore, value in FM can be viewed as intangible and is co-created with the end user in mind (service industry reference from: Cal Poly, CH2M HILL, EDS, US Pentagon, Pratt Institute and University of Salford).

The term 'value for money' was used in the UK's government restructuring of higher educational reform; it signifies getting the best cost and quality for specified services. An organisation can use the same concept of best value by continuously pursuing quality FM

services for the least amount of cost (Atkins & Brooks, 2009). This hinders on the decision of an organisation to either keep FM services in house or to outsource services rendered. According to Atkins and Brooks (2009 p.7) value in FM is all about "cost or price and quality and performance". FM adds value to the organisation by the performance of workflow activities and safeguarding the workplace accordingly. While keeping employees' health, safety and welfare in mind linking productivity in the workplace with organisations core goals, missions and visions (Wiggins, 2010).

It is standard for an organisation to determine the value for money based on what they paid for the services last year compared to what the same service is costing them today. The cost factor becomes a tangible determination and is easily calculated. Nonetheless, FM organisations should consider value for money in terms of measuring performance, quality and efficiency of a given service; it's not always about minimizing cost, unless cost is a major organisation strategic initiative. Another way of determining value in FM, as expressed by Coenen and von Felton (2012), is the co-creation of value through working closely with the supply chain, subcontractors, furniture vendors, and customers to determine value for money, and quality of timely efficient services.

The necessity of human value and the impact on the FM workplace should not be overlooked. The contemporary workplace of today has taken a giant leap from the days of Frederick W. Taylor (1911) and his workplace efficiency experiments. Today's workplace has become technologically savvy with an importance placed on social media and global connectivity. Additionally, the workplace has always been considered an immense overhead expense. Therefore, the FM department who is partly responsible for managing the workplace and company assets influences "corporate culture, staff behaviour, productivity and the ultimate bottom line" (Stuart, 2012, p.128).

The C-suite, which is the highest executive leadership of a firm, i.e. Chairman, Chief Executive Officer (CEO), Chief Operating Officer (COO), Chief Financial Officer (CFO) (IFMA, 2007; Moore & Sonsino, 2013), is starting to take notice and consider the importance of a "value-focused workplace" that will have considerable benefits and added value, not just financially, "but also by its ethical and environmental performance-commonly known as the Triple Bottom Line" (Elkington, 1998, In Stuart, 2012 p.131). Facility managers will continue to play a larger role in the future workplace where value

for money is not just about cost of providing services. It's about the value of maximising human capital, an educated workforce, creating a learning environment with open communications. Value in the workplace will continue to evolve and facilities management will be at the forefront of this ever-changing global marketplace.

2.4.2 Identify the Value Stream in the System

The value stream is where visuality enters the picture, a value stream map is a visual representation of all actions required to bring a product or service through problem solving, information management, and physical transformation to the end user, from start to finish (Womack & Jones, 1996). Here, value refers to the nature of activities being carried out. The value stream is the entire set of actions (processes and procedures) that transform a product or service in to reality. The first step in creating a value stream is to illustrate (visualise) the current state, also referred to 'as is' state. The next step is to review 'as is' current workflow activities from start to finish, eliminating tasks that cause waste in the system. The emphasis is put on noticing the non-value added tasks and where improvements can be made throughout the system. The new value stream becomes the future state, or the 'to be' state (Womack & Jones, 1996).

2.4.2.1. Identifying the Value Stream in Facilities Management

In FM ecologies the 'as is' activities for services provided can be value streamed mapped to show the current state (as-is) of operations. After careful examination of the value stream one can visualize where wasted efforts and the need for improvements could occur. Additionally, working with the customers, clients, or end users in mind to seek a future (to be) state (Bicheno & Holweg, 2009). According to Bicheno and Holweg (2009) value stream mapping is a brilliant exercise for employees to collaborate on, not only by determining the current and future state, employees get a chance to work together to devise new concepts. The value stream exercise is additionally a great first step to lean initiation (Bicheno & Holweg, 2009) and visual management. It starts the conversation of examining the big picture of the organisation. Liker (2004) implies the value stream helps you to "learn to see the waste, develop a lean vision, and apply it" (Liker, 2004, p.303) to every workflow activity and process, visualizing how it all fits together within the whole system.

An example of a value stream map request process for a global real estate energy management service provider is illustrated in Figure 1. The end user is a Finnish trade organisation and retail establishment. In her research, Jylhä (2013) recommended that the clients value stream map their workflow processes. The research study revealed wasted workflow tasks and "value losses" (Jylhä, 2013, p.23) within sub process activities. Jylhä's (2013) research found that there were insufficient tools for managers to provide quality delivery of services; furthermore services for the same request differed per client. It was concluded that the real estate provider and energy management organisation had different interpretations of who the end users were. This inhibited the creation of value prior to the value stream mapping exercise.

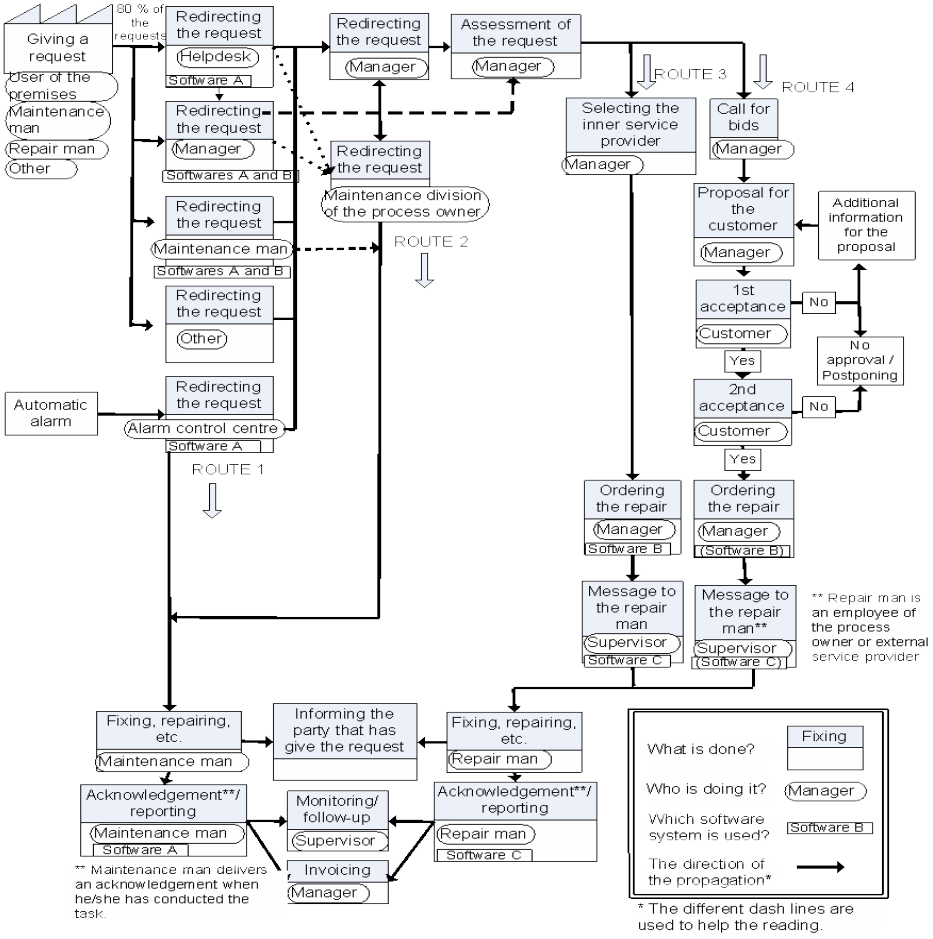


Figure 1: Energy Management Service Request Process Value Stream Map (Source: Jylhä, 2013, p.12)

By performing a value stream exercise "three value creation practices" were noted. The sub processes were realized; a "lack of power" was noted; and different customers received different services. This "decreased the capability of the current process to

generate customer value" (Jylhä, 2013, p.23). Hence, by conducting a lean visual management activity such as value stream mapping resulted in the creation of added value subsequently by determining the waste and inefficiencies in the system. The literature on value stream mapping specifically in facilities management has its limitations, examples of the value stream and discussions available in peer reviewed academic papers, reports, articles, books, are lacking. The example presented is from a recent Ph.D. directed at creating value or waste in the Finnish real estate (FM) industry.

2.4.3 Force the Value to Flow through the Systems

The notion of flow through the systems can be viewed as reducing cycle times and batch sizes to the absolute minimum, ensuring each operation is visible, defined, and has a visible status to eliminate stoppages in the production process. In facilities management systems the value flow can be relayed to the cycle time of the work order process or services provided. Womack and Jones (2003) declare that the manager needs to let value flow through the process of any given activity. It doesn't matter if it is a car manufacturing plant, a healthcare service provider or a university facilities management department. Once management understands value for a given activity, they will automaticity know how to keep the process flowing more efficiently, and continuously creating a psychological flow. This becomes the biggest challenge of all, where everyone working on a specific activity will seek to "keep the system flowing smoothly with no interruptions" (Womack & Jones, 2003, p.65). Creating an educated workforce is vital to the success of any facilities management system. Each employee must understanding the importance of their role and how it relates to the whole system, always keeping quality and continuous improvement in mind.

2.4.4 Pull from the Customers Side

Flow comes from within the organisation at the employee level and pull of the process is the demand from the end user. In manufacturing, the products and services are produced and delivered to the customer upon request. This works well in manufacturing, though in FM terms, this would translate to mean that no service is provided unless the customer requests it. However, there are preventive maintenance activities performed that maintain efficiency of equipment and facilities that are not requested specifically by an external customer. They are performed to keep environmental systems running at peak

performance. Therefore, in the FM industry another customer exists in the value stream, the internal customer, the FM organisation themselves.

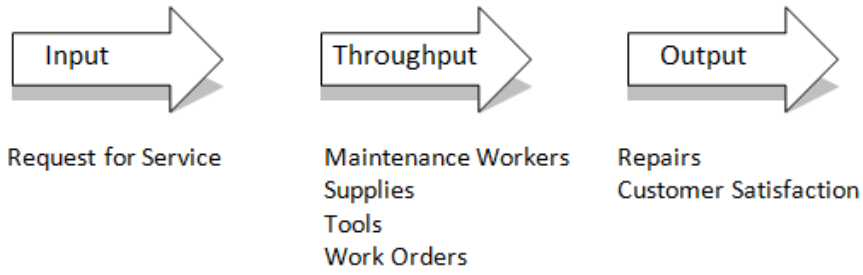


Figure 2: Customer Pulls Facilities Management Services Request
(Source: Anderson, et al, 2006)

To get a broader glimpse of a pull example and systems thinking (process) approach to facilities management, conceptualize services provided as inputs, throughputs and outputs, illustrated in Figure 2. It can be best described in terms of a typical service request and the overall flow of the work order activity. Therefore, pull in FM Systems take resources that exist in the environment (input) and transforms them (throughput) into desired results (output) (Anderson, et al, 2006).

2.4.5 Pursuit of Perfection

In developing a lean enterprise, the drive for perfection and best practices must exist across the entire organisation or only few benefits will foster. There has to be a consistent continuous process of reflection in place in order for the value to flow efficiently and effectively through the value stream. Collaboration between both internal and external customers must exist resulting in a more satisfied customer. In a lean enterprise everyone involved is constantly seeking perfection, the best way to do their job, or the task at hand in order to save time and cost, and eliminate wasted activities. The term perfection can be very harsh and in cultural terms it can lead to employees not feeling good enough, and pressure to always be perfect. Is anything, or anyone ever perfect? For this thesis, the term that will replace perfection is continuous improvement. We can all strive to improve; we don't have to strive to be perfect.

Lean has been defined and the 5 lean principles have been discussed and how they may or may not add value to FM systems. The case study research will seek to explore what lean principles fit well in facilities management. When implementing lean principles, or any

new approach there needs to be an organised framework such as a project delivery system for structure and success. Milestones, processes and procedures should be in place to introduce these new systems to employees, not all at once, but little by little. The theory here is to integrate lean principles in to facilities management ecologies through the use of a project delivery system to better control the inputs, output, and throughputs.

2.5 Lean Management Systems

At the Smithsonian's Office of Facilities Management and Reliability (OFMR) in Washington, DC. Wurtzel and Cooper (2013) establish that facilities management may be using lean leadership and not even know it. There are many different interpretations of what lean really means, based on the organisation and industry sector. Facility leaders have a tendency to think of lean concepts in the workplace for improved workflow productivity and use in continuous improvement initiatives (Wurtzel & Cooper, 2013). "Lean knowledge is too valuable to simply be used as a descriptor of potential success: it is not just about understanding the concept and potential; it is about implementing the concept for improved organisational performance. It is time for FMs to become leaders within their organisations. This begins by not just talking lean, but by walking lean, too" (Wurtzel & Cooper, 2013, p.16).

Furthermore, Wurtzel and Cooper (2013) contend that facility managers need to understand two main principles of lean in order to reap all the benefits, "continuous improvement and respect for people" (Wurtzel & Cooper, 2013, p.16). If FM leadership comprehends the basic knowledge of lean principles, implementing the tools, and techniques in to corporate culture, in turn will link the FM department more strategically. Resulting in the achievement of both a successful internal and productive value driven FM department aligned externally to the organisations mission, vision and goals.

This is where the gap appears; companies employ lean principles, or develop frameworks to measure the leanness of their organisation. Yet there are limited process and procedures in place to guide them on their lean transformation journey. Far too many organisations have not been successful in their lean journey for the reason that they put more emphasis on lean or TPS tools and techniques. Devoid of implementing lean as an organisational management system that infuses a new culture throughout (Liker, 2004).

Liker established a method that integrates lean principles in to an organisation. He divided the TPS in to 4 categories, and established a "4-P" approach (Liker, 2004, p.6):

1) Problem Solving.
2) Process.
3) People and Partners.
4) Philosophy.

Problem solving refers to creating a learning environment and continuous improvement through keeping track of best practices. People and partners stands for teamwork, respect for co-worker's and challenging each other in the workplace. Process describes the value stream and mapping out activities, as a result waste is eliminated from the process flow. Without the implementation of the 4-P approach across the entire enterprise, Liker (2004) argues that success emerges one step at a time, stifling total efforts of sustaining a long term lean enterprise. Likers approach has its merits; yet it stops short of introducing a methodical lean project management delivery approach.

Implementing lean in an organisation other than manufacturing, can be an overwhelming task. In manufacturing you can see the progress on the production, or in construction the progress will be in the building vs. the schedule. In service organisations the majority of change happens internally. "With the trend toward accelerated change, the scope of project management has expanded from (the Apollo days) construction projects, and aerospace to encompass organisational change, research and development (R&D), high tech product development, banking and finance, non-profit services, environmental remediation, in fact, just about every field of human endeavour" (Dinsmore & Cabanis-Brewin, 2014, p.xi). Changing an organisations mind set by engaging a new way of working, and creating a lean culture, is similar to developing a new project or program.

Mann (2010) suggests that not including a lean project management delivery system with your lean implementation initiative can result in "reinforcing old habits and ways of thinking" (Mann, 2010, p.5). As an organisation starts to execute lean initiatives in to the workplace, behaviour and cultural change issues can start to arise. "Without a lean management system in place to support the new physical arrangements, people are left to rely on their old tricks for fooling the system" (Mann, 2010, p.5). Failure begins to happen and both leadership and operatives find fault with the proposed new system. It can become difficult for management to follow through and operatives notice the lack of

conviction. The new lean implementation initiative turns out to be just another failed attempt at an organisational transformation program gone wrong. Implementing a lean management project delivery system consisting of processes, procedures, accountability and focus supports the lean journey long term. For this reason, Mann (2010) established a process focused and process improvement closed loop system, illustrated in Figure 3.

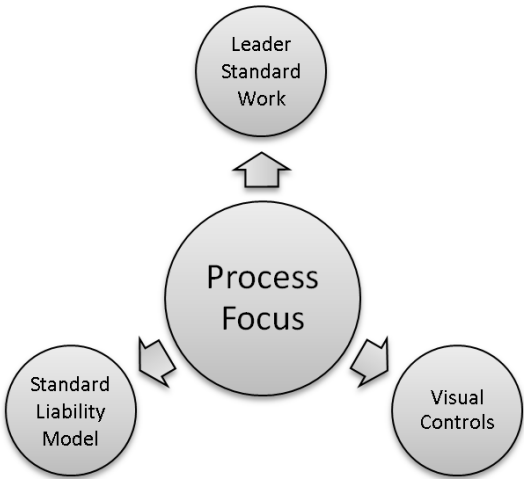


Figure 3: Lean Process Management System
(Source: Interpreted from Mann, 2010, p.8)

Mann's lean process management system emphasis's the use of visual controls as confirmation for "capturing process performance data, including information on misses, defects, interruptions, systems failures, and abnormalities" (Mann, 2010, p.7). It highlights daily accountability for assigned tasks, leader standard work consisting of monitoring and documenting, and setting standard work process and procedures within a formal Shewhart/ Deming cycle: of plan, do, check, act; and consistent follow through.

Alternatively, Glen Ballard developed the Lean Project Delivery System (LPDS) based on the Lean Construction Institutes (LCI's) mission in his 2000 White Paper. LCI's mission was to foster a more productive management system for design and construction of capital projects. LPDS uses techniques from the Toyota Product Development System incorporating "target costing and set based design" (Ballard, 2008, p.1). The theory is that a project should be looked upon as a "temporary production system" (Ballard & Howell, 2003). Its basic principle is to deliver a service, while "minimizing waste" and "maximizing value" (Interpreted from Koskela, 2001, In Ballard & Howell, 2003, p.2). Ballard and Howell (2003) suggest that there is much research and testing to be done to

improve the LPDS. Nonetheless, using some type of lean management system in managing construction and production systems is a “new way of thinking” (Ballard & Howell, 2003, p.14). Lean management systems should be automatically used in organisation transformations and department projects. “Applying a new way to project management appears to offer opportunity for performance improvement comparable with those achieved with the change from mass to lean forms of manufacturing” (Ballard & Howell, 2003, p.14).

Use of lean management systems will regulate the workflow that visual management identifies. Lead time will be reduced while waste in the work system is eliminated, and everything starts to flow better. Visual systems “imbed lean” (Galsworth, 2005, p.1) in to the workplace empowering employees to visually create a more adaptive work environment that is connected to all aspects of the organisation. Visual and lean are equally important and should be linked together to form a more strategic enterprise. The outcome becomes a true visual lean alliance that is merged with similar concepts, tools, techniques and technologies (Galsworth, 2005). The next construct of the research to be discussed is visuality; visual management and creating a visual workplace management system.

2.6 Visual Workplace Management System

Visual workplace management is a system that uses a lean approach to implementing visual management technologies and practices in the workplace. Visuality becomes an integral part of the visual workplace management system as it supports an innovative visual culture where knowledge is shared (Galsworth, 2005). All information on the company website, in a binder, in files or company data systems becomes liberated and openly (visually) communicated to employees and customers (interpreted from Galsworth, 2005, p.17). This is done “by converting that information into a visible, at-a-glance format for all who need it to access and use” (Galsworth, 2005, p.17). Employees will be able to decipher workplace information “just by looking”. The knowledge shared becomes a powerful tool. “More than ever before, when we work in a fully-functioning visual workplace, we understand that. We become powerful. When we liberate information, we liberate the human will” (Galsworth, 2005, p.17).

2.6.1 Visuality

According to *The Oxford American Desk Dictionary and Thesaurus* (2nd ed.) (2001, p. 943), visual is defined as an adjective and "is of or used in seeing", as a noun; it is described as a "visual image or display, picture". Human beings visualise their surroundings in colour, objects, light and interpret them individually. "Every day, every hour, we're seeing and absorbing information" (McCandless, 2012, para.2). The Vision and Learning Organisation (n.d.) attests that our "vision allows us to take what we see and process this light information so that we can" (Vision and Learning.org, n.d., Copyright © 2006 - 2008):

- **Identify** what we see by where it is, how far away it is, how big it is, how fast it is moving, and what texture it has.
- **Store** current information for future retrieval.
- **Integrate** the sight information with all our other senses: touch, hearing, taste and smell.
- **Compare** this information to previously stored information in order to confirm prior experience or reconstruct a prior experience if necessary.
- **Derive meaning** from both the new information and past information.
- Decide the **relationship** between where we are and where it is, or find out where we are in space.
- **Act** on this new meaning.
- Use this new perception to **direct movement** or thought.

Visuality can be interpreted as an array of visual images that we come in contact with each day. While we journey to and from work there is a need to be able to interpret traffic signals and signs that tell us to stop, be cautious, winding road ahead, divided highway, or food and lodging is in close proximity. When driving in a car, a visual display might show patterns on the road that informs us to pay attention to which side of the road or which lane to be in; if we are allowed to pass a car ahead, or adhere to the lane we are driving in. When travelling by subway, (also known as underground, metro, tube, U-Bahn, and S-Bahn) entrances are labelled with specific colours, patterns, signs or structures noting location, line and letter or number. When inside a subway station, airport, train station, ferry port, or even a retail mall, hospital or at a university there are visual clues that direct us to our destination via signs, symbols, and colour. These are all

visual devices that are “guiding us, informing, instructing, and making us comply” (Galsworth, 2005, p.xiv) each and every day as we travel and go about our daily lives. This is considered a visual unspoken language. Visuality when used in the workplace sets up the foundation for employees to integrate visual technologies that contribute to the creation of artefacts that communicate work activities and organisational strategies.

2.6.2 Visual Communication

Visuality in an organisation communicates company knowledge such as missions, visions, and goals; human resources information for instance benefits and payroll status; employee and company performance; strategic initiatives and job task activities. Additionally, it “requires a partnership among workers, managers, and skilled and technical staff in which the parties are responsible to each other for the outcome” (Grief, p.xviii). In order to complete the outcome successfully there must be transparency among the cohesive working environment. Visual communications, trust and information sharing are vital to an organisations achievements (Grief, 1991).

According to Mestre, Stainer, Stainer, and Strom (1999) people tend to communicate through the unspoken word. They “hear without listening and write with vulnerability of intended meaning, but communicating is the ability to encapsulate, often quite complicated issues, in simple and effortless ways” (Mestre, Stainer, Stainer, & Strom (1999, p.34). Mestre, Stainer, Stainer, and Strom (1999) contend that Oakland’s (1999) philosophy of our five senses realized that visuality (sight) contributes 75% to the development of knowledge. The rest of the five senses and their contribution to deciphering knowledge are illustrated in Figure 4 (Mestre, Stainer, Stainer, & Strom, 1999, p.35):

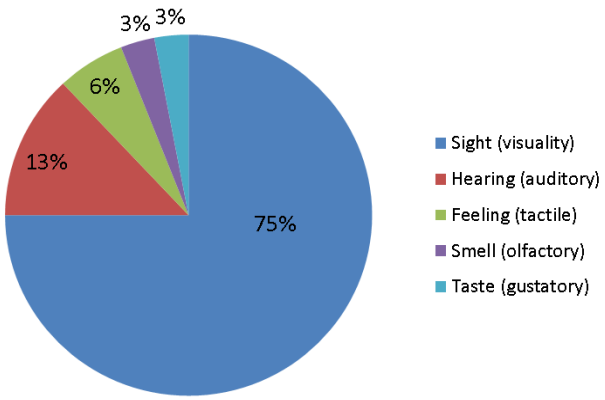


Figure 4: Deciphering Knowledge through our Five Senses
(Source: Oakland, 1999, In Mestre, Stainer, Stainer, & Strom, 1999, p.35)

The Japanese are extensive users of visual communications in the workplace, it is engrained in their corporate business "management processes" (Mestre, Stainer, Stainer, & Strom, 1999, p.34). While "western corporations generally underestimate the impact and effectiveness of visual communication" (Mestre, Stainer, Stainer, & Strom, 1999, p. 35). Japanese standard business practices apply visual management strategies through visual communicators such as "signs, banners, buttons, name tags, charts, information boards, insignias, colour schemes, and even architectural features" (Mestre, Stainer, Stainer, & Strom, 1999, p.35). Visuality is not a new fad of communicating. Visual communications has been around since Egyptian times (Grief, 1991; Mestre, Stainer, Stainer, & Strom, 1999; Tezel, Koskela, & Tzortzopoulos, 2009, 2010) and beyond. There are known prehistoric visual communications that date back further, referred to as the Aurignacian culture of the upper Paleolithic period cave illustrations in France (Smith, Bouchard, & Lorblanchet, 1999, p.347) as well as the Altamira cave drawings in Spain (White, 1992).

According to Grief (1991) we really don't know when visual communications began. Grief (1991) suggests that the military used flags to distinguish troops from one another. Or was it ancient man who "carved notches in the butts of their muskets to indicate performance or when communities carved its creed on the walls of its temple" (Interpreted via Grief, 1991, p.1). To summarise, visual communications may actually have evolved when prehistoric man started to draw images of animals and their hunting techniques on cave walls (Grief, 1991; White, 1992; Smith, Bouchard, & Lorblanchet, 1999). We may never know the real answer, just speculation.

There are four advantages to visual communications, they are as follows (Mestre, Stainer, Stainer, & Strom, 1999, p.36):

1) Assimilation:
    a. This is made simpler as clear and creative imagery, graphs or slogans require little brainpower to understand and act upon *vis-á-vis* verbal data.
2) Exposure:
    a. Reinforces themes; the "mere exposure effect", according to Matlin (1992), is the tendency for receivers of stimulus to like something more or find it less distasteful after repeated exposure.

3) Evoking:
    a. This triggers emotions and responses, resulting in motivation and commitment, from the heart of the matter to the heart of the worker.
4) Unifying:
    a. Ensures that members of the organisation, through accessibility of knowledge and information, know what they are about and where they are headed.

Though the Japanese work ethic and culture embrace visual communications as second nature in the workplace, the principle functions of visual communications can be effective in an array of organisations, and industries. In the Japanese work environment, it is important to define ones group membership within the organisation, "demarcating subgroups within the company from other sub-groups, as well as answering the question "who are we?" (Mestre, Stainer, Stainer, & Strom, 1999, p.39). And "why are we here"? This fosters "a unified mental model of the companies values, beliefs, emotional attachments and goals" (Mestre, Stainer, Stainer, & Strom, 1999, p.39). The seven principle functions of visual communications in the workplace are as follows (Mestre, Stainer, Stainer, & Strom, 1999, p.38):

1) To signal group membership.
2) To acquaint members with corporate vision and culture.
3) To maintain corporate vision.
4) To alert new members to changes in the work environment.
5) To manage human relations.
6) To provide avenues for expression.
7) To transform the corporate paradigm.

Each function is linked to corporate identity and questions that one must ask themselves. Function three relates to corporate values, vision and mission asking; "why should we keep being and doing as we are?" While function four informs employees of changes taking place or soon to be implemented by answering the question; "what requires our attention to be successful?" Function five deals with human relations and conflicted issues asking the question; "how can we get a long?" Coupled with function six, that allows employees to express their sentiments toward the company's mission and vision

by asking the question; “how do we fell?” Lastly, function seven links employees as part of the change efforts answering the question; “how do we get from here to there?” (Mestre, Stainer, Stainer, & Strom, 1999, p.39).

An example of visual communications in the workplace is illustrated in Figure 5. The sign is displayed in a coffee kiosk at a UK University. It visually communicates to the employees what type of cleaning solution to use, and what surface to use it on when cleaning the kitchen. The employee explicitly will understand visually what they are responsible for and how to clean the kitchen area. Once they know where the cleaning solutions are kept they can do their job more productively. Note that the sign is colour coded, illustrating shared information between the organisation, management and staff.

Figure 5: Coffee Kiosk Workplace Sign: What to use when cleaning the Kitchen (Source: EcoLab poster used in Coffee Kiosk at UK University, 2012)

A further example of visual communications is a study of visual management on Brazilian construction sites that Tezel, Koskela, and Tzortzopoulos (2010) conducted. The report concluded visual communications on construction sites were very effective due to the fact that construction workers are sometimes poorly educated. The authors concede that visual communications management “serves different functions within an organisation, namely transparency, discipline, continuous improvement, job facilitation, on the job training, creating shared ownership, management by facts” and brings “simplification and unification” (Tezel, Koskela, & Tzortzopoulos, 2010, p.2) to the workplace.

Visual communications in the workplace is associated with the 5S system. The 5S method stems from the Japanese visual work practice and is one of "the most popular tools" (Bicheno & Holweg, 2009) associated with lean and visual management systems. It's a five step process to organising the working environment. You can see the results right away as the workplace is decluttered and organised. According to Bicheno and Holweg (2009), the "real objectives of a 5S program should be: to reduce waste, reduce variation, and improve productivity" (Bicheno & Holweg, 2009, p.78). In Japan the 5S system is interpreted as: "seiri, seiton, seiso, seiketsu, and shitsuke" (Bicheno & Holweg, 2009, p.78). It translates in to Western terms as "sort, shine, set in order, standardise and sustain" (Mann, 2010, p.262; Bicheno & Holweg, 2009, p.78).

There are many opinions of 5S utilization in the workplace, though Bicheno and Holweg (2009) allude that it should become a natural part of our daily work ethic. Instead of complaining about a chaotic work environment, employees begin to attain ownership and become more engaged when the workplace is organized and free of clutter. Employee attitudes are more positive and they envision that "I work in a really well organized office where everyone knows where everything is and any out of place or missing item is seen immediately. A common alternative to the 5S is the CANDO mnemonic – Clean-up, Arrange, Neatness, Discipline, Ongoing improvement" (Bicheno & Holweg, 2009, p.78). This leads to what is known as visual management. We start with visuality and move through visual communication methods linking various management tools and techniques that have evolved in to what is known as visual workplace management. Visual management is associated with lean methods of managing a factory, plant, construction project or in this instance, the facilities management workplace.

2.6.3 Aspects of Visual Management

Visual management is a visual communication systems theory that can be implemented in any type of organisation to improve performance. According to Galsworth (2005) it's the visual language of a lean enterprise system. Visual management can aid in the way that the work systems are organized (Liff & Posey, 2004). Liff and Posey (2004) argue that "visual management appeals directly to the high level of visual literacy that exists among today's workforce" (Liff & Posey, 2004, p.4). Furthermore, visual management systems align organisations mission, visions and goals against performance measures reinforcing

a direct link between employees and company performance (Liff & Posey, 2004; Galsworth, 2005, 2011). This is where lean and visual management become intertwined.

“Visual management extends beyond the shop floor to the design of forms, to the presentation of information, to the office layout, and to the home, together saving countless hours of waste spent searching and clarifying” (Bicheno & Holweg, 2009, p. 84). It eliminates the need for employees to ask questions or leave their work area to find information needed in order for them to do their job. Visual management, visual controls and the term visuality are also referred to as “control by sight” (Bicheno & Holweg, 2009, p.82) all alternative methods of a lean enterprise.

Based on a literature analysis of the term visual management, Tezel, Koskela, and Tzortzopoulos, (2009) elucidates that authors such as Liker, 2004; Grief, 1991; Drew, 2004; Imai, 1997; Hoseus, 2008; Denis & Shook, 2007; Schonberger, 1986; Shingo, 1989; Mann, 2005; Ohno, 1988; Aik, 2005; Bilalis, et al., 2002; Suzaki, 1983; Parry & Turner, 2006; Mestre, et al., 1999; Standard & Davis, 1999; tend to use many different terms in describing visual management. They argue that there is a lack of consistent visual management terminology and mention that visual management is described in terms of the visual workplace, visual shop floor, and visual factory. What these terms are refereeing to is the actual place in which visual management has been integrated such as the workplace, or a factory, or the shop floor. A factory floor is sometimes referred to as the shop floor. Visual aids, visual controls and visual technologies, are all constructs of visual information that sustains the visual place, through visual communications wherever that maybe.

Furthermore, Tezel, Koskela, and Tzortzopoulos, (2009) describe these visual management terms as being misrepresented typically in collected works. Visual management is such a wide-open subject matter to investigate; the interpretation is left open for the researcher to develop their own theory of what visual management is, based on their literature review, research exploration, and data findings. As previous authors have mentioned lean is also up to interpretation based on the industry and sector, we can argue that visual management is as well.

2.6.4 Visual Technologies

Visual technologies are strategies that provide a worker with important knowledge they need in order to perform their work activities more efficiently. It reduces the need for unnecessary "motion caused by chronic information deficits in the workplace" (Galsworth, 2005, p.1). Incorporating visual technologies in the workplace empowers employees to become leaders and take pride in their job and work environment. Galsworth (2005) is a visual practitioner that has been doing research for over 35 years in the visual workplace and visual thinking. Her research has assisted companies around the world in solving real life organisation problems in the fields of manufacturing, aerospace, and retail maintenance. Theories of visual thinking and incorporating visual technologies in the workplace combined with lean principles have been very successful for the companies who sought out her expertise.

Affirming that Tezel, Koskela, and Tzortzopoulos (2009) research claims there are many interpretations of visual management, this thesis decided to concentrate efforts on Galsworth's philosophy. Three categories of visual technologies were selected to establish a pattern of exploration in the facilities management field. Visual management workplaces have been established in service industries such as manufacturing and construction, this research goes beyond those industries and seeks to test the theories in the facilities management workplace. The next section depicts the visual technologies that could be integrated into the workplace to create a visual workplace management system that forms part of a lean enterprise system. Visual technologies are the tools, techniques, and methods that "convert the physical environment in to a visual one" (Galsworth, 2005, p.99).

2.6.4.1 Visual Controls, Visual Office, Machines and Guarantees

Visual management aspects of lean has stemmed from the conception of TPS when visual controls or "andon (indicator lights)" (Shingo, 2005, p.120) were introduced to stop production if issues occurred on the assembly line. According to Shingo (2005) any problems pertaining to manufacturing can easily be communicated through the use of visual controls. The 7th principle of the TPS uses visual controls to communicate deviations from the norm to "support flow and pull" (Liker, 2004, p.38). Womack and Jones (2003, p.56) link the development of visual controls as a "critical lean technique" that creates transparency in a "lean enterprise". As a result of visual controls in the

workplace by way of andon boards and coloured lights; displaying standard operating procedures and processes; progress boards; kanban cards; colour coding; red tag maintenance boards; line stop cords; design to task items; poka-yoke systems, and visually presenting employee's contributions and teamwork, all transform the workplace in to a proficient visual system.

Visual controls, visual office, machines and guarantees "structure the size, number, range and other quantifiable values of the physical workplace in order to control behaviour" (Galsworth, 2005, p.152). The actual visual device provides employees with information needed and quality control that aids them to become value added participants. Employees will be able to ask "core questions of how many or how much, and when or how long" (Galsworth, 2005, p.152). Instances and definitions of visual controls, visual office, machines and guarantees are as follows (Galsworth, 2005, Interpreted from multiple pages, unless otherwise cited):

Andon boards are electronic boards that display status of production or services using colour coding and **colour coded lights**. **Traffic-light pulls** use **colour coded lights** and signals to distribute and organise merchandise and supplies.

Design-to-task is one of the more effective visual techniques. It is linked with the use of tools in the workplace. Such as hammers, wrenches, rivets, screwdrivers, bolts, and pliers. These tools are organised in shadow boards, built in tool boxes, tool carts, tool drawers, or hung on walls with exact borders cut out or tape outlining the tools shape. Once removed you can see that an item is missing, in addition a tool put away in the wrong place will stand out, and you will automatically know it doesn't belong. The visual workplace is designed around the tools, hence design-to-task.

Kanban can be either a card or a ticket that forms part of a visual pull system and used to signal parts and supply replenishment; a kanban card can follow an item through the production line, or workplace, and indicates product specifications, and number of pieces to manufacture, and helps to monitor the production line. It has additionally been associated with construction sites, lot sizes and grocery stores.

Poka-yoke system or **visual guarantee** is a quality assurance system that "translates specification information in to the process of work itself. Actual devices range from mechanical apparatus, to sensors, and limit switches, all of them are ingenious. They are point of use solutions that often impact the stream of value directly" (Galsworth, 2005, p.161-162).

Visual machine is associated with visual maintenance and fixing equipment, machines, and changeover status for production runs. An equipment changeover cart can have tools necessary to make changeovers in production lines. Signs can be displayed for changeover queues. Machine equipment such as pulleys and belts can be displayed in an orderly fashion. Colour coded charts instructing employees how to change lubricants or how to fix equipment can help with employee errors (Galsworth, 2005, p.170).

Visual pull systems share information based on quantity, material, and dimension, or production efficiency. They are in the form of **kanban**, or a **heijunka box**. Heijunka systems level items, while sequencing the work orders into various components and smaller production units.

2.6.4.2 Visual Order, Establish a Visual Foundation

Visual order is linked to the Japanese workplace 5S system of seiri, seison, seiso, seiketsu and shitsuke. This idea of a clean, clutter free, organised workplace in the western world doesn't always work as effectively as it does in Japanese corporations. In order to implement visual technologies in the workplace, 5S forms the foundation of a visual workplace. Some visual order applications are taping borders around items and creating ID labels. Instances and definitions of visual order, establishing a visual foundation are listed and defined as follows (Galsworth, 2005, interpreted from multiple pages, unless otherwise cited):

Customer driven visual order is created when employees become visual thinkers and start to care more about servicing the end user. They develop their own visual workplace through visual devices and what Galsworth (2005) calls mini-systems. Employees are able to share information with others in the workplace and have answered their need to know questions. As a result, an employee can help train their peers by showing them what visual technologies they integrated and designed. An example of a customer driven

visual order might be in terms of a sign that introduces the customers' delivery status and progress updates. Or a clean drop off and pick up area that is taped, colour coded, that may have angled borders for equipment that need to move, or be stored at a certain angle. Customers may visit the workplace at any given time and a customer driven visual ordered workplace can sell them on the quality services that are provided, internally as well as externally. Companies can instruct their customers, both internal and external, and supply chain to do a walk through and visual audits of their work environment becoming a part of the visual workplace management process.

Patterns of work are developed by tapping borders around equipment, machines, and supplies, thus making patterns in the workplace. Using address labels and ID labels, colour delivery bands, colour coded gauges, double border functions of solid and dashed tape, and outlining tool storage with markers. These are day to day visual work patterns that organise the workplace in a visual fashion.

5S system in Western terms is to sort, scrub the workplace, secure safety, and select locations, than set location and sustain as if it were a continuous habit. Galsworth (2015) argues that companies tend to fizzle out after they have implemented their 5S rollout. The 5S system preps the workplace to receive visual management systems. The first task is to remove all excess waste: S1, sort through, sort out. Then scrub the workplace and prep work surfaces for visual labelling, visual borders, and address and ID labels: S2, scrub the workplace. S3 secures the safety of the workplace, correcting any areas of risk and securing equipment and tools that may be out of place. In S4 solutions, locations for material, company information, and job task instructions are positioned and employee work areas are assigned. And S5 sustains the visual order set in place. This is the section where you can "verify and improve the positions" of items in the workplace before they get "locked in place" (Galsworth, 2005, p.111).

Visual safety solutions secure the working conditions by means of visual solutions that employees create sustaining a safer work environment. An example might be labelling a delivery off load area with thick bright yellow tape for the delivery trucks and drivers, that way they don't hit and damage anything upon delivery. Using distinct labels, colours, and written words on trash bins or containers in areas where scraps and trash might be separated to make a safer work environment. Labelling hazardous material with proper

safety identification information. In some cases barriers might have to be designed to go around specific egress and pathways for employee safety.

2.6.4.3 Visual Displays, Performance Metrics and Standards

This is the core of operations and maintenance performance, and the responsibility of management personnel, team leaders, directors, and staff members that oversee work functions. Operation standards need to be set up, in facilities management this can be developing service level agreements and key performance indicators for work tasks. There needs to be a set of performance criteria that each job function is measured against. Visual standards are "simply to capture technical and procedural standards in a visual format, then to install these as close to the point of use as possible" (Galsworth, 2005, p.132).

Visual displays can be customer service boards, assembly displays, operations and maintenance work displays. Maintenance work order display boards show what work has been done, what work orders need to be completed by what dates and who is working on them, they should be colour coded as well. Manufacturing displays can be linked to changeover in production scheduling. Visual displays, additionally can advertise organisation policies, procedures, marketing brochures, strategic initiatives, and human resource benefits and policies.

Visual standards instruct employees on the process and procedures that need to be performed for job activities. Visual standards do not change employee behaviour, "they tell us what to do; they cannot make us do it" (Galsworth, 2005, p.133). Developing process and procedural standards in the workplace will have a direct influence on the budget, quality, safety, method, and performance of each function in the workplace.

Visual performance metrics measure data criteria of job functions against cost, performance, quality, safety and time. It is a useful tool for quality improvement, by measuring performance, and developing performance reports for management to monitor services provided, and to realise where changes are needed. It raises the 'red flag' and helps in deciding what systems need to be amended, and what systems are doing well. Setting up key performance indicators and service level agreements are visual performance metrics that should be used in the facilities management industry. Another

visual tool that is highly effective in the workplace is a visual A-3 report. An A-3 report is a visual representation of a managerial, product, or service issue developed on an A3, 11 x 17 piece of paper. It can have structure or non-structure, colour coded with graphics or no graphics. Additional key visual performance indicator tools that can be used are SWOT analysis, SMART analysis, and Balance Scorecards.

2.6.4.3.1 Performance Indicators as Visual Methods in Facilities Management

According to Amaratunga and Baldry (2000, p.293), "facilities management (FM) is based on the premise that the efficiency of any organisation is linked to the physical environment in which it operates and that the environment can be improved to increase efficiency" (Grimshaw & Keeffe, 1993, In Amaratunga & Baldry, 2000, p.293) through the use of key performance indicators. Becker (1990) suggests that the total function of FM in the workplace is to manage ecologies related to employees, and building operations and maintenance to include assets, furniture, fixtures and equipment (FF&E), which can lead to the overall success of an organisation. The aim of FM should not just optimise costs of operating and maintaining buildings; it should raise the efficiency level of the workplace. This is based on the notion that the facility managers' role is to manage building assets and resources in order to achieve the mission, vision and goals of the organisation holistically (Spedding & Holmes, 1994; Amaratunga & Baldry 2000). Loosemore and Hsin (2001) contend that FM and real estate organisation's main objective is acknowledging property performance, which is approximately 80% – 90% of total costs (Valins & Salter, 1996, In Loosemore & Hsin, 2001, p.465).

As the world economy continues to drive organisations to review procurement systems, re-examine business practices and efficiencies in the workplace it is up to the facility managers to validate that their department efforts are in line with overall organisations strategic initiatives. In optimising facilities services within the entire organisation one must select the appropriate performance measurement tools. In 1992 when Kaplan and Norton introduced the balanced scorecard (BSC), the intention was to set up a visual management tool that would support managers in compiling financial practices with operational practices on issues that look intensely at internal processes and procedures, customer satisfaction, company initiatives, and future improvements. The BSC has gradually gained popularity; the International Facility Management Association adopted it as part of their strategic plan. They introduced the FM industry to a strategic visual

management tool that can be generated to link FM core values and strategic competencies of the organisation holistically.

This is in line with the findings by Meng (2011) and the fact that Amaratunga and Baldry (2000) applied the (BSC) method to develop a conceptual framework for measuring FM performance in higher education (HE) properties. In retrospect, Mok (2005) and Hamid (2009) established that HE in the UK has suffered financial pressure due to reductions in funding from the UK Department of Education. Resulting in UK universities transforming the way they manage university estates. Similar to the lean transformation that Cardiff University, Cardiff, UK is experiencing. Consequently, university leadership is depending ever more on the facility managers, who operates and maintains the university estate to perform a more strategic role in bridging the gap between the estate and university. There has been little acknowledgement from senior leadership in the past aligning facilities management with the university holistically.

It is particularly common for governments when they encounter reduced financial capacity to decrease financing the growing demands of higher education (HE). Universities are then tasked with increasing student tuition (Mok, 2005; Hamid, 2009; Comm & Mathaisel, 2005; Department of Education, 2010) as is currently happening throughout the UK higher educational system. Higher education providers are adapting to a more competitive world where resources are scarcer. Attaching far more weight to efficiencies, contemporary universities are under immense pressures to transform their roles and adapt to rapid socio-economic and socio-political changes. Universities have a duty to accommodate increasing demands from local communities, parents, students and employers (Currie & Newson, 1998; Mok & Currie, 2002; Comm & Mathaisel, 2005). This is evident at The Kangan Institute in Melbourne, Australia, not only do they teach a curriculum in lean visual management, the university itself is experiencing an institution wide lean visual management strategic transformation (Kangan, 2010) all due to reasons stated above.

2.7 Visual Workplace Management

According to Kattman, Corbin, Moore, and Walsh (2012) the term ‘visual workplace’ is relatively new. Creating a visual workplace does something more than quantify a lean enterprise; it adds a sense of sustainability to the workplace strengthening the

organisation holistically (Galsworth, 2005). Sustainability becomes deeply rooted in visual's ability to engage employees in their quest for creativity, balance and functionality of their own workspace. This happens by prompting employees to feel more a part of the organisation by crafting their own visual workplace devices, resulting in a sense of ownership. This is in conjunction with Alexander's (2003) theory that employees need to embrace their individual workplace. Creating a visual workplace is fundamental in making this happen.

The research embraces Dr. Gwendolyn Galsworth's (2005) theory that a visual workplace brings stability to the built environment, eliminating wasted efforts, introducing an unspoken organized workplace that enables employees to contribute to visual solutions enhancing their own workplace through visual thinking. Dr. Galsworth's research defines a visual workplace as follows (Galsworth, 2005, p.10; Vinas, 2006):

> *"A visual workplace is self-ordering, self-explaining, self-regulating, and self-improving work environment-where what is supposed to happen does happen, on time, every time, day or night-because of visual solutions."*

The primary function of a visual workplace is to "ensure that what *is supposed* to happen *does* happen" (Galsworth, 2011, p.6). In a visual workplace environment the information needed to do the assigned task presents itself through visual devices. This is achieved through visual material of vital information needed to make a value added contribution to the organisation. Galsworth (2005) contends that the visual workplace creates a language, a vocabulary of visuality that eliminates barriers, and envelops sustainable improvement initiatives forming a visual order, the foundation of a lean visual enterprise.

A visual workplace is desirable when there are too many questions asked by employees. Most of the time their questions will go unasked and unanswered. This can create budget, scheduling, quality and safety issues. Galsworth (2005) contends that creating visual thinking empowers employees to think more individually and develop instantiations that improve working conditions, hence creating visual workplaces. This is what Galsworth (2005, p.27) considers the "I-Driven Approach" to workplace visuality. The visual "I-Driven Approach" (Galsworth, 2005, p.27) provides transparency in the workplace encouraging employees, and employers to become visual thinkers. This converts

employees in to ‘value add employees’ (Galsworth, 2005). Visual thinkers should consider the following questions (Galsworth, 2005, p.23-24, p.27):

What do I need to know? and *What do I need to share?*

The first question: “What do I need to know?” (Galsworth, 2005, p.23), gets answered as the value add employee reviews their workload for the day. They look for the right tools that will make them more efficient and provide a safer working environment. An example would be where things are located, how to retrieve the correct information, who do they deliver information to, and who needs to know what (Galsworth, 2005). There are no right or wrong questions and answers. The questions are unique to one’s job task, company, and work environment. Galsworth (2005) refers to value add employees as hourly paid employees.

The second question: “What do I need to share?” (Galsworth, 2005, p.24), corresponds to what information needs to be shared amongst co-workers, supervisors and managers in order for everyone to work in a more informed cohesive unit (Galsworth, 2005). There are specific questions that a supervisor may need to ask in regards to budgets, contracts, schedules and employee benefits, such as paid time off, vacation days, and job activities. In turn this creates a more collaborative transparent working environment where everyone has all the answers visually in front of them. Additionally, as employees organize their own workspace, and create visual devises, they become proud of their surroundings and transpire to be better visual communicators.

It can be argued that visual is about information and people, targeting waste at the workplace level, answering employee’s questions in a visual format. The technologies of a visual workplace translate inefficiencies into visual artefacts that are spread throughout the built environment, enabling people to benchmark systems establishing key performance indicators (KPI’s) (Liff & Posey, 2004; Galsworth, 2005). In the case of a service industry such as facilities management, establishing visual artefacts, service level agreements, and performance measurements aid in benchmarking department systems and strategic initiatives.

These previous sections: visual workplace management system, visuality, visual communications and visual workplace management can be surmised into a **house** of **visual workplace management**. Developing a visual workplace management system in an organisation will increase employee **knowledge** developing a learning **culture shift** where employees want to discover more about lean and visual management technologies. They want to share the knowledge by mentoring each other and co-creating visual artefacts in the workplace**.**

Think in terms of building a residential house, you start from the ground up. The footings are formed and concrete is poured. The footing is **visuality** which supports the foundation, **visual communications**. Followed by the exterior walls (**lean principles and concepts)** and interior walls (**visual management)** that structurally supports the building and roofing system. The roof becomes the overall **visual workplace management system**, encompassing all the approaches, technologies, and tools protecting the workplace from external elements. This is further illustrated in Figure 6.

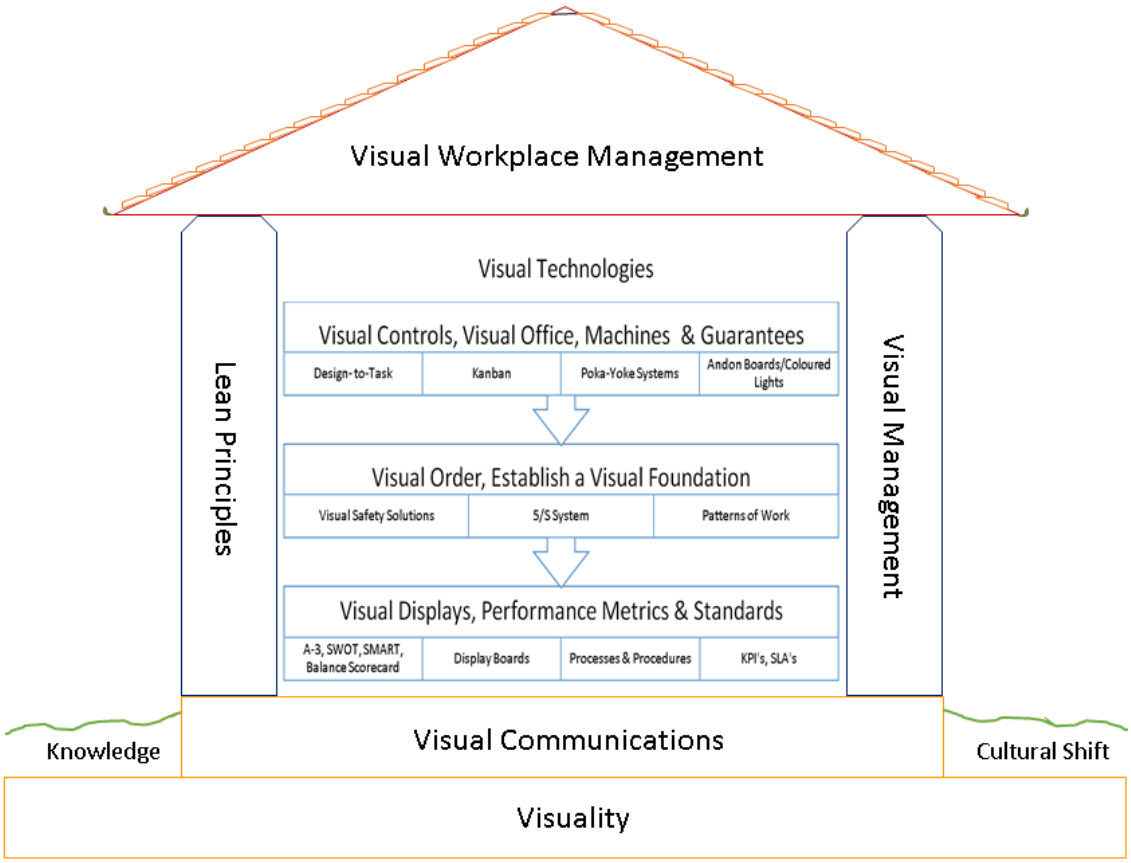


Figure 6: Visual Workplace Management Building System

The interior walls, floor boards are made up of three levels of **visual technologies**. Level one is **visual displays, performance metrics and standard technologies**. This includes performance standards such as visual A-3 reports, SWOT analysis, SMART, and balance scorecards. Standard workplace practices such as processes and procedures, monthly performance reports, key performance indicators and service level agreements are injected in to the system along with visual display boards to communicate workplace performance standards and metrics. The second level is **visual order, establishing visual foundation technologies**. Composed of the 5S organisation declutter system, customer specifications and requirements, finding patterns in the workplace and visual safety solutions. The third level is **visual controls, visual office, machines and guarantees technologies**. This is made up of kanban systems, Heijunka boxes, pull systems, colour light controls, design to task and poka-yoke systems, computers, CAFM and CMMS systems, tablets, office telephones and smart phones.

Similar to developing a lean organisation, whereas lean is the philosophy and value, value stream, visual management, learning organisation, elimination of waste and just in time (JIT) are tools and techniques of a lean enterprise. The interpretation, challenge and depth of creating a lean visual management workplace provides organisations a chance to create their own bespoke visual workplace environment. This makes for an enriching occurrence and more opportunity to research visual management integration in facilities management systems. An in-depth literature evaluation concludes that their lacks publications and research explorations of a standard visual workplace management system especially in FM. The next section explores FM sectors more in depth to find evidence of lean and visual management in facilities management systems, does it exist, or is it more infrequent than imagined.

2.8 Evidence of Lean and Visual Management in Facilities Management Sectors

The literature analysis defined the FM industry, introduced lean philosophy and concepts, systems thinking, visuality, visual management technologies and a visual workplace management system. What is missing is the link to the facilities management sectors such as: security management, operations and maintenance, cleaning/janitorial services, helpdesk/work reception centre, and real estate/property management. A literature search identifies academic research and professional practices to understand if lean principles

and visual management are integrated or can be integrated in facilities management systems.

2.8.1 Facility Security Management

Engaging the facility manager to provide management responsibilities of facility security systems has become more and more important since the 9/11 attacks on the United States, the continuous terrorist bombings, school, mall and night club shootings (active shooting), and upheaval around the world. According to IFMA's (n.d.) glossary of FM terms facility managers' responsibility is the "protection of people and property as primary concerns" and the need to adapt a resilient security plan that takes in to consideration operational security, physical security, and technological security components of the facility. Facilities security management is a global initiative that every FM enterprise should be aware of, whether a hotel, restaurant, or commercial facility. And especially education, retail, manufacturing and government facilities where there are larger numbers of people. The combination of a strong emergency preparedness plan, business continuity plan and a keen understanding of the physical environment should be as important as going to work every day for the facility manager.

In contrast, there is a Global Information Assurance Certification (GIAC) Paper written by Berman (2003) for the SANS Institute pertaining to lean thinking in the information security field. It's not necessarily FM related, it does however review the five lean principles and where it can be integrated within information security systems. The SANS Institute is an academic research organisation devoted to security education globally. Berman (2003) determined, "visualisation is a key component of lean thinking". Lean offers security professionals' transparency in gathering "real time feedback" of information required to protect organisational systems (Berman, 2003, p.13). The SANS Report contends that there is insufficient case study literature linking security management with lean principles and visual management (Berman, 2003). Once again, an industry is seeking business improvements such as lean thinking, transparency, and visual management in the workplace, in order to add value to the customer and organisation holistically. Much can be learned from the study even though it's not related to facility security management systems.

2.8.2 Operations and Maintenance (O&M)

Facility managers' responsibilities not only deal with space planning and management, security, information systems, technology, in addition to operating and maintaining the built environment. More generally, Cotts, Roper, and Hicks (2010) assert that operations and maintenance is a high volume part of the facility managers business. A medium sized corporation can produce an abundance of work orders, as much as 50,000 requests annually and four times that number of preventive maintenance work tickets. All work order requests require customer interaction, customer satisfaction and timely response from the FM department. This task is one that needs to be planned properly and efficiently providing excellent customer service around the clock (Cotts, Roper, & Payant, 2010).

Al-Sudairi (2010) conducted a research study that aimed to implement lean multi-skilled technicians to improve the work order (WO) and preventive maintenance (PM) process at Saudi Consolidated Electric Company (SCECO). His research process mapped the 'as is' and 'to be' value stream of the WO and PM process. The concept of multi-skilled labour proved to be successful in preventive maintenance cycles reducing the overall time it takes to complete a PM WO by 56% and 68%.

The research study affirmed that multi-skilled technicians are a vital link in the work order and preventive maintenance process. According to Al-Sudairi's (2010) findings by "extending maintenance technicians' breadth and depth of their skills will have a positive impact on their performance, and eventually add value to the final product or service. However, it is extremely important to look into maintenance processes as a system of different inputs that include people, materials and technologies in order to enhance their efficacy and value" (Al-Sudairi, 2010, p.11). Utilizing multi-skilled workers in the manufacturing and construction industry is one of the major principles of lean production theory success (Al-Sudairi, 2010).

Managing O&M of facilities is always left up to interpretation for FM services department. For instance, Mosekke, Tembo, and Cloete, (2011) evaluated the existing facilities maintenance systems in Botswana. Their findings concluded that there was a "lack of knowledge on the different types of maintenance" (Mosekke, Tembo, & Cloete, 2011, p.48). Furthermore, the typical focus of FM O&M in Botswana was "emergency

and day-to-day maintenance" issues (Mosekke, Tembo, & Cloete, 2011, p.48). There is no mention of lean principles or visual management integration. The research study concluded that there lacks standard processes and procedures, and recommended the need for more workplace efficiency's; training; performance measurements, and continuous improvement efforts in order to sustain FM O&M in Botswana (Mosekke, Tembo, & Cloete, 2011).

There have been many studies done on operations and maintenance practices, though not always linked specifically to implementing lean principles and visual management in facilities management systems. Tsang's (2002) study and his Ph.D. research looked at ways to reduce the cost of O&M linking it to the organisation in a more strategic way. His research made light that organisations need to embrace "lean manufacturing, just in time production, and six-sigma programs" (Tsang, 2002, p.8) in order to cut costs, eliminate waste, and yield efficiency and quality in the workplace. Not specifically in the facilities management workplace, his study was focused on maintenance services in manufacturing plants. Again, the research is lacking in evidence of lean visual management in operations and maintenance of facilities management systems.

2.8.3 Cleaning/Janitorial Services

The building cleaning service industry has been going changes drastically over the past few decades. In 2001, Luis Agular researched the transformation of cleaning services in Toronto, Canada. According to Agular (2001) a shift is taking place from performance of multiple zone cleaning tasks to more specific macro assignments that resemble an assembly line of activities. Agular's study (2001) makes the case that cleaners previously arranged the sequence of their individual tasks and largely determined the pace of work to complete those tasks. By interpreting Taylorism theory of an established regimented system of managerial practice and work organisation, helped transform cleaning services in Canada. This is evident in the reassignment of cleaners to specific tasks, as well as adding computer technology to track and monitor the workers (Agular, 2001).

As a result of the socio-economic climate there has been a fluctuating tenancy rate in building occupancy that has been hard for the building owners to conceive (Aguiar 2000). As a result, building owners and managers have been much more demanding of clients

and their supply chain, including building cleaning contractors. The Building Owners and Managers Association (BOMA, 1990, p.ii) states:

> *"In these times of extremely competitive office markets and heroic efforts to retain tenants and to attract new ones, building management is asking how cleaning services can be provided most efficiently and effectively. Office worker satisfaction and productivity counts, as does the bottom line cost of assuring exemplary building performance"*

According to Delbridge (et al, 1992) and Agular (2001) (lean) just-in-time/total quality management (JIT/TQM) strategies reorganises the workforce. The principle underpinning of JIT/TQM system is to further entrench management's control, and to eliminate workers 'slack' during work shifts. Restructuring cleaning activities resulted in reduced work shifts that caused cleaners to work harder, faster, and more vigorously.

In the building cleaning industry, the workplace is promoted and organised through TQM in order to keep up with clients changing expectations. The cleaning sector emphasises quality and enhances communication with clients, as well as building long-term relationships. TQM features in the cleaning industry include: leadership, customer focus, process evaluation, measurement, knowledge, variation, and responsible decision making. This is promoted through the use of technology (Agular 2001) and lean strategies such as JIT and TQM that reduce cost, eliminate waste and add efficiency, and quality to the cleaning sector.

2.8.4 Helpdesk/Work Reception Centre

The helpdesk and work reception centre is considered the hub of a facility management services department. It is the single point of communications for the majority of services provided, synchronized with customer calls and customer service evaluations. At the help desk, also known as the work reception centre (WRC), services are received, prioritized, tasked, coordinated and evaluated (IFMA, 2004; Cotts, Roper, & Payant, 2010).

If the WRC has the right technological tools they can manage all the dispatching of charge backs, department and organisational benchmarking and calculate unit costs for capital projects, manage work orders, and preventive maintenance services. According to

Cotts, Roper, and Payant (2010) the WRC is the driving force behind all routine work in the facilities department. Since this work constitutes such a high percentage of the departments' mission, it is important that employees are efficient. While each organisation has its own unique set of requirements, there are common procedures. An example of this would be how the WRC has the capacity to receive service requests on a twenty-four hour basis, seven days a week, fifty-two weeks a year (24/7/52). There is limited evidence linking lean and visual management to the FM work reception centre.

2.8.5 Real Estate/Property Management

Although O&M is a key responsibility for facilities managers, and the WRC is the centre of FM functions, real estate and property management is another important responsibility. Real estate and property management activities are difficult to measure; according to IFMA (2006) few would argue that the physical work environment has a considerable effect on employee motivation, productivity, and morale. Moreover, real estate decisions can have a significant impact on the organisation's ability to perform its core mission. Elements such as proximity to skilled labour, access to highway/public transportation, utility infrastructure, and availability of services are just a few of the factors facility managers have to take in to account when analysing real estate or building issues. The building or facility selected and managed has a large impact on how customers and employees view the organisations character.

Cotts, Roper, and Payant (2010) affirm that an IFMA survey obtained that over 70% of facility managers serve in the role of lessee, fewer than 30% as lessor. When the facility manager becomes a property manager their number one goal is to maximize profit of the organisation. This can lead to an increased outsourcing of FM services, and the reduction of staff, resulting in adopting a 'Property Management Model' for facility management (Cotts, Roper, & Payant, 2010). When this occurs it is best to have an experienced engineer supervisor assigned to each building to handle all O&M problems. If planned carefully, and implemented properly, this one point of contact for each building can work well. On the other hand, if O&M functions are ignored, centrally provided building engineers can lose control, consequently reducing the facility management organisation to marginal performance. There is insufficient literature linking real estate and property management to lean principles and visual management.

2.8.6 Evidence of Lean Facilities Management in the UK

The research case studies take place in a UK university facilities management department therefore; further research of lean in UK facilities management was explored. The literature revealed evidence of a lean movement in the areas of construction, manufacturing, healthcare, and public sector organisations in the UK. One of the world's largest lean research centres is located at Cardiff University's Business School, Cardiff, UK. It was at Cardiff that Daniel T. Jones instituted the Lean Enterprise Research Centre (LERC) in 1994. He and his team have been researching, educating and communicating lean initiatives ever since. Jones, along with Womack and Roos, are known for developing the term 'lean thinking' in the book, *The Machine that Changed the World* (Womack, Jones, & Roos, 1990). LERC's research and education is limited to the public sector, small and medium enterprises (SME's), lean logistics, food sector, service and manufacturing organisations, research in facilities management is limited. In addition, Cardiff University at the time of this research was going through a university wide lean transformation program (LERC, 2012). There was insufficient evidence of how Cardiff's facilities management department was affected by the lean program.

A thorough literature review conducted suggests that the areas of lean and visual management research activity in the UK are largely in aerospace, healthcare, public sector, manufacturing, service/finance industries and the transportation sector. An example of its application in facilities management is that of a UK consulting firm, Agile Business Solutions (2011) who was involved in training (Sodexo) an outsourced facilities management services provider for a large international pharmaceutical manufacturing company in lean principles. Through this research, the initial lean workshop that introduced lean principles and visual management to facilities management staff was observed. The pharmaceutical company uses lean principles and Six Sigma tools on the manufacturing side of the business, thus far has not addressed lean initiatives in facilities management.

Since 2005, the National Health Services Trust's (NHST) started using lean tools at Bolton Hospitals NHS Trust, in order to eliminate wasted efforts and improve the quality of customer services provided. In 2006 they were tasked with re-examining the issues of value measurement. The Royal Bolton Hospital NHS Foundation Trust (RBHNFT) was chosen to pilot lean initiatives. RBHNFT introduced a version of lean management, titled

the Bolton Improving Care System (BICS). BICS is based on the fundamental criteria of lean management applied to healthcare that can be used at different departmental levels, to track the patience journey, or to view FM services hospital wide. Instrumental to BICS has been the focus and development of rapid improvement events (RIE's). The BICS lean study focused on the clinical and laundry employees' relationship with the patients in order to improve services rendered, eliminate wasted efforts, and add value for money initiatives (Tyldsley & Wyton, 2011).

To conclude this section, different practice sectors of the FM industry were explored using a lean lens. The researcher investigated whether or not lean principles and visual management technologies were integrated in FM practice sectors. The summation is that there is insufficient evidence linking facility management practice areas to lean principles and visual management technologies. Few service sectors scattered around the world are implementing, or tempting to integrate lean or visual management in FM systems. There is no integration of lean and visual management in facility security management; it has attempted to be integrated in the operations and maintenance sector in Saudi Arabia; cleaning and janitorial service sector in Canada are using lean techniques; and in the UK lean is limited to the NIH healthcare facilities sector. The application of lean principles in facilities management is largely unexplored and not integrated holistically throughout the facilities management industry. If lean and visual management is being implemented in facilities management systems, the research publications are limited. It is anticipated that the value and originality of this thesis establishes a need for future development of a lean visual workplace management project delivery system in facilities management.

2.9 Change Management

Linking facilities management to the organisation holistically through systems thinking, lean management processes and building a visual management workplace will incur change in the overall FM system. It doesn't matter where you start the implementation process; you will need some type of process focus improvement plan and a lean visual champion, or change agent to manage the transformation. There is a considerable amount of literature on change management processes and models and how to go about implementing change in an organisation. Topics of discussion range from individual change, team change, organisation change, leading change and appointing a change agent

(Cameron & Green, 2015). More specifically, this thesis will concentrate on the theory of change management in facilities management, and lean management systems.

Finch (2012, p.1) acknowledges that physical change or "change in mind" occurs in facilities management as part of a transformation program, new real estate acquisition, redesign of the workplace, or new standard work processes. Even the buildings and assets facility managers oversee are in constant flux. Literature advocates that facility managers need to understand what change management processes are, such as the REACTT change framework "which identifies the key stages of facilities change management" (Finch, 2012, p.1). Change in the facilities management workplace comprise of changes in people, places (real estate assets), processes, and (machines) technologies, as well as services provided. The challenge for the managers of FM systems is how to implement change successfully (Bicheno & Holweg, 2009, p.203). Trying to change an organisation, department, person and their social system is never an easy task. In developing a lean visual management FM system, change can occur by way of a Kaizen (Japanese term meaning 'good change') event or continuous improvement cycles, such as plan, do, check, and act.

Facilities management is a service industry and considered a socio-technical system where there is a close relationship between technology, machines, people and processes. In a socio-technical system, "human beings and physical equipment need to work in harmony to create the desired outcome" (Bicheno & Holweg, 2009, p.203). Bicheno and Holweg (2009) contend that people are influenced by changes in processes and can hold up providing services, just like a broken machine will stop the assembly line. If the social system is to change, there needs to be some sort of change management system in place to manage all of the socio-technical systems in order for change to be sustained. "The main elements of a social system are: performance measurements; responsibilities and work structures" (Bicheno & Holweg, 2009, p.203). It is advised that "making changes to someone's working space and procedures, and not managing these changes will mean that the individual is likely to oppose, and in some cases even sabotage the proposed changes" (Bicheno & Holweg, 2009, p. 203).

According to Finch (2012) there are two types of change in facilities management: 1) "the punctuated nature of change", where any changes that affect facilities will have a direct

impact throughout the organisation. And 2) “focus on human engagement, which is central” (Finch, 2012, p.12) to the achievement of any change management initiative. The challenges of change are not just in the building assets, they can be in the form of new technologies, computer system upgrades, developing new work standards, creating performance metrics, and transformation programmes. According to Finch, Wehrungs (1988, In Finch, 2012) REACT risk management model is a good tool for organisation transformation initiatives in facilities management, illustrated in Figure 7.

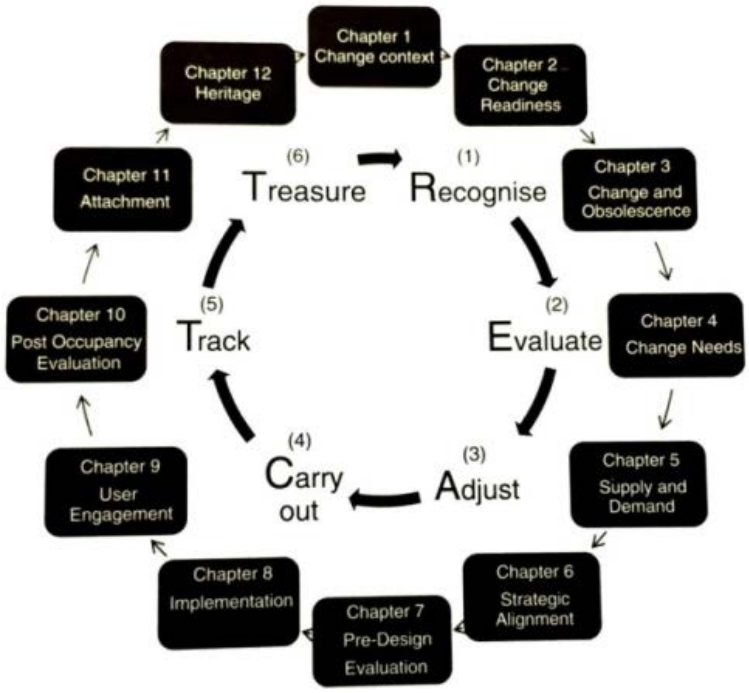


Figure 7: Wehrungs REACT Model Framework for Facilities Change Management (Source: Wehrungs, 1988, In Finch, 2012, p.13).

The REACT model has six stages (Wehrungs, 1988, In Finch, 2012, p. 13).

1) Recognise: The organisation has to be ready to embrace change and “avoid working on the wrong problem”.
2) Evaluate: How do we evaluate the challenges and clients’ needs.
3) Adjust: Once change takes place you adjust to the breakthrough, innovation or creative ideas, or just better provisions.
4) Carry Out: This is the mobilisation or implementation stage, and plays an important role in getting the end user to participate. There is a chance to transform users’ negative attitudes that might be associated with the resistance to change, to hopefully a more positive energy.

5) Track: Change management is a continuous process and best practices should be tracked at all stages, especially post occupancy.
6) Treasure: This stage will evaluate place attachment, known as “treasuring what is possessed” (Finch, 2012, p.13-15).

Facility managers are change agents and will need to become more knowledgeable about basic technologies, models and frameworks that allow them to manage continuous change in the organisation. The REACT model is a structured tool that will keep the facilities manager on track when implementing change across the organisation. How successful they will be in overseeing the change initiative will depend on their grasp of change concepts such as REACT, how they view an organisation, and Kurt Lewins three step change model.

In 1951 Lewin developed one of the most well-known organisational change models that is still highly regarded today (Cameron & Green, 2015). He proposed an organism metaphor of organization change in a three step process. The three step process is Unfreeze, Move (Change), and Refreeze. Lewins uses the analogy of an organisation being a block of ice that is constantly in flux. The first phase encompasses the unfreezing of existing conditions, and preparing the organisation for change, creating the need for change. In the next phase you change the new organization, get employee buy in and communicate how the new workplace will affect everyone. It is imperative that employees are involved with the overall change process from start to finish. The third step is to refreeze the newly formed organisation by setting standards of work practices, policies, an employee reward system, and continuous feedback channels (Cameron & Green, 2015). Many organisations start a transformation programme and never think about a change process and managing expectations.

2.9.1 Organisational Change

Prominent authors in the field of organisation change, such as Kurt Lewin, tend to describe organisations in terms of metaphors. For example, Lewin describes organisations as being organisms of change and similar to freezing and unfreezing ice. Weight is put on managing customer expectations and benefits of the change initiative. Gareth Morgan, another change leader, has done a lot of research on organisation metaphors and

developed eight descriptions in understanding organisation culture. He classifies the eight metaphors of change as (1986, In Cameron & Green, 2015, p.95-96):

1) Brains.
2) Cultures.
3) Flux and Transformation.
4) Instruments of domination.
5) Machines.
6) Organisms.
7) Political Systems.
8) Psychic Prisons.

Cameron and Green (2015) contend that thinking about an organisation as a metaphor is a good way to recognise the many facets of a changing organisation. Here is a quote to sum up metaphors and organisations by Gareth Morgan (Morgan, 1986, In Cameron & Green, 2015, p.95):

"Metaphor gives us the opportunity to stretch our thinking and deepen our understanding, thereby allowing us to see things in a new way and act in new ways. Metaphor always creates distortions too. We have to accept that any theory or perspective that we bring to the study of organisation and management, while capable of creating valuable insights, is also incomplete, biased, and potentially misleading."

(Morgan, 1986, In Cameron & Green, 2015, p.95):

Table 4 illustrates additional authors in the field of organisation change and the metaphors they use in describing organisations (Cameron & Green, 2015, p.105).

Table 4: Models of Organisation Change and Associated Metaphors
(Source: Interpreted from Cameron & Green, 2015, p.105)

Models of Approaches to Change and Associated Metaphors				
	Organisation Metaphors			
Model or Approach	Machine	Political System	Organism	Flux and Transformation
Lewin: Three Step Model	✓		✓	
Bullock and Battan: Planned Change	✓			
Kotter: Eight Step System	✓	✓	✓	
Beckhard and Harris: Change Formula			✓	
Nadler and Tushman: Congruence Model		✓	✓	
William Bridges: Managing The Transition	✓		✓	✓
Carnall: Change Management Model		✓	✓	
Senge: Systemic Model		✓	✓	✓
Stacey and Shaw: Complex Responsive Processes		✓		✓

Peter Senge is best known for his systems thinking approach to organisational change and what he has established as “profound change” and creating the “learning organization” (Smith, King, Sidhu, & Skelsey, 2015, p.40). To understand profound change is to understand how organisations go through different phases of development to maintain transformation. Or possibly the opposite, where lack of practices in the transformation effort are causing the system to stop automatically (Smith, King, Sidhu, & Skelsey, 2015). Senge has developed a 10 system decree that aids in understanding an organisation as a system, and the difficulties that one might endure when trying to implement change (Interpreted from Bicheno & Holweg, 2009, p. 204):

1) Behaviour grows better before it grows worse: Management is deluded (and rewarded!) by short-term results. Why? Because the whole system is not fully understood.
2) Cause and effect are not closely related in time and space. If there is a problem in the office, the solution lies in the office…Very likely not so.
3) Dividing an elephant in half does not produce two small elephants. Again, a warning on reductionism.

4) Faster is slower. Perhaps the supreme implementation law! Take time to achieve buy-in. The essence of what policy deployment should be about.
5) Small changes can produce big results, but the areas of highest leverage are often the least obvious. This is about leverage. Look to Malcolm Gladwell in The Tipping point of 'maven's in an organisation who have great influence despite their apparent lowly status. Find them! Likewise, timing is critical. Goldratts conflict resolution diagram may be useful in finding influential relationships.
6) The easy way out usually leads back in. There are many quick and easy solutions to problems in organisations, they are all wrong. Juhani's law states that 'the compromise will always be more expensive than either of the suggestions it is compromising'.
7) The harder you push, the harder the system pushes back. Or, systems bite back. Most systems are in a state of natural balance. When a factor is altered others compensate. Hence the rapid growth of wildlife when predators are removed, which then stabilises due to food shortage. This happens in organisations also. Senge calls this 'compensating feedback'.
8) There is no blame. Senge's point here is similar to Deming's preference to start with the process rather than the person. And Covey says: win, win, or walk away, seek ways in which both sides will win. Compromise is essential.
9) Today's problems come from yesterday's solutions. This could be a re-statement of the push down, pop up principle. Attack one problem, stemming from past actions, and another pops up. This is the fundamental reductionist rather than holistic thinking. In lean, using a new target to solve the problem often leads to unexpected behaviour.
10) You can have your cake and eat it too, but not all at once. The essential message of lean, you can have short lead-times and high quality and low cost, but it takes time to achieve. TRIZ (the Russian originated theory of inventive problem solving, believes that finding 'contradictions' is the starting point for innovation. It seeks "AND" not 'OR' solutions.

Senge's research has focused on the "importance of cultural alignment in order for profound change to take place" (Smith, King, Sidhu, & Skelsey, 2015, p.45). For example if there exists a 'strong command and control' ethic in the work place, establishing 'coaching' sessions would probably not be recognised (Smith, King, Sidhu, & Skelsey,

2015, p.45) This leads in to the next section on behavioural challenges that occur when organisations transform the workplace without a management project delivery structure in place to manage change and expectations.

2.9.2 Cultural Issues

Culture in the workplace refers to how employees and employers perceive their working environment. It denotes employees' attitudes, work ethic, and behaviour in the workplace (Liff & Posey, 2004; Mann, 2010). According to Liff and Posey (2004) culture can be influenced by change in the organisation, structure of the organisation, leadership, design of the work place, and social interactions. On the other hand, Mann (2010) interprets culture as a *"hypothetical construct"* (Mann, 2010, p.3). Meaning culture can be an idea or an impression, "a concept we make up to organize and get a handle on what we have seen or experienced" (Mann, 2010, p.3). Industry refers to organisational culture in terms of how employees react to change in companies' processes, procedures, and systems. The literature and press are always writing about an organisations ability to construct a certain culture based on their missions, visions, and new initiatives in the workplace (Liff & Posey, 2004).

Today's organisational culture is a result of new developments and initiatives in the work place, and company culture is bespoke upon the desired environment of the workplace. While collecting data for the research exploration studies, the researcher stumbled upon cultural clashes that disrupted the data collection phase of the research. As a result, cultural constructs and change management is deemed to have a direct influence on the outcome of this study.

2.9.3 Behaviour Conflicts

"Behaviour is a function of how people react to their environment. Put another way, to change behaviour you have to change the environment" (Foretel Limited, 2008, p.19). According to Vicher (2012, p.128) "employees are likely to express resistance to that which is new and unknown." Vicher (2012) developed the following bulleted stages of workplace change (Vicher, 2012, p.128):

- Fear of loss.
- Mistrust of supervisor.

- Identify a champion.
- Too much change going on.
- Engage employees in the process.
- Manage any cost involved.
- Learning new processes.

Facility managers must understand the ramifications of transformation and its influence on employee behaviour. Before starting any change program, project or transformation effort, facility managers should prepare a risk management plan that takes in to consideration transformation conflicts and possible employee issues. Being proactive will result in a more productive workforce and positive change efforts. On the other hand, the disadvantage will result in employee conflict and "importing previous processes and ways of working that no longer fit" (Vicher, 2012, p.128).

2.10 Conclusion

There are many definitions of facilities management, as an industry FM has yet to find its place in the built environment. For the purpose of this research study an alternative definition of facilities management was constructed:

> *Facilities Management is a profession that integrates a variety of disciplines and industries in order to manage, maintain, operate and ensure functionality of a sustainable built environment by integrating people, place, processes, and technology to encompass a healthy, safe and efficient, value driven workplace aligning the FM function to enterprise initiatives holistically.* Audrey Schultz (2016)

What is known for sure is that through managing building assets, ecologies of people, places, processes and technologies; and encouraging a healthier, and safe working environment, facility managers could well become value added employees to the organisation holistically. If and only if they take pride in the process of promoting a more holistic systems process approach toward operations and services provided. It is mandatory if value based FM is going to take place that facility managers consider a strategic systems thinking approach when managing their operations. This should be linked to long and short-term initiatives and levels of FM services that are in line with organisations strategic vision, mission and goals. Through the implementation of a lean project management delivery system, creating standards of work, value stream mapping,

continuous improvement, and combining lean principles and concepts, coupled together with visual management technologies will develop what Senge identifies as a ‘learning organisation’.

The researcher investigated further if evidence of lean principles and concepts, and visual management had been implemented in various sectors of the FM industry. The literature yields that lean visual workplaces are limited to manufacturing facilities, aerospace and retail maintenance, and transportation sectors. That doesn’t mean that some facilities management departments are not practicing lean or have not developed visual workplaces, what it suggests is that there is a lack of published research attesting that a lean visual FM department exists. The deficient evidence of lean and visual management in facilities management makes a strong case for further investigation. Cultivating a range of cases that adds up to a broader view of what specific lean principles and concepts, and visual management technologies ought to be integrated in facilities management ecologies is warranted.

There is a need for further research development in lean principles and visual management technologies in a service industry such as facilities management. The research case exploration will seek to integrate the visual elements and visual technologies that were developed in the visual workplace management systems approach illustrated in Figure 6. The main dimensions of visual technologies that will be explored are: visual displays, performance metric and standards; visual order, establish a visual foundation; visual controls, visual office, machines and guarantees. The next chapter expands on the research philosophy, theory and methodology utilized in the research studies, and how data and evidence was gathered.

CHAPTER 3
RESEARCH PHYLOSOPHY, THEORY AND METHODOLOGY

3.1 Research Methodology

Chapter Three establishes the research philosophy, theory and methodology that formulate the central research and case study exploration. Design science research as the main research philosophy with an action research approach is presented, along with the similarities between the two and how they complement the research investigation. An introduction to soft systems methodology framework is presented. Conclusively, the data collection research methods are outlined and conferred.

3.2 Researching an Organisation

Doing research in an organisation is an integrated approach across the human sciences that pursues methods and theories based on socio-economic, socio-political and socio-technical constraints. What this means is that an integrated social science approach combines an array of concepts. It's the complexity, culture and politics of organisations that often place constraints on the researchers' ability to extract the necessary data needed for their enquiry. Access to employees and data can stifle research progress, as discovered while undertaken this research exploration. Organisation operatives often have their own agendas that do not necessarily favour the researchers; the researcher needs to tread lightly understanding their position throughout the entire process. The research process is a rigorous cycle, as illustrated in Figure 8, and the researcher has to make sure that they link the study to the aims and objectives (and questions and hypothesis if warranted).

This research is influenced by the fact that organisations are operating in a competitive nature typically confronted by financial limitations, industry, and organisational constraints. The researcher needs to be flexible and understand that research efforts may have to change radically in order to accommodate participants. Furthermore, if the overall research findings indicate organisation inadequacies, and the participants become aware of this, they have a tendency to be very critical and outspoken (Gray, 2004), as materialized during observing the operatives in this study. Therefore the researcher must be knowledgeable of these factors and careful not to alienate participants in describing events and analysing data.

3.3 Research Overview

The scientific research process illustrated in Figure 8 is for examining research subjects such as organisations and their operatives that are in need of resolutions (Gill and Johnson, 1997). This continuous research cycle approach is constructed from data collection, validation, and reassessment activities that are applicable to the creation of knowledge. These research activities "contribute to the understanding of a phenomenon" (Vaishnavi & Kuechler, 2004, para.4). In design science research the majority of phenomenon's are generally "created as opposed to naturally occurring" (Vaishnavi & Kuechler, 2007, p.7). It is through design activities that the new knowledge becomes evident.

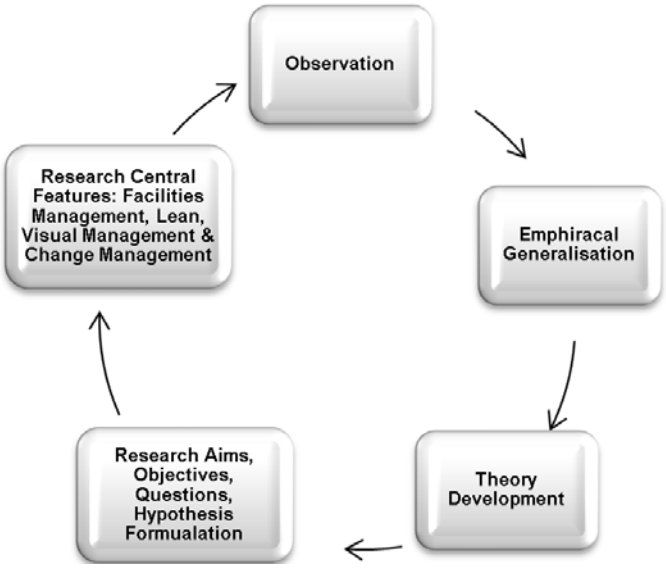


Figure 8: Scientific Research Process
(Interpreted from Marshall, 1997)

Design science research is sometimes referred to as the "improvement research", due to the importance of solving real life problems, and measuring them against the value added by the outcomes. Gray (2004) makes note that basic research of an organisation only validates, clarifies or builds on theory. This form of research that takes place becomes a collaborative union between the researcher and the organisation and the axiology, or value produced by the research is quantified.

3.4 Generating Research Theory

As defined by Kerlinger and Lee (2000, p.9; In Gray, 2014, p.5), theory is:

> *"A set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations, among variables, with the purpose of explaining and predicting phenomena."*

According to Yin (2009, p.36) "theory development takes time and can be very difficult" (Eisenhardt, 1989, In Yin, 2009, p.36). Gray (2014) elucidates that theory can be either "predictive" or "explanatory in nature" (Gray, 2014, p.5). Yin (2009) asserts that explanatory research "may cover the issue or problem being explored, the methods of exploration, the findings from the exploration, and the conclusion (for future research)" (Yin, 2009, p.176). On the other hand, Gray (2014) concedes that in developing a theory as a researcher it must be "worthy of predictive qualities" (Gray, 2014, p.5). Gray argues that "if a theory is no longer predictive, a crisis ensues and the theory will over time be challenged and replaced by a new one" (Gray, 2014, p.5). Then again, it can be argued if other researchers are intrigued with the axiology generated by the research enough to progress the investigation, agree or not agree with the theory, it's the data outcomes that will validate whether the theory is no longer worthy. And new phenomenon could possibly be generated that adds to the original research expanding its value. Gray's theory is rather one-dimensional.

Conversely, at the onset of organisational research, a specific theory may not have been formulated, it can be a grounded theory approach. Gray (2014) concedes that in doing research on an organisation and its operatives "it may be quite valid to undertake an investigation that merely seeks to find the immediate goal of a relationship between two variables (a characteristic that is measured such as income, attitude, action, policy)" (Gray, 2014, p.6), or strategic initiatives. Nonetheless, Kerlinger and Lee (2000), and Gray (2014) acknowledge that theories are connections found in research associations that are typically universal in nature and can be applied across many disciplines. To summarise, the nature of theory adapted from Gill and Johnson (2002, In Gray, 2014, p.6), theory:

- Is an accumulated body of knowledge, written by acknowledged experts.
- Informs innovative concepts and innovations.
- Is a body of work where inconsequential or misleading ideas can be clarified.

- Represents knowledge that should be viewed critically and rejected when incompatible with practice.
- Adds interest and intellectual stimulation to a project.
- Acts as a model against which current business processes can be evaluated.
- Guides the research methodology application.

As far as this thesis is concerned, the researcher will develop their own theory regarding lean principles and visual management technology integration in a university facilities management department. This research is explanatory in nature grounded upon a qualitative research investigation that reveals itself during several phases of the design science research investigation. This happens during the initial literature review and exploratory case study research phase when the problem is acknowledged. At this point the artefact to be designed has not yet been identified. Once the problem statement in the research case studies have been identified a continued literature review is conducted and the artefact to be designed is constructed. The field investigation, literature review, interviews, field observation all have a direct impact on the theory behind the designed artefact. The next section describes the search for inductive and deductive reasoning.

3.4.1 The Search for Inductive or Deductive Analysis

As far back as 1933, Dewey (Gray, 2014) "outlined a general paradigm of enquiry that underpins the scientific approach, consisting of inductive discovery (induction) and deductive proof (deduction)" (Gray, 2014, p.16). In deduction analysis the researcher starts with a widespread observation and then works their way backwards examining the details. In induction analysis the researcher tries to find relationships by sorting through fragmented data (Gray, 2014) in order to understand the set of circumstances.

In this thesis, as scientific knowledge was formulated, it was discovered that combining the original three central constructs; facilities management, lean principles, and visual management technologies lead to the theory that integrating lean visual management is about people, not just technical processes and procedures. It was about the relationship of change in the workplace. Additional theories made themselves known, such as what lean principles and visual management technologies could be implemented in facilities management with success. Along with the visual management technologies that could be designed and integrated in facilities management systems. How they functioned, didn't

function, or if they continued to function. There was not any one scientific theory that could have altered the final outcomes, several theories emerged. In the design sciences new theory is developed by creating artefacts and implementing them, by observing and participating in action within the case organisation. The research foundation is concluded to be induction in nature due to the fact that the research approach, opinions and relationships are formulated as a result of the literature review, exploratory research, artefacts created, and data evaluation from the artefact implementation. According to Gray (2004) the research study will atomically build the case of interlinking the parts and pieces forming the overall theory and relationships.

The deductive research process engulfs a theory that formulates a hypothesis amongst numerous interacting variables. Then the hypothesis is tested and the researcher accepts or rejects the findings based on evidence. The data findings therefore may be synthesised in a theory or concept and then tested through experimentation (deductive) (Gray, 2014). Whereas the inductive approach concentrates on synthesising the data collection finding patterns that develop between the different variables (Yin, 2009).

Gray (2004) contends that in inductive analysis the researcher makes discoveries yet they are too imprudent to acquiesce sometimes to make a speedy conclusion. This doesn't mean that are not any specific theories concerning the current research constructs; just the fact that specific constructs have been chosen as the main thesis focus suggests that the study has valuable considerations. Further development of the thesis and the scientific knowledge of the central research constructs takes shape by conceptualising paradigms. As the research exploration begins to take shape new phenomena is developed. The researcher will start to form an opinion while gathering evidence and sorting through data and observation, this is considered induction analysis (Marshall, 1997; Yin, 2007). It can then be concluded that the chosen research framework of a design science philosophy with an action research approach is inductive in nature.

3.5 Philosophical Assumptions of Reality, Knowledge and Value

It is essential to refer to the philosophical assumptions of research, reality, knowledge and value: epistemology, methodology, ontology and axiology. According to Oates (2006, p. 282) "Different philosophical paradigms have different views about the nature of our world (ontology) and the ways we can acquire knowledge about it (epistemology)"

(Oates, 2006, p.282). On the other hand, Crotty (1998, p.10) "suggests that an interrelationship exists between the theoretical stance adapted by the researcher, the methodology and methods used, and the research views of epistemology", as illustrated in Figure 9. Vaishnavi and Kuechler (2007) affirm that the design sciences benefit not only from epistemology, and ontology, the research gains further from axiology: "the study of values" (Vaishnavi & Kuechler, 2007, p.16). The questions is then asked, "What value does an individual or group hold, and why?" (Vaishnavi & Kuechler, 2007, p.16).

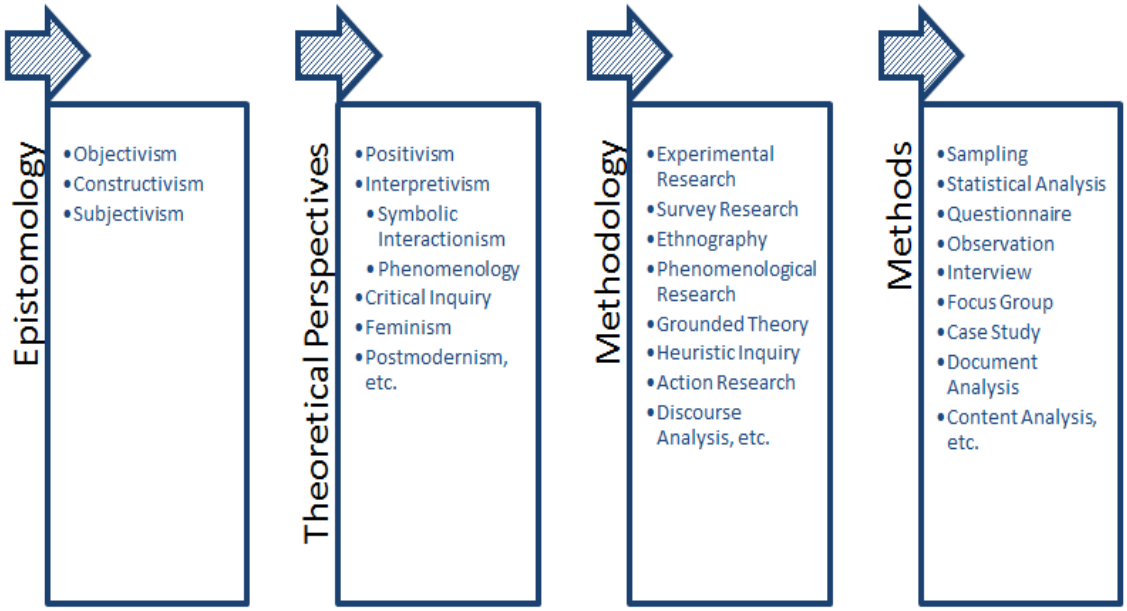


Figure 9: Epistemology, Theoretical Perspectives, Methodology & Research Methods (Source Adapted from Crotty, p.10, 1998; Interpreted by Gray, 2014, p.19)

Research design methods are influenced by the actual methodology selected. The chosen methodology is influenced by the "theoretical perspectives adopted by the researcher, and, in turn, by the researcher's epistemological stance" (Gray, 2014, p.19). In spite of the immense discussions in the area of paradigms of research, it is understandable that the principle distinction in philosophical orientation of research in the social sciences has to do with the epistemological standpoint of the researcher. According to Crotty (1998, p. 10):

"Ontology is the study of being. It is concerned with 'what is', with the number of existence, with the structure of reality as such…it would sit alongside epistemology informing the theoretical perspective, for each theoretical perspective embodies a certain way of understanding 'What is' (ontology) as well as a certain way of understanding 'what it means to know' (epistemology)." (Crotty, 1998, p.10)

Easterby-Smith, Thorpe, and Jackson (2008) contend that having an epistemological perspective is important for two reasons. First, it can help to clarify research methodology issues. Secondly, knowledge of research philosophy will help the researcher determine which methodology will yield meaningful answers to the research questions. Many scholars may "conduct research for an entire career without considering the philosophical implications of their passively received areas of interest and research methods" (Kuhn, 1996; In Vaishnavi & Kuechler, 2007, p.16).

Figure 10 defines this philosophical assumption of the methods used in identifying a design science research progression in order to establish the emergence of knowledge. Authors Vaishnavi and Kuechler (2007) assert that the research of Gregg, Kulkarni, and Vinze (2001) labels design science research as a "socio-technologist/developmentalist approach" (Vaishnavi & Kuechler, 2007, p.17) tending toward a more interpretative positivist research methodology, as shown in Figure 10. Through the rigour of the research, knowledge is embraced, and axiology occurs between the researcher and participant, as they "share the value" of the research together (Vaishnavi & Kuechler, 2007, p.17).

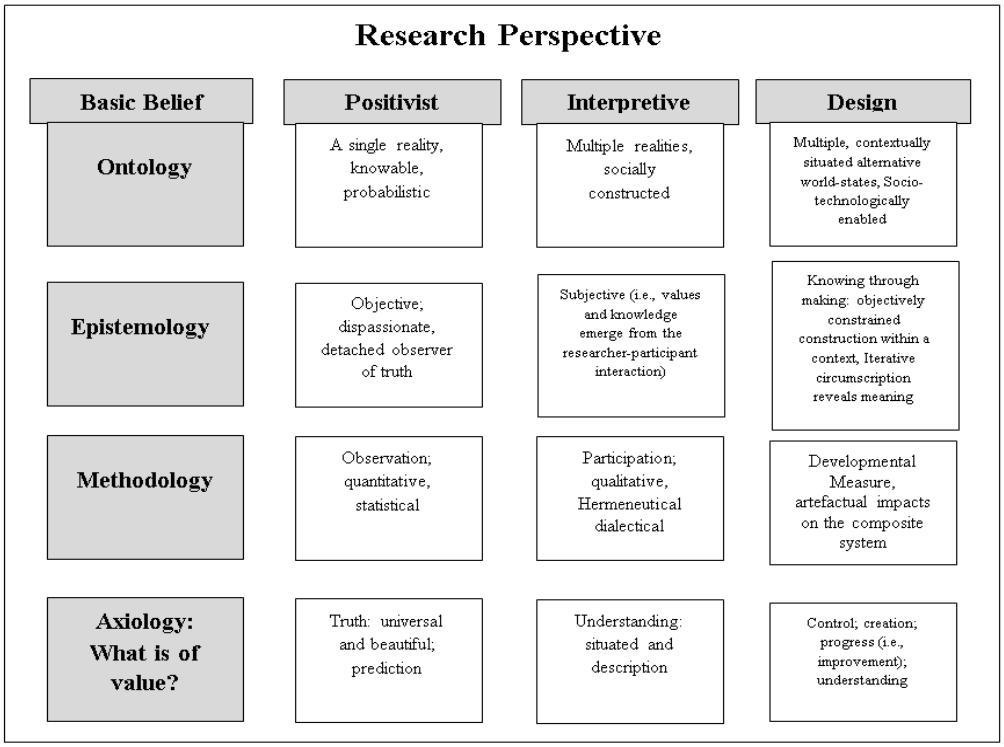


Figure 10: Philosophical Assumption of Three Research Perspectives
(Source: Vaishnavi & Kuechler, 2007, p.17)

The design science researcher can change the reality of an organisation by implementing an innovative artefact. Through positivist ontology the complexity of an organisations "socio-technical system" becomes a unit of measurement. Whereas the actual "problem statement" is constantly being revisited throughout the research effort. Abductive reasoning occurs during the creation of an artefact that is intended to solve the problem in what Vaishnavi and Kuechler (2007) consider a grounded reality, similar to the natural sciences belief. The researcher begins to understand the epistemological constraints while constructing the artefact (Vaishnavi & Kuechler, 2007, p.18).

3.6 Design Science Research Methods

Design science research (DSR) derives from the design research community of practice which include computer science, engineering, and information systems. In these practices a positivist and interpretive qualitative research view is used in the construction of a technological artefact such as algorithms, computer programs and software systems (Vaishnavi & Kuechler, 2004). A typical design science research cycle "generate(s) understanding that can only be gained from the specific art of construction" (Vaishnavi & Kuechler, 2007, p.12). It is only through this exercise that the researcher "*learns* or *discovers* when things *do not* work according to theory" (Vaishnavi & Kuechler, 2007, p.12). This doesn't necessarily occur due to a misconception of theory; this is expected given the unpredictable nature of building on theory. It's not until the researcher is compelled back to identifying why the problem existed in the first place, "contributing valuable *constraint knowledge* to the understanding of the always-incomplete-theories that addictively motivated the original design" (Vaishnavi & Kuechler, 2007, p.12).

A design science research cycle starts with an awareness of a real problem (Vaishnavi & Kuechler, 2007; Järvinen, 2007; Offerman, et al, 2009, Article 7; Holmstrom, Ketokivi, & Hameri, 2009). The real life problems can be found in organisations, at the workplace, in different industries such as architecture, construction, facilities management, higher education, healthcare, and information systems and technology. Numerous design science explanations and frameworks have been published in the information systems (IS) industry by researches such as: Hevner, 2007; Holmstrom & Järvinen, 2007; Ketokivi & Hameri, 2009; March & Smith, 1995; Offerman, et al, 2009; and Peffers, et al, 2006. The design science model in Figure 11 was selected to illustrate "the knowledge generation inherent" in design science methodology. It shows the fundamental mapping of process

steps that can be an integral part of “any design effort” (Vaishnavi & Kuechler, 2007, p.19), not just design science research. The arrows directed toward Circumscription indicates where new knowledge is formed. The Circumscription process in design science research is key to developing theory that “could only be gained from the specific act of construction. Circumscription is a formal logical method (McCarthy, 1980) that assumes that every fragment of knowledge is valid only in certain situations. Further, the applicability of knowledge can only be determined through the detection and analysis of contradictions. In common language, the design science researcher *learns or discovers* when things *do not* work “according to theory” (Vaishnavi & Kuechler, 2007, p.12).

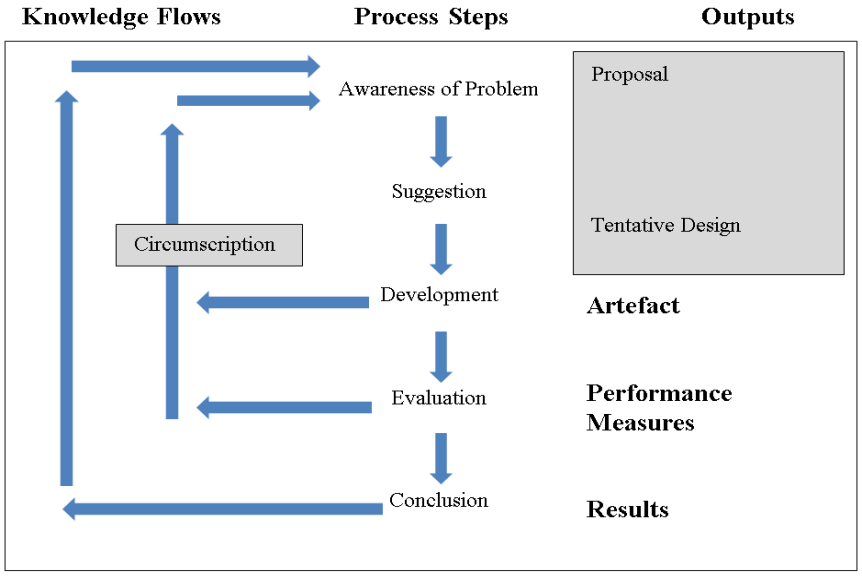


Figure 11: Design Science General Cycle
(Source: Järvinen, 2007, p.49; Vaishnavi & Kuechler, 2007)

The output of process step one, can be in the form of a formal or non-formal proposal, and continues into the suggestion phase. The proposal could be prepared for a research grant, a research project, or it can be developed for the organisation that is being studied. At this phase the design of an artefact is only suggested, it is a tentative solution or possible prototype for solving the research problem. Vaishnavi and Kuechler (2007) affirm that the suggestion phase is judged harshly in design science research due to the fact that the idea of “human creativity” is not always well understood. With that said, “The step has necessary analogues in all research methods; for example, in positivist research, creativity is inherent in the leap from curiosity about organisational phenomena to the development of appropriate constructs that operationalize the phenomena and an appropriate research design for their measurement” (Vaishnavi & Kuechler, 2007, p. 20).

In the development phase the researcher recommends some type of improvement artefact based on “theory and existing knowledge” (Järvinen, 2007, p.49). Järvinen contends that this phase emphasises the problem-solving/performance-improving nature of activity” (Järvinen, 2007, p.49). The innovation is primarily in the design of the artefact, not necessarily how the artefact was constructed. The important aspect is how the researcher is going to use the artefact to solve the research problem. An artefact output is in the form of either a framework, construct, instantiation, method, or model.

In the evaluation step, the artefact is introduced in order to test its validity. The behaviour of the artefact is scrutinised if it measures up to the original hypothesis, research aim, or problem statement. “This phase exposes an epistemic fluidity that is in stark contrast to a strict interpretation of the positivist stance. At an equivalent point in positivist research, analysis either confirms or contradicts the hypothesis. Essentially, saved for some consideration of future work as may be indicated by experimental results, the research effort is finished. For the design science researcher, by contrast, things are just getting interesting” (Vaishnavi & Kuechler, 2007, p.21). The evaluation and data findings are looped back to “another round of suggestion”, hence the arrows directed toward Circumscription, illustrated in Figure 11. An additional literature review and artefact design takes place based on new theoretical data.

In the final conclusion phase, the artefact behaviour is determined to be “good enough”. In respect to any revised hypothetical expectations, at this point the research effort can be confirmed. The research can then be concluded and written up. Newly discovered knowledge can be applied in similar situations or left for future research either by the researcher themselves or other research scholars (Vaishnavi & Kuechler, 2007, p.22).

3.6.1 Design Science Guidelines

Hevner, March, Park, and Ram, (2004) developed guidelines for design science research in information systems, though any researcher can use the guidelines while doing a design science research study. There was not any specific order to the design science guidelines that they constructed. According to Hevner, March, Park, and Ram, (2004) “researchers, reviewers, and editors must use their creative skills and judgement to determine when, where, and how to apply each guideline in a specific research project. However, we contend that each of the guidelines should be addressed in some manner for

design-science research to be complete" (Hevner, March, Park, & Ram, 2004, p.82). The design science guidelines described in Table 5 have been interpreted from Hevner, March, Park, and Rams (2004) with modifications, rearranging and refining, and setting a concise logical order for use in Facilities Management and for this research exploration:

Table 5: Design Science Research Guidelines for Facilities Management
(Interpreted from IT-DSR Guidelines by Hevner, March, Park, & Ram, 2004, p.82)

Guideline	Description
Guideline 1: Problem Relevance	The objective of design science research is to develop a solution or solutions relevant to solving real life business problems.
Guideline 2: Design an Artefact	Design science research should produce a viable artefact in the form of a construct, an instantiation, a method, or a model.
Guideline 3: Design Evaluation	The value, quality and effectiveness of a design artefact should be rigorously demonstrated in a well-executed evaluation method.
Guideline 4: Research Rigor	Design science research relies upon the application of rigorous research methods in both the construction and evaluation of the designed artefact.
Guideline 5: Research Contributions	Effective design science research should provide clear verifiable contributions in the areas of the design artefact, its foundation and methodologies used.
Guideline 6: Design as a Search Process	The search for an effective artefact requires utilization of all available means to reach the desired outcome while abiding by proper regulations and organisational principals.
Guideline 7: Research in Action through Case Study Implementation	In order to complete all the research guidelines successfully, a case study must be involved in order to identify current problems, design an artefact, and conduct a laboratory experiment through action and participation.
Guideline 8: Communication of Research	Design science research must be presented effectively to all case study participants.

For this research study the guideline order was rearranged, the wording has been amended and an eighth guideline was added, guideline number 7: Research in Action and through Case Study Implementation. When undertaking a design research exploration, the first phase, step or guideline should be to identify a problem. The second phase would be to design a solution by constructing some sort of designed artefact. The artefact must then be evaluated through testing in laboratory experiments, or with organisation participants through observation and action.

Using the action research cycle loop to identify the problem, design a solution phase, back to the case study, and again participating in action phase. This loops the continuous improvement cycle of clarification, practical relevance and what worked or didn't work. Additional questions can be asked such as, how can the design artefact once implemented become better? What needs to be tweaked, added, taken away, or improved upon to make the design artefact more successful in aiding the problem?

3.6.2 Design Science Research Framework

Literature suggests that there are various phases and steps in developing a design science framework, as illustrated in Figure 11. Offermann, Levina, Schönherr, and Bub (2009) suggest that "researchers vote for a combination of research perspectives and their respective research methodologies; rigour and relevance as requirements in design science are generally accepted. What has been lacking is a formalisation of a detailed research process for design science that takes in to account all requirements" (Offermann, Levina, Schönherr, & Bub, 2009, p.86). Offermann, Levina, Schönherr, and Bub's (2009) research has resulted in the development of a design science research process that combines methodologies such as participative action research through use of case studies and observation. Although their research is specifically geared toward management research and information systems; this thesis continues their research and proposes a design science research framework with an action research approach for the facilities management industry.

Illustrated in Figure 12 is the proposed design science research framework that was designed for this thesis. After a thorough literature review, design of the exemplary case study, and further case study explorations, the research framework was divided in to three design science research phases: 1) Identify Problem; 2) Design Solution; 3) Evaluation. Within each phase are various steps to conduct research outcomes.

Phase one is the identification of the research problem. In this phase the researcher works closely with the case organisation conducting exploratory research which will provide more information about the case organisation, and determine what the real organisation problems are that need to be addressed. First phase of the literature analysis takes place to gain a better understanding of the research, research methodology, case organisation content, and current issues. During this phase, the researcher and research participants

determine the value of the research to the organisation, as well as the participants. There is a continuous cycle looping the literature analysis phase one back to the identification of the problem; then linking the identification of the problem to conducting exploratory research. Always keeping in mind how identifying the problem phase is linked to accessing the value of the research. The loop resembles the Deming continuous improvement cycle of plan, do, check, and act (PDCA). In this case it is more research oriented and the loop may resemble: plan, research, check, and accomplish (PRCA). Asking the research question: What seems to be the real life problem(s)? Another question leading to phase two might be: What type of artefact could be designed to solve the current research problem(s)?

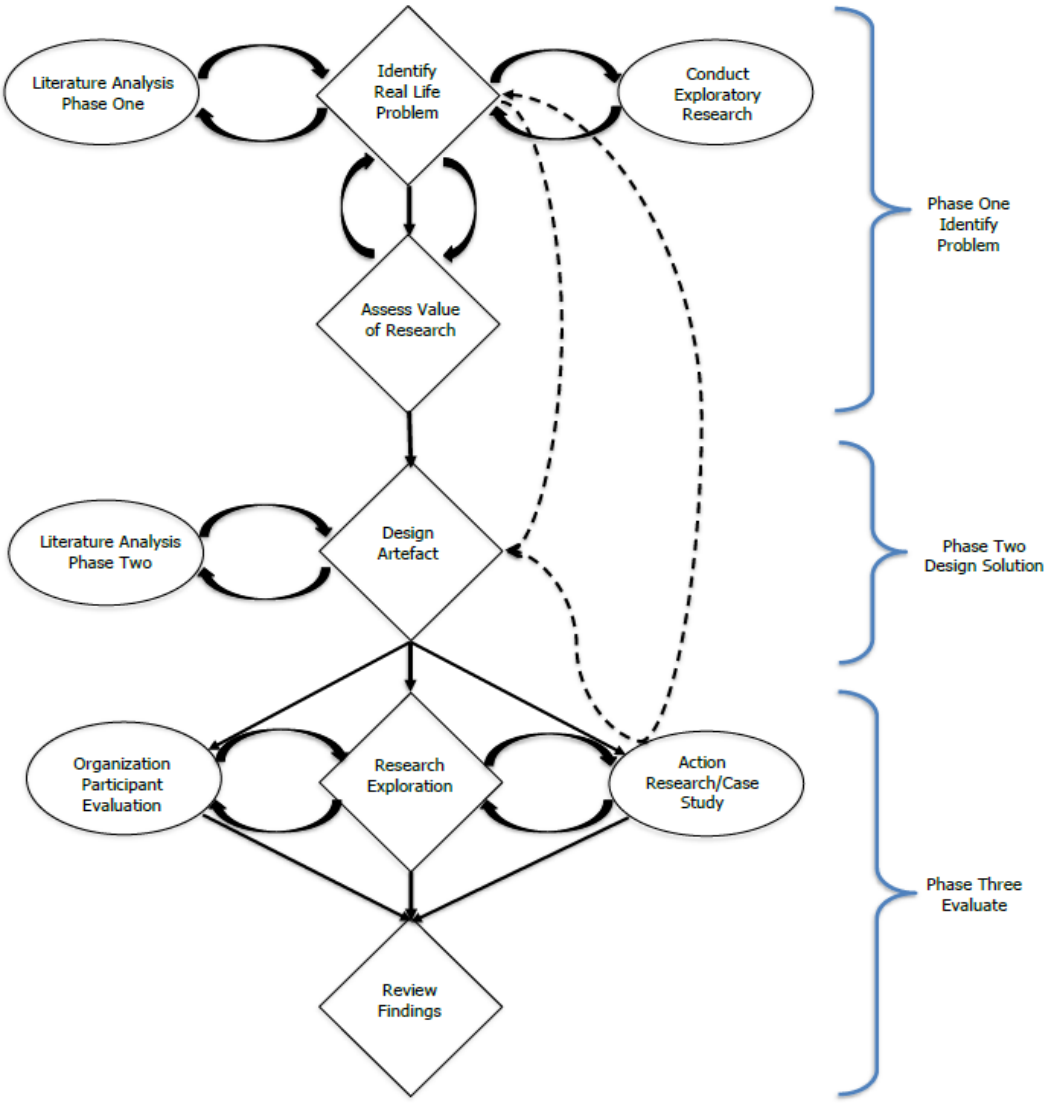


Figure 12: Design Science Research Framework for Facilities Management

In Phase Two, the actual design of an artefact takes place, and a more comprehensive literature review is conducted to better integrate the design of the artefact with organisational strategies. The researcher becomes more familiar with the initial organisational problem(s) and designs the most comprehensive artefact in order to mitigate the problem statement(s). The continuous improvement cycle may look more like: plan, discover, examine, and implement (PDEI).

There is an "inadequate theoretical base upon which to build" an artefact that has a big enough impact on a facilities management organisation. "A constructed artefact embodies the designer's knowledge of the problem and solution. In new and emerging applications and technology, the artefact itself represents an experiment." It is in the "execution, we learn about the nature of the problem, the environment, and the possible solutions, hence, the importance of developing and implementing prototype artefacts" (Newell & Simon, 1976, In Hevner, March, Park, & Ram, 2004, p.99). In the third phase, only when the artefact is being manipulated in the organisation by participants can its importance, value, and reliance be determined. There are questions to ask at this stage such as: Is the artefact working as planned?; Has it done what it was expected to do?; and Has it solved a real life organisation problem(s)?

At this stage action research comes in to the mix. The artefact is being implemented, and is being used by the case study organisations operatives. The operatives and the researcher are participating in the process actively and creating the research outcomes through using the designed artefact in action. In conventional research knowledge is created, while "action research is an approach to research which aims at both taking action and creating knowledge or theory about the action. The outcomes are both an action and a research outcome" (Coghlan & Brannick, 2010, preface). Another aspect of action research is the collaborative qualities, "in that the members of the system which is being studied (in this case an FM department and their operatives) participate actively in the cyclical process" (Coghlan & Brannick, 2010, preface). Where, in traditional research an operative or organisation may be the actual object of the investigation (Coghlan & Brannick, 2010).

The final stage in phase three evaluation is reviewing the research exploration findings and writing up the outcomes. This can be in the form of a report that gets distributed to

the research organisation and participants, or a research thesis as in this case. The success of the artefact implementation is determined by how well it was designed to mitigate the original statement problem. Not every attempt at designing an artefact and implementation will be successful. This could depend upon the continued length of the research study.

A significant detail to this case research occurred a few days prior to the first designed artefact implementation. The case organisation, a university facilities management services department offered the researcher a part-time position as a reception/helpdesk support team associate. This was at the beginning of phase three when researching in action began to take place. An additional literature review was conducted to find out how to interconnect design science with an action research approach. Reading Havner's (2007), Järvinen's (2007) and Offermann's (et al, 2009) research philosophy made it all seem logical. Through the researchers' theory development, the case study could be re-evaluated and design science research with an action research approach framework was developed, illustrated in Figure 12. The next section will describe action research more in-depth.

3.7 An Action Research Approach

"Action research is not a methodology, it's an approach to inquiry that supports many methods" (Burns, 2007, p.11) through triangulation of diverse sources. It combines numerous perspectives of inquiry across organisations, social schemes, education, and human services. Action research seeks to understand the "dynamic of change", "must involve more than an individual" and "multiple perspectives" (Burns, 2007, p.158-159). The literature suggests that there are numerous definitions of action research (AR); "Rapoport, 1970; MacDonald & Walker, 1974; Elliott, 1981; Ebbutt, 1983; Ruddock & Hopkins, 1985; and Carr & Kemmis, 1986, as well as Hugh Socket, and Robert Stake are among the earlier influencers of action research methodology" (McNiff, 1997, p.27). Bell (1999) proposes that researching in action is a systematic progression of enquiry, reflections and action conducted by researchers regarding their own workplace or organisation. It must be participatory in nature, where not only is the individual researcher conducting a research study; they are participating with the organisation, workplace, group or community of people that are affected by the study.

According to McNiff (1994, p.21) “action research is never static. The term itself implies a continual process”, a quest for knowledge. The “process, which shows how one person’s ideas develop and may be used by another to move his own ideas forward. It is a powerful method of bridging the gap between the theory and practice” (McNiff, 1994, p. 21). Kurt Lewin, a social psychologist, theorised that “the best way for people to move forward was to engage them in their own enquires into their own lives” (In McNiff, 1994, p.22). Lewin stressed the importance of democratic collaboration and participation. “It is no use for people to inquire on their own, for they are a part of the life of other people. It is no use standing to one side, for we are all parties in the human endeavour” (McNiff, 1994, p.22).

Kurt Lewin was one of the originators of action research, producing “studies with emphasis on leadership, power, group dynamics, stress and identity” (Järvinen, 2007, p.39). Rapoport was another early follower in the social sciences who was influenced by the practicality of people challenging the status quo. He advocated for the research aims and objectives to be a joint collaborative partnership with “mutually acceptable ethical frameworks” (Järvinen, 2007, p.39). Lewins action research theory depicts a four phase spiral: “planning, acting, observing, and reflecting” (McNiff, 1994, p.22; Coghlan & Brannick, 2013, p.7). A typical Lewin action research cyclical theory is illustrated in Figure 13.

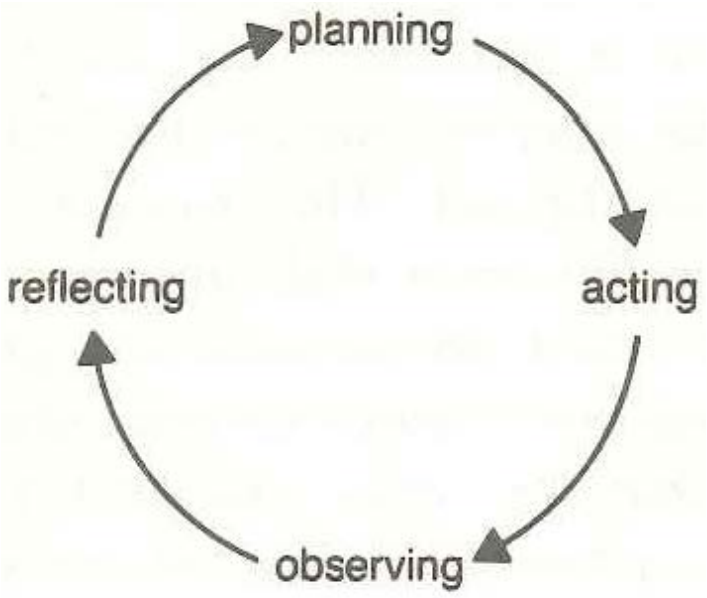


Figure 13: Kurt Lewins Spiral of Action Research
(Source: McNiff, 1994, p.22)

Burns' (2007) action research reflective cycle has the same named cycle of enquiry as Lewins' original cycle shown in Figure 13, except that they are juxtaposed. Burns (2007) takes a systemic viewpoint of action research and has adapted his action research cycle of plan, reflect, observe, and act, illustrated in Figure 14, (Burns, 2007, p.12).

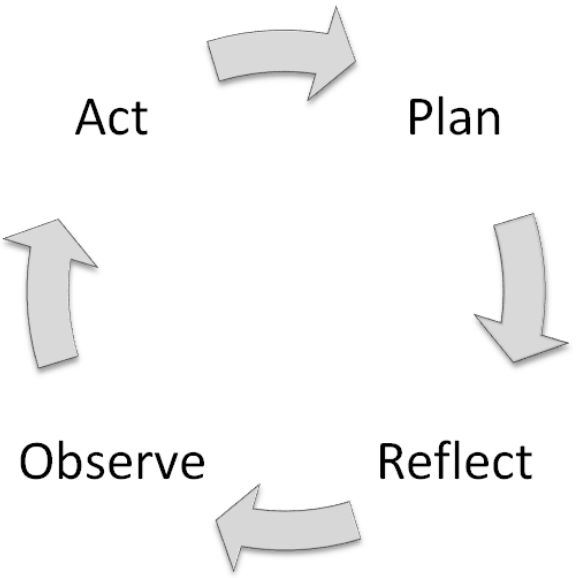


Figure 14: Burns Action Research Cycle
(Burns, 2007, p.12)

Lewins and Burns classic action research cycle has four steps, while Susman and Evered incorporated a five step action research cycle (Järvinen, 2007, p.39), shown in Figure 15.

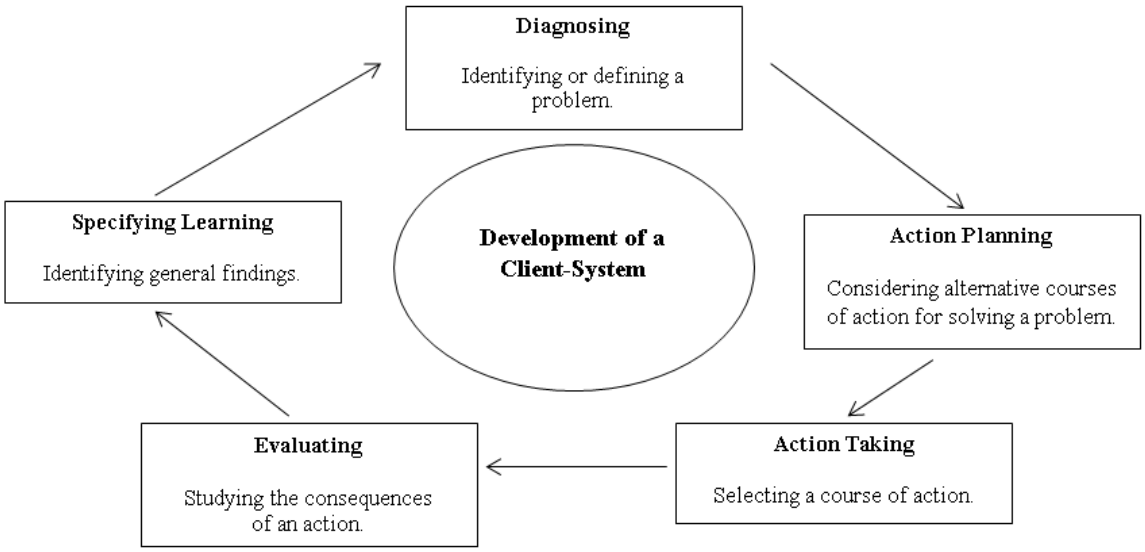


Figure 15: Susman & Evered's Process of Action Research
(Source: Susman & Evered, 1978, In Järvinen, 2007, p.39)

Furthermore, Stringer (2007) developed a mere simplistic interacting action research spiral of: look, think, plan. Stringer emphasized that an action research cycle should be a continuous "process of observation, reflection, and action" (Stringer, 2007, p.9). As the researcher completes each cycle "they review (look again), reflect (reanalyse), and re-act (modify their actions). These cycles can sometimes be framed as phases of a research process so that planning, implementing, and evaluating, can be seen as cycles of a project" (Stringer, 2007, p.9). Nevertheless, according to Järvinen (2007), all action research and their steps will differ depending on the research problem and collaborators system.

Whatever type of action research cycle is chosen the main elements are similar. What always stays the same is that "action research is a collaborative approach to inquiry and investigation that provides people with the means to take systemic action to resolve specific problems" (Stringer, 2014, p.8). Action research "provides a means for people to clearly understand their situation and to formulate effective solutions to problems they face" (Stringer, 2014, p.8). The participants and stakeholders of the research participate collaboratively with "an explicit set of social values" (Stringer, 2014, p.14), as noted below:

- It is *democratic* in nature, enabling the participants of all people.
- It is *equitable*, meaning that it acknowledges peoples equality of worth.
- It is *liberating*, while providing freedom from oppressive, deliberating conditions.
- It is life *enhancing*, as it enables the expression of peoples full human potential (Stringer, 2014, p. 14).

It is expected that all stakeholders involved in the research are closely "affected by the problem" and therefore "should be engaged in the process of investigation" (Stringer, 2014, p.15). The researcher takes more of a facilitator role as the stakeholder's engage more deeply in the action of understanding and refining their situation. Hence, the research inquiry involves the community of practice in "changing the social, organizational, and personal dynamics of the research so that all who participate benefit from the outcomes" (Stringer, 2014, p.15). The research becomes consensual while the stakeholders learn to see their issues more holistically. The outcomes of this type of

collaborative enquiry can be used systemically throughout the organisation and enhanced in the future when other potential issues emerge.

3.8 Design Science Research and Action Research Approach Framework

In both design research and action research there appears to be a deficiency of models and frameworks in facilities management research. Searching for a research framework that combines the two aspects of research in facilities management was non-existence. Previously mentioned in section 3.6.2 and illustrated in Figure 12: Design Science Research Framework for Facilities Management, was designed from an extensive literature review and adaptation of Offermann, Levina, Schönherr, and Bub's (2009) research of design science research processes in information systems. It is the best solution for this type of organisational research to combine both design sciences with action research while doing the case explorations. The action research cycle selected for this thesis and best complements the research enquiry is illustrated in Figure 16.

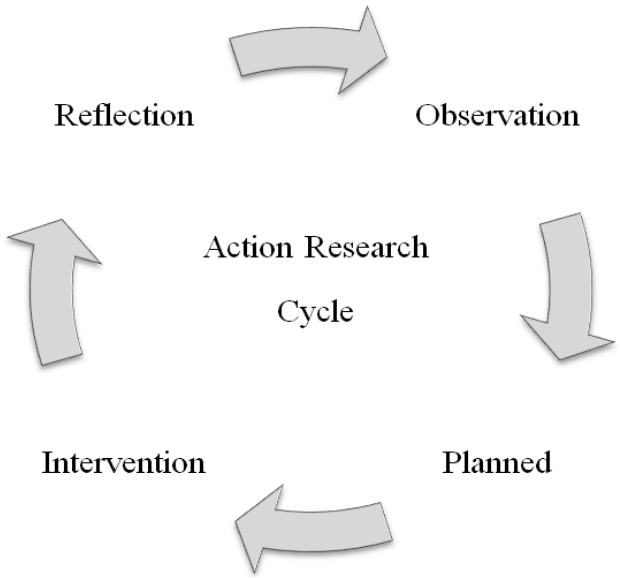


Figure 16: Action Research Cycle Selected for this Research

The action research cycle takes place in the third phase when the designed artefact has started to be integrated into the case study. Observation of the operatives' reactions and changes in the environment begin to occur. The organisation participants evaluate the integration of the artefact and the affect it has on their environment. The next cycle of intervention is planned; at this stage co-creation of additional artefacts can take place, or the researcher might consider amending the exiting artefact. In every action research cycle a reflection takes place, the researcher steps back, and evaluates what has just

occurred. The action research cycle chosen is interjected in to the design science research framework, to illustrate the cycles of enquiry that occur, refer to Figure 17.

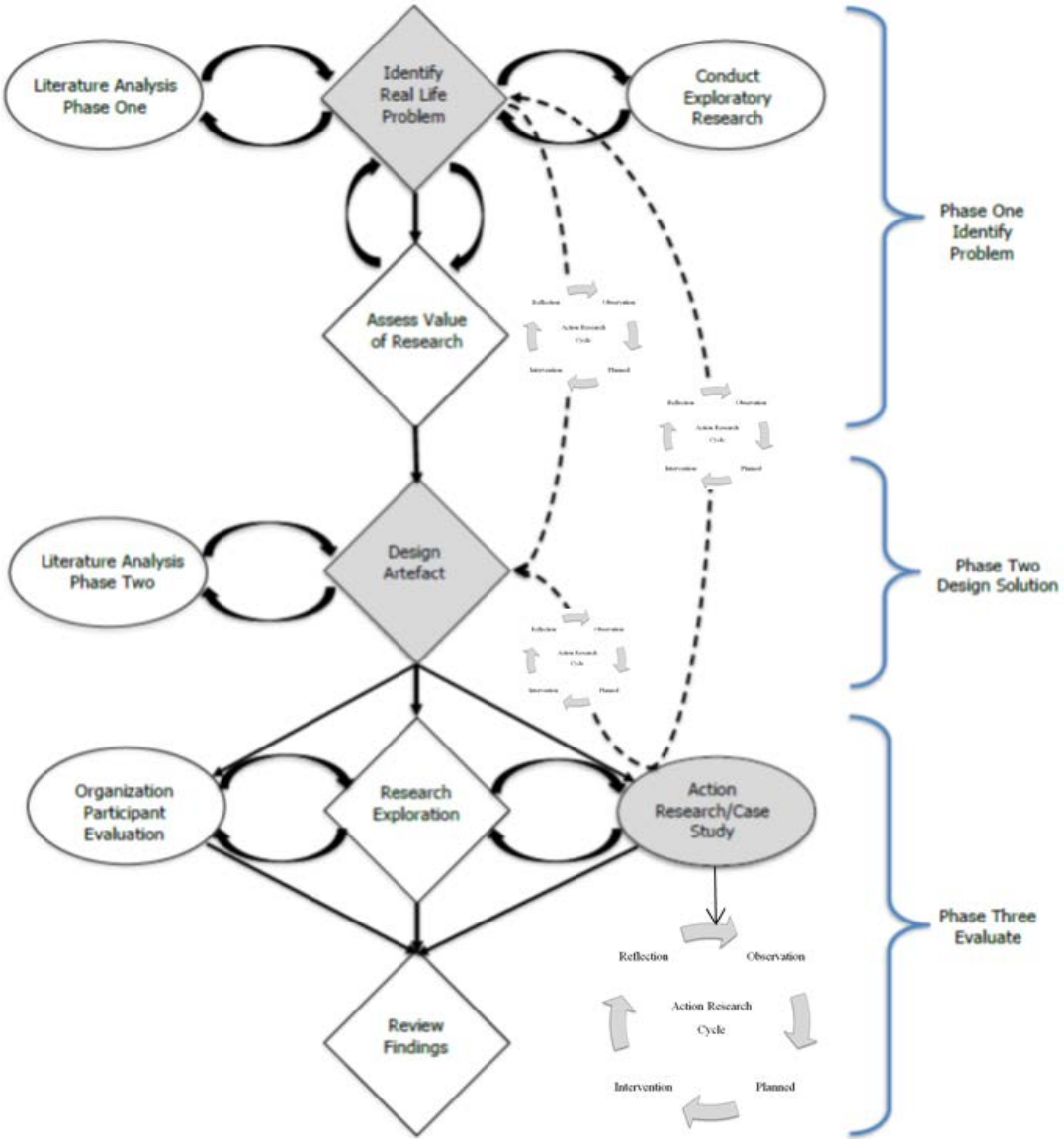


Figure 17: Design Science Research with Action Research Cycles Framework

The action research cycle forms part of Chapter Five, case study two; it starts after the designed artefact has been introduced to the organisation participants. The researcher observed how the facilities management operatives adopted the designed artefact, how the design artefact influenced their workplace, and what significant outcomes manifested. The organisation participants evaluated the designed artefact after its initial integration. The case study continued to unfold as new artefacts were designed by the participants and co-created with the researcher. A more systemic view of their facilities management

department started to evolve and two more areas of the department developed into another research exploration.

3.9 Soft Systems Methodology

The inquiry learning cycle of the thesis are summed up into a soft systems methodology (SSM) framework. A systems thinking approach to the entire thesis structure from start to finish, is formulate through the implementation of design science research with an action research cycle framework. The final thesis findings take shape through a soft systems approach. "Systems thinking entails thinking in layers defined by an observer" (Checkland, 1999, p.A24). The thesis is written in chapters, which could be looked upon as layers of learning, justifying, exploring, in some instances taken action by doing, designing and co-creating artefacts. The chapters' link together through the research exploration, and frameworks developed through use of "systems insights" (Checkland, 1999, p. A24), which allows the researcher to adapt to the changing relationships between the various layers (chapters) of enquiry.

Soft systems methodology is used to measure performance of the system through development of a model or framework. Each model or framework developed can use a 3E method to synthesising the data; this was first developed in 1987 by Forbes and Checkland (Checkland, 1999). The 3E method is as follows: "criteria of efficacy (E_1), efficiency (E_2), and effectiveness (E_3)" (Checkland, 1999, p.A25). There are two other E's that can be added, and they are: "(E_4) ethicality and (E_5) elegance" (Checkland, 1999, p.A25). Methodology is defined as "*a set of methods, rules, or ideas that are important in a science or art: a body of methods, rules, and postulates employed by a discipline: a particular procedure or set of procedures and the analysis of the principles or procedures of inquiry in a particular field*" (Merriam-Webster, 2015).

Much has evolved in systems thinking methodology since earlier research of the 1970's, through 1990's. What emerged is a soft systems action research approach that resolves real life problems within a system. This was a way to humanize the systems thinking approach and seek models to solve real life problematic conditions. SSM consist of a learning cycle that is oriented toward the group involved in the research and problematic situation. According to Checkland and Poulter (2006) there are seven steps of "inquiry which, through social learning, works its way to taking action to improve" (Checkland &

Poulter, 2006, p.xvi) the system. The SSM learning cycles for action, is illustrated in Figure 18 and a basic summary of soft system methodology is outlined below (Checkland, 1999, p.A9; Checkland & Poulter, 2006, p.170):

- Think about a problem situation, not necessarily a problem.
- Find out about the problem thru:
  - → Analysis:
    - One: Interviews.
    - Two: Social.
    - Three: Political.
  - → Models.
  - → Pictures.
- Think of some relevant systems of purposeful activity; name of worldviews they encapsulate.
- Build the models of these national systems:
  - → Root Definitions.
  - → PQR:
    - P: Maintain and develop a knowledge base in science and technology within the corporation.
    - Q: By defining and carrying out R&D in a sponsor/researcher relationship.
    - R: Contribute to maintaining good company performance viability.
  - → CATWOE:
    - C: Senior management in the company.
    - A: Skilled professionals (as sponsors and researchers).
    - T: Carry out R&D via a sponsor/researcher relationship.
    - W: R&D, continuously carried out in a science based business can contribute to company performance and viability.
    - O: Senior company management.
    - E: Company culture and norms: in summary define and carry out work, document and report it in explicit procedures, do both research-push, and market-pull, R&D, and sponsor, and researcher relationships.

→ 5Es

- Efficacy: Did what you expect to achieve, actually was achieved?
- Efficiency: Was the ratio of inputs to the outputs worthy, even if the findings were not what was expected?
- Effectiveness: Did the over action(s) actually address the problem? The statement? Even if it was inefficient?
- Ethically: Was the action completed in an ethical manner?
- Elegantly: Did the design of the action, elegantly achieve what transpired in the four other E's?

- Use the models to question the perceived real-world situation, structuring a debate about change. 'Action to improve' based on finding accommodations (versions of the situation which conflicting interest can live with).
- Inquiry in principle never-ending: best conducted with wide range of interested parties; give the process away to people in the situation.
- Seek accommodations which meet criteria, systemically desirable (based on these models) and culturally feasible (for these people in their situation). An accommodation is a version of the situation which different people (different worldwide views) can nevertheless live with (Checkland, 1999, p.A9; Checkland & Poulter, 2006, p.170).

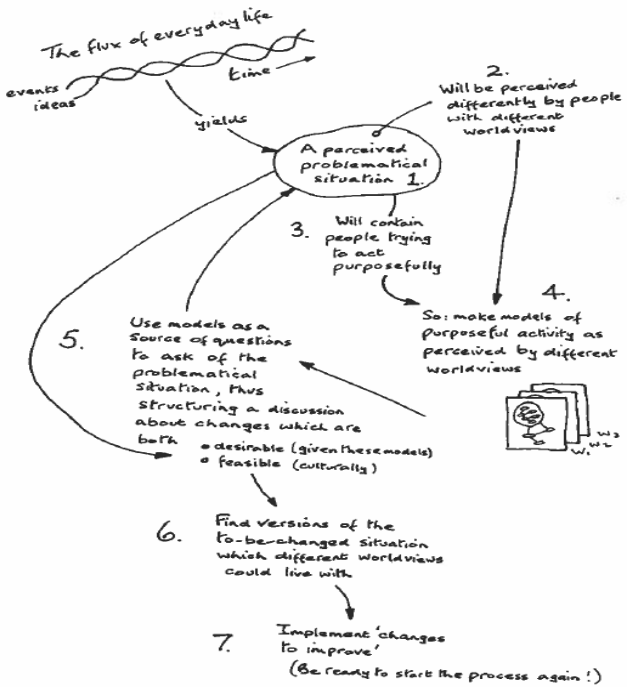


Figure 18: Soft System Methodology Learning Cycles of Action
(Source: Checkland & Poulter, 2006, p.xix)

In starting the learning inquire SSM model for this thesis, a schematic A3 unstructured visual report was composed, displayed in Figure 19. From this schematic plan the final SSM model was developed and illustrated in Chapter 6, Figure 49. The main thesis problem and world view was found through the original literature analysis.

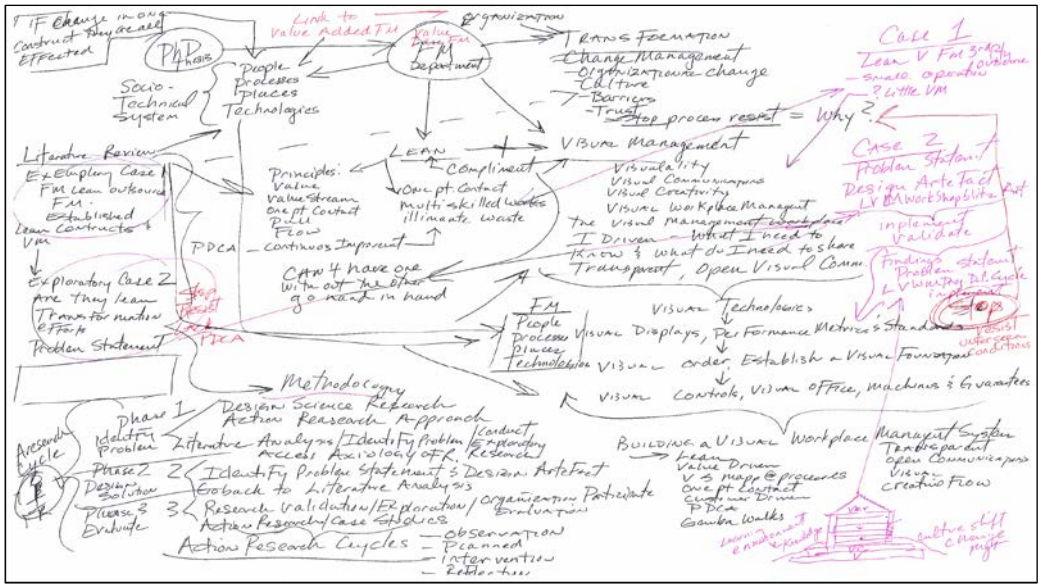


Figure 19: Soft System Methodology Phase One Schematic Plan

Not only was a systems process approach embedded in the methodology of this research investigation; it linked the integration of lean and visual management in facilities management functions, connecting the FM department to the organisation holistically. Soft systems methodology emerged while solving real life facilities management research and assisted in the discovery of what models to use and develop. Holistic thinking theory developed in the 1950's, that regarded organisations as a collection of systems, and system thinking integrated the various systems that form parts of the organisation. This facilitates "the problems of many different disciplines that could be expressed and solved: and it was hoped that by doing this would help promote the unity of science" (Checkland, 1999, p.A3).

3.10 Data Collection Techniques

The chosen qualitative research methods included questionnaires, unstructured and semi-structured interviews, participatory observation, and shadowing in action. Interviews are a standard research tool used to assess research participants "experiences and their inner perceptions, attitudes, and feelings of reality" (Zhang & Wildemuth, 2009, p.222). There

are three structured classifications of interviews: “structured interviews, semi-structured interviews, and unstructured interviews. Structured interviews have a set of predefined questions that would be asked in the same order for all respondents. Structured interviews are similar to surveys. Semi-structured interviews are more flexible. Structured interviews include both closed-ended and open-ended questions. The interviewer has a certain amount of scope in adjusting the sequence of the questions to be asked, and to add questions based on context of the participants’ responses”. Whereas an unstructured interview technique, developed in the discipline of anthropology and sociology, is a method that provokes people’s reality. In literature terms, an unstructured interview is an “informal conversation, in-depth interview, nonstandard interview, and ethnographic interview” (Zhang & Wildemuth, 2009, p. 222).

As an action research scientist observing people in their work environment, one way of building trust, and acquiring additional knowledge about the workplace, and the person being interviewed, is an unstructured interview, also known as in-depth interviews. According to Dawson (2009) unstructured interview data collection is a means to a more holistic enquiry in understanding the participants’ opinions and circumstances. This requires a more informal research enquiry to be conducted while observing and shadowing participants. As a researcher, employee of the case organization, and facilitator in action, it was noted that the more casual the data gathering and question techniques, the more comfortable the research participants were. In writing up the research exploration findings, action research reflective analysis was performed. This is where the researcher stops, steps back and queries insights, while planning the next action steps (Coghlan & Brannick, 2013).

Due to the culture of the facilities management department, a more informal social action data gathering method was chosen. Meetings were set up in advance with the primary stakeholders who consisted of executive leadership, and management staff to discuss the interview process; who would be interviewed, what access the researcher would have to participants, and what data collection documents would be shared. Once stakeholders approved the research, and data collection techniques, future meetings were set up, authorisation to meet with participants was given, and organisation documents were provided. The primary stakeholders also became the researchers’ four points of contact.

Meeting minutes and notes were taken by the researcher during the meetings, and provided to the attendees.

The questionnaires distributed amongst the primary stakeholders and secondary stakeholder participants were not filled out in a timely manner. Or the questions were left unanswered, while personal information was answered. The researcher made appointments to visit with the participants on a one to one basis, and turned the questionnaires in to semi-structured or unstructured interviews; this established a more casual data gathering method and atmosphere. Semi-structured interviews according to Dawson (2009) are the most common, and used more often in qualitative social inquiries such as action research. All participants are asked the same questions and the interview is flexible, and casual in nature. The researcher chose to use a combination of both closed-ended, and open-ended interview questions; a very common approach to qualitative research data collecting. The participating facilities management organisations made available to the researcher archival documents, records, and reports, as well as current documents, records, and reports.

3.10.1 Participant Data Collection

Initial meetings with research participants were scheduled to establish key points of contact, and to introduce the researchers aim and objectives. Location of the meetings where set up by participating case study management. The researcher was escorted, and observed by managerial staff while conducting certain interviews. Additionally, managerial staff had to attend certain secondary stakeholder meetings. Field notes and photographs (if approval was given) were used as central data collection techniques while observing participants in their daily work environments.

In Chapter Four, exemplary case study one, the researcher gathered data from company documents and monthly performance reports, conducted observation techniques such as, shadowing, photographs, observing people in their working environments, and semi-structured and unstructured interviews. Semi-structured interviews were scheduled with the following participants: main outsourced facility manager who was in charge of the new university off site building; one district manager; one planning and dispatch coordinator; two reception associates; one building engineer; one security officer; one main university facility manager housed at the new offsite facility; one main university

general manager housed at the offsite facility; one main university facilities IT specialist housed at the new offsite facility. The researcher was able to observe and shadow two receptionist for a total of three days, during three separate weeks. A total of ten people were involved in the research exemplary case study exploration.

Chapter Five, exploratory case study two research exploration, had a total of thirty-six research participants. This included a set of semi-structured and unstructured interviews, and questionnaires. The researcher shadowed three reception/helpdesk support team associates at three different building locations, on three separate days; the researcher shadowed one multi-skilled electrician for one entire work shift. A questionnaire was sent out to twenty-four participants. Sixteen participants attended a workshop artefact that was designed and presented. An additional eight participants where part of the field study. A few additional participants where observed as part of the case study. There was crossover of participants who contributed to both case studies, since the investigation included several cases in the same business department through systemic action research.

3.11 Ethical Issues

This research thesis takes in to account ethical issues such as; informed consent, anonymity, while interviewing and observing participants, treating people with respect, considerations and concerns. The idea of maintaining confidentiality during participant observation is a key factor in this research exploration. All participants were provided with a hand out that described the research aim, objectives and methodologies. A consent form was provided that defined the ethical concepts; if the participant was in agreement then permission was granted by signature, dating a document, and returning copies to the researcher. The actual names of participants, and university investigated will not be disclosed due to confidentiality requests of the organisation and participants.

3.12 Conclusion

Chapter Three introduced the research philosophy, methodology, and approach to research. An overview of inductive and deductive theories was presented. Aspects of research theory to include epistemology, ontology and axiology were adeptly discussed. Design science research with an action research approach, and soft systems methodology was introduced and illustrated. Qualitative data collection research methods were outlined. Through the rigour of design science research methodology with an action

research approach, and a soft systems methodology model of learning cycles of action, the research framework metamorphosed into the thesis presented on these pages. The next section starts the exploratory case study research.

CHAPTER 4
EXEMPLARY CASE STUDY ONE: OUTSOURCED LEAN FACILITIES MANAGEMENT SERVICE PROVIDER

4.1 Introduction to Exemplary Research Case Study One

Evidence concedes though lean visual management concepts are limited in facilities management industry, when implemented value based facilities management begins to occur. Linking the facilities management department to the organisation holistically building a more effective relationship between the two. Chapter 4 presents the first stage of the research exemplary case study. The case considers a lean services company, Balfour Beatty and their third party facility management services operations, Balfour Beatty Workplace (BBW). BBW won a contract to manage third party outsourced facilities management services for a university's newly constructed high profile off campus facility located in NW England. The university is the lessee of four stories in a media and communications building approximately 2.3 miles or 3.7 kilometres from main campus. This is a new real estate and legal endeavour for the university, they had never entered in to a real estate legal agreement for offsite facility services. Figure 20 illustrates the sequence of logic that occurred during the case research.

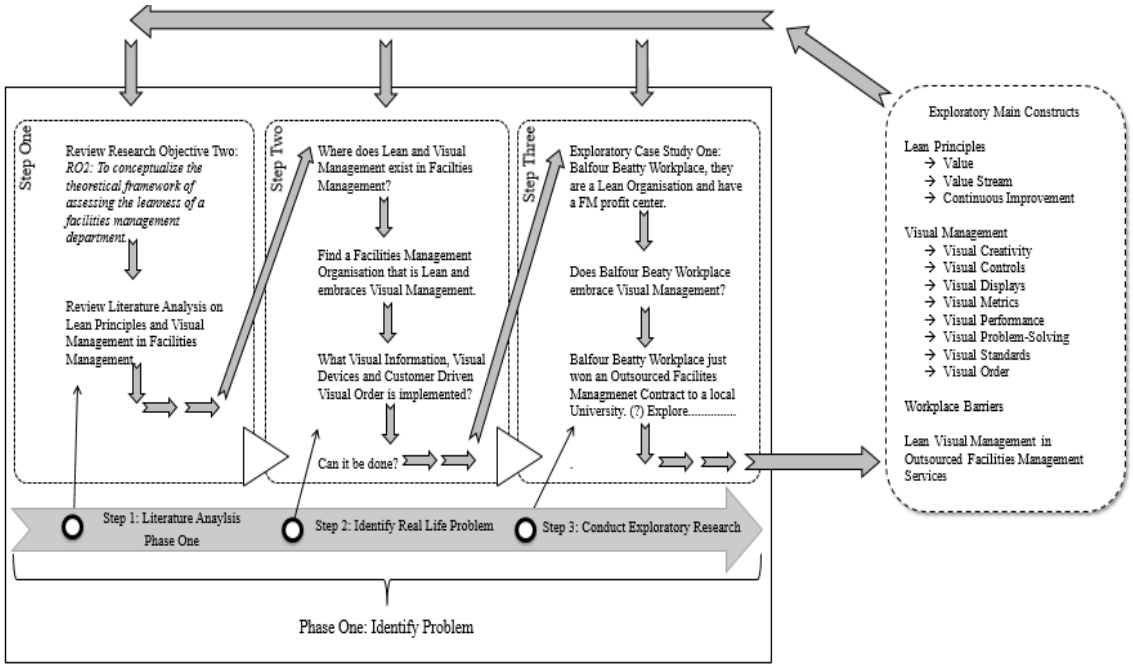


Figure 20: Research Sequence of Logic Exemplary Case Study One

Balfour Beatty Workplace's outsourced facilities management services contract began September 2011, one month prior to the building opening in October 2011. Their contract was based on service level agreements and key performance indicators that were in line with university's organisational and customer goals, mission, vision, and performance metrics. At the time of this case study BBW was responsible for providing cleaning, janitorial, reception, and security and switchboard services. BBW's areas of responsibilities are presented in Table 6.

Table 6: Balfour Beatty Workplace Areas of Responsibility

Balfour Beatty Workplace Areas of Responsibility		
Reception Area	Conference Facilities and Video Conferencing	Digital Media Laboratories
HD TV Studios	Radio Broadcast Studios	Performance Laboratories
Post-production Suites	Research Facilities	Academic Offices
Student Lounge	School Library Area	Teaching Areas

There is an array of internal and external customers that BBW has to maintain relationships with, such as the many university departments involved in the offsite facility and external community partners. Local media, journalism and IT tenants located in the building complex are customers of the university, as well. One of the local media tenants, the British Broadcasting Corporation (BBC) rents digital studio space, production laboratories and equipment from the university, in addition to using university personnel to include students when needed. Six months after the facility opened, additional tenants started leasing floors above the university space. It was mentioned that a high profile IT firm and an independent media organisation had just signed a lease. Prior to their move in dates a main building entrance and new central reception area, for non-university tenants, would be designated.

BBW considers themselves a sustainable lean organisation and implements lean techniques and Six Sigma tools on construction projects. This study explores the leanness of Belfour Beatty Workplace's performance managing the university's third party outsourced facilities management services. The case will explore if they practice lean facilities management, and what lean principles and visual management technologies are being implemented, if any. The case study exploration starts with examining how BBW,

an outsourced FM service provider, adds value to their contract and end users, internally and externally. The study will reveal if lean principles such as value stream mapping of processes and procedures, and continuous improvement cycles have been performed. It will additionally, examine if BBW has implemented visual management technologies.

4.2 Value provided by Outsourced Lean Facility Management Services Provider

A sizeable advantage for BBW is that they secured additional outsourced facilities management contracts in close proximity to the new university site. This is significant for their ability to deliver FM contracts successfully through the use of their National Operations Centre (NOC). All helpdesk calls for the offsite university facility, in addition to their other local FM services contracts, are answered through the NOC. Housed within walking distance of the university's offsite facility, the NOC provides central work reception support services and a single point of contact for BBW's local customers (BBW, 2011).

The NOC is managed similar to a call centre, designed with an open office concept where planning and dispatch coordinator's for BBW's local customers sit in rows of desks with computers and headphones. One full-time planning and dispatch coordinator is assigned to the university's offsite facility. They are responsible for coordinating all building issues closely with the building engineer, subcontractors and stay in daily communications with the facility manager and district manager. The NOC is accountable for "*planning and organising the full life cycle of all facilities management work orders from the time they are logged to completion, this would involve understanding the work orders and allocating the correct skill set(s) of the engineers or subcontractors and updating the system*" (BBW, 2011). The lead times for answering the phone, assigning work order tickets, follow-up and closing tickets are measured against the FM contract service level agreement performance criteria.

The NOC provides BBW with flexibility of using planning and dispatch coordinators and building engineers (and suppliers) from other local client facilities when needed. This is considered multi-skilled staffing; a lean technique that supports BBW's management of complex FM service contracts with limited budgets. For instance, their handypersons/ porterage staff assigned to the university are multi-skilled employees performing janitorial duties when needed. They do everything from carrying boxes, moving furniture,

conference/event set up, to cleaning and whatever else is asked of them in any given day. Besides delivering FM services, BBW staff is helping the landlord and university finish the construction snag list. The newly constructed buildings snag list contains construction defects and warranty issues that need to be completed prior to defect/warranty expiration period. This was not in BBW's original contract, they are providing additional services in order to keep the university customers comfortable, happy and secure in their new space.

One of the main case objective was to determine BBW's perception of value based outsourced FM services. At first a questionnaire was developed and administered to BBW employees, however it was not being filled out and returned. This became a typical theme throughout the case studies. As a result, the researcher decided to change data collection methods turning the original questionnaire into an unstructured interview conversation, a less formal approach appeared to function better. The administered questionnaire can be found in Appendix A. Scheduling availability to meet with everyone took time, being that facilities management is such a reactive service function, everyone was always busy putting out fires.

The first two questions asked in the unstructured interview were: what does "value" mean to you?, and how do you perceive "value"? BBW's facility manager who is in charge of the university's offsite building alleged that:

> *"For me added value gives the university the time to take care of what they need to do and not having to deal with the pain of FM and fixing a broken light or AC issue – we fix it with a smile on our face. It's the way we look at everything. We allow the customer, the university to do their job, which is teaching degree courses and we take care of everything else to make that happen".*

Balfour Beatty's organisations values of integrity, teamwork, excellence and respect trickle down to the way BBW provides FM services, how their employees perceive value, and how customers are treated. It was established that there appears to be a sense of ownership. Or could it be that employees are still enamoured with managing a new high profile media education facility, which is located in close proximity to the BBC. Still, the facility manager assigned to the university has worked for BBW for some time and transferred from another BBW managed facility. Their management and leadership skills

are based on Balfour Beatty's lean organisational training, as well as their own experience managing outsourced third party FM services contracts. They seem to be open and transparent in daily operations and interaction well with staff. There is a very positive customer service attitude which could be contributed to this scenario.

The planning and dispatch coordinator considers value in respect to how the different stakeholders and customers view their environment. They feel it is about building relationships between all stakeholders and being respectful that lets BBW engage in their work. This leads to a smoothness and ease of workflow activities that allows all stakeholders and BBW to perform their job meaningfully on a daily basis. On the other hand, the university's operations director who manages BBW's contract and is assigned to work at the new facility, considers value more in line with the third party outsourced FM services contract. Value for the university's operations director is in "*terms of financial levels based on the budget, extra value in terms of what you pay for*" and the services rendered. They are merely concerned with BBW providing a healthy, clean environment and making sure that university students, teachers, administrators, and visitors to the building are satisfied. For BBW's one assigned building maintenance engineer, "*value is worth what you pay for, services expected, and feeling of accomplishment when services are completed"*. There is one common scheme, to make sure no matter what needs to be done, it gets accomplished within the contractual SLA performance metrics. Combined with what customers and occupants of the university facility value such as: "a clean, comfortable, healthy, secure and safe environment" (EE, 2015, p.83).

4.2.1 Offsite Facility Management Service Provider Value Stream

As soon as BBW was awarded the offsite FM services contract they set up employment criteria, hired necessary personal, and value streamed mapped all processes and procedures prior to the facility opening. Value stream mapping of processes and procedures is the second lean principle. Figure 21 illustrates the value stream map of the NOC service desk procedures. Determining service level agreement criteria and performance measurements are linked to visual management through category: visual displays, performance metrics and standards category.

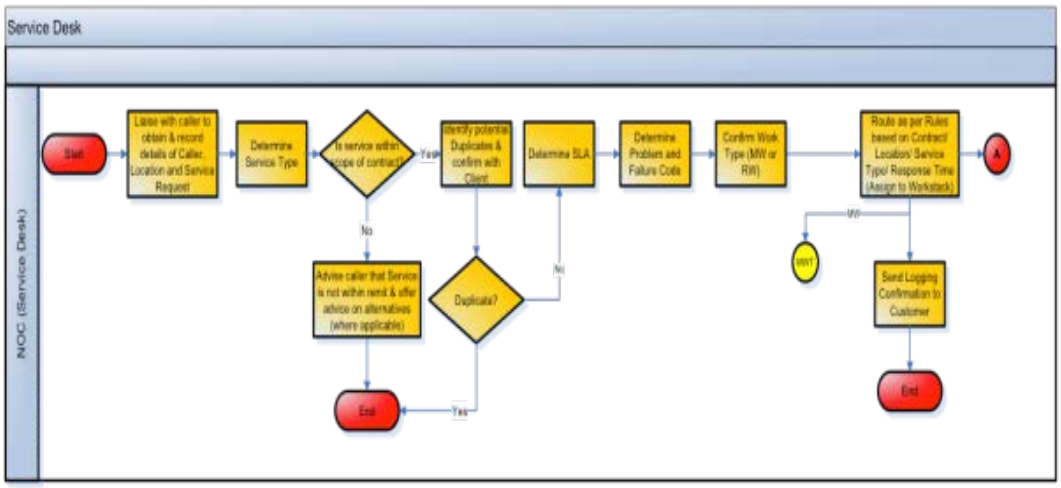


Figure 21: Belfour Beatty Workplace's NOC Service Desk Value Stream Map

One full-time planning and dispatch coordinator logs the work orders through completion, and assigns them to the one multi-skilled building engineer. The NOC is in walking distance to the new facility which adds value in the ability to communicate closely with university staff. Having multi-skilled handyperson/porterage staff adds value to BBW's FM services contract, as well. Furthermore, BBW can pull additional resources from other local facility contracts if needed; such as maintenance, operation personnel, suppliers and contractors. There are fewer BBW employees on site due to the size of the offsite facility, as well as the stringent contract budget.

4.3 Visual Displays, Performance Metrics & Standards

One major issue with the new facility is that there is no exterior signage on the building that indicates the university is present. This has caused issues with students, parents, visitors, and the community not knowing which building the university is located in. It was noted that BBW and the property management company were in negotiations to order proper exterior signage for the building. In May 2012's monthly performance report, BBW alluded to signage being ordered for way finding areas in the offsite building that has been approved by the university and property manager. This should clear up the confusion of the university's offsite building location. This does not form part of BBW's FM services contract, though it has affected customer service and reception duties. Nevertheless, BBW took the initiative to independently work with the building owner/property manager in resolving this issue, getting buy in from the university took time. It was an extra expense that had not been realised prior to the university leasing the space. Given the high profile location and being in close

proximately to BBC‘s campus, the sign can only enhance the university’s reputation twofold. With a proper visual sign displayed on the outside of the facility, will not only direct customers, student, and faculty to the building with ease, it will aid in marketing the university. Along with perhaps furthering the interest of potential students and community partners.

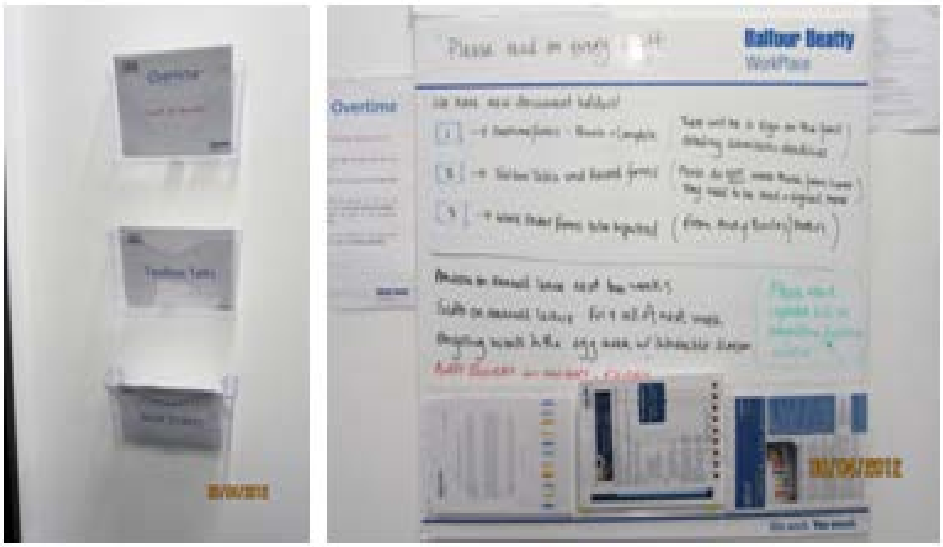


Figure 22: Balfour Beatty Workplace Visual Communications White Board

In the facilities management office behind the main reception desk, which forms the hub for daily employee communications, is a whiteboard that conveys essential information. The whiteboard is illustrated in Figure 22. In building any lean enterprise visual displays are an important function of visual communications for daily activities. Literature suggests one of the first lean tools an organisation can start to use in their lean journey are visual management technologies such as visual displays, visual boards, performance metrics and work activity standards such as service level agreements and key performance indicators. BBW has been utilising visual management technologies, such as visual boards and visual displays, from the very start of their contract. Although, they have not implemented visual communications for scheduling events and on site planned maintenance. Visual boards communicating current and future employee ‘need to know’ information, as well as managing document control systems are very much in place.

4.3.2 Offsite Service Provider Visual Performance Indicators

BBW’s management of the offsite facility is measured against monthly performance indicators based on contractual agreements. BBW must provide monthly audits in the

form of performance reports to the university's estate and property services leadership linked to FM services contract, service level agreement criteria and response times. This is then communicated to university executive leadership on a monthly basis. May 2012 monthly performance report indicates that BBW operates a 24/7 helpdesk service for the university with in the FM contracts SLA criteria. There were 273 calls to the helpdesk that month, a significant increase from the previous month. A total answer rate of 97% with 8 calls answered outside the SLA. Total reactive work performance logged for May 2012 through BBW's National Operations Centre and percentage completed within SLA criteria for each service line is shown in Table 7. Reactive service performances for internal mechanical and electrical services were at 100%, and 98% reactive for total work performance in May 2012, refer to Table 8 (Atkinson, 2012).

Table 7: Belfour Beatty Workplace Reactive Works by SLA Criteria

Service Level of Agreement Criteria	Fail	Pass	Grand Total	% of SLA
Out of Hours Response		1	1	100%
P2 = Response Time: 4 Hours/ Rectification: 8 Hours		4	4	100%
P3 = Response Time: 24 Hours/ Rectification: 48 Hours		48	48	100%
P4 = Response Time: 2 Days / Rectification: 4 Days	4	216	220	98%
Grand Total	**4**	**269**	**273**	**98%**

Table 8: Belfour Beatty Workplace Reactive Work Performance, May 2012

Service	Fail	Pass	Grand Total	Completed % of SLA
Catering and Vending		43	43	100%
Cleaning		14	14	100%
Conference and Meeting Room Management		33	33	100%
Internal Fabric Maintenance	3	43	46	93%
Internal Mechanical and Electrical Services		35	35	100%
Porterage	1	93	94	99%
Security Services		5	5	100%
Security Systems/Access/CCTV		3	3	100%
Grand Total	**4**	**269**	**273**	**98%**

There were not any direct customer responses communicated to BBW based on customer reactive work order tickets completed that month, though positive commentary was received via e-mail. Grounded on the monthly performance reports, BBW provides

quality outsourced services to the university with in planned SLA and KPI targets. This is recorded through the use of monthly visual performance reporting which provides an open and transparent objective to measuring outsourced FM services contracts.

4.4 Visual Order, Visual Foundation Established at Offsite University Facility

The university building is new, and BBW keeps the facility very clean, free of clutter and organised. This is considered a function of visual order and the 5/S system; “the process of creating a clutter-free workplace with visual controls through five steps of: sort, set in order, shine, standardise and sustain” (Productivity Press, 2006, p.4). It is looked upon as a “good starting point” (Productivity Press, 2006, p.4) and foundation to any lean enterprise. Though, it does seem rather sterile especially in the open office area where all faculty, management and technical staff reside. There is no assigned desk, seating and computers, even though the facility manager and university staff tend to sit in the same workstations. Up against one of the interior side walls are lockers that are assigned for employees to keep work and personal items in. Furthermore the facility manager maintains a paperless office environment and they seemed very proud of this. Looking at their desk you would never guess they were the facility manager, there are no visual files, clip boards, report folders, binders, even pens and paper. Any folders, reports, binders and work related communications are kept neatly and organised in the FM office behind the reception area on the first floor.

Visual safety solutions are additionally housed in the FM office behind the reception area, where security has their closed circuit television (CCTV) monitors and surveillance system. There is one security person sitting at the monitors 24/7. They keep all security working files and binders in the FM office, or at the front reception desk. The office has visual displays. Everything is labelled in some respect so that everyone knows what it is, and where it is, sharing the information needed between employees by way of visual technologies. Everything has its place and the office is very orderly and clean.

4.5 Visual Controls, Visual Office, Machine and Guarantees

The receptionists embraced visual creativity in organising design to task work activity clipboards at the front desk. They designed and printed out documents with the university’s new logo and colour scheme. The reception folders and clipboards designed and labelled are the daily occupancy report, door patrol log, access card log, key register

log, security handover report and weekly events. Additionally they designed a student sign in log with an instruction sign that reads, "*Students please print your details clearly, Thank You*".

These design to task folders, instructions, clipboards and activity documents are a representation of creating visual communications strategies while suggesting an open transparent work environment that is knowledge based. This is in line with Galsworth (2005, 2011) visual workplace strategy that empowers employees to organise their workplaces in order to communicate and work more efficiently. The questions employees should ask are: *what do 'I' need to know?,* and *what do 'I' need to 'share?* (Galsworth, 2005, p.23-24; 2011, p.25-26). The use of visual technologies and communications is working out well for staff, faculty, students and visitors at the new offsite university media facility.

The planning and dispatch coordinator at the NOC uses visual machines and guarantees such as computer aided facility management (CAFM) systems via a computer and monitor. Along with a telephone, and headphones communications system to interface with the building engineer and facility manager. The building engineer is assigned his own digital assistance system (PDA), connected directly to the NOC's CAFM system and accessible to the planning dispatch coordinator. Having access to a PDA system is a huge advantage for the building engineer. They are able to receive work order tickets, make comments and close out tickets all by using their PDA. It makes them more responsible for their individual actions and WO tickets.

4.6 Offsite Service Provider Barriers in the Workplace

Some of the barriers affecting BBW's management of the new university facility is the fact that the building engineer has to deal with the post construction snag list and warranty issues. BBW's contract did not state they were responsible for fixing the construction snag list and defects of the newly constructed building, the building owner and property manager are responsible. The buildings end users are not privy to this they just want a clean, healthy functioning building and wonder at times why issues are not taken care of promptly.

The building engineer alludes to the fact that the PDA system is a good form of communications yet there are issues with network coverage. It's a good device for one location, once they leave the facility communications is limited. Additionally, they would like better correspondence and e-mail record keeping attributes. One of the biggest barriers that BBW's planning and dispatch coordinator faces is the "*need to tailor make the process based on the line of approval to get it right*". They are consistently monitoring the SLA and performance metrics making sure that the clients are happy and building issues get repaired promptly.

According to BBW's facilities manager, the biggest hurdle besides the post construction snag list is the facilities management industry and asset management. "*It is the relationship between IT, engineering and the customer*". For the university's operations director the workplace barriers are the leasehold issues with the landlord. The landlord, property owner is "*responsible for the toilets, but when 50% of the toilets do not work and 50% of the faucets/taps are out of order, it is the basic things – the hot and cold water, that is what gives you the biggest headaches*".

According to the university's own internal technical (IT) services and support staff assigned to the new offsite facility; IT services provided are very reactive. It seems that they are always firefighting issues and reacting to university leadership matters. In view of the fact that the university's transformation programme is in progress, there is not a clear strategy and direction for the new offsite facility and a big communications deficient exist. The schools located at the offsite facility lack the confidence and leadership guidance to make decisions, they are not the enemy but the client. As stated by the university's technical team leader "*there are two different methods, two different systems in place*". There is the "*complex old system*" and the "*new systems, (they both need) to interface with each other. Lots of things we try and do and the university says we don't do it this way*". The barriers that exist for in-house and outsourced FM services at the new university location is the inconsistency between the old and the new.

For instance, while setting up an event at the new facility, it took over a week to get in touch with the university FM event coordinator. Even after leaving many messages and contact information. Once communication was established, it took several weeks for them to return calls concerning a room for said event. Another situation occurred when a

university research team was presenting an international training workshop for Balfour Beatty employees. When the research team showed up for the workshop it was not on the schedule. Not even BBW reception staff new about the event, its location, and IT requirements. In the end, the workshop went on; although during the event an executive from Balfour Beatty USA, was unable to communicate effectively with the offsite facility. Conferences, event scheduling and coordination have excessively been an issue for the university, and there is no plan in site to rectify the situation.

4.7 Offsite FM Service Provider Lean Visual Management Opportunities

Balfour Beatty Workplace has implemented lean principles and visual workplace management technologies from the very beginning of their contract. Value based FM services were established through the use of the 5S system of providing a clean, healthy, and safe comfortable work environment. It is looked upon as a "good starting point" for any lean enterprise (Productivity Press, 2006, p.4). Though, visually it is rather sterile, especially in the open office area where all management and technical staff reside. Another aspect of visual control 5S method is sharing information needed between employees; information communications between BBW's facility management staff seems to be working very well.

All process and procedures were value streamed mapped once the contract was awarded. BBW had been managing the offsite university facility for six months when the research was ending; they were already starting to review their operation and value streams to consider improving services where needed. This appears to be an important lean principle for an FM outsourced services operation. Embracing lean continuous improvement theory, staying on track with their lean enterprise and starting to re-evaluate their value stream. Another lean approach that is working out well is hiring multi-skilled workers, utilising a central operations centre, along with one assigned person to handle building issues and communicate to the one building engineer. Not only has this saved time and money, it has streamlined the process and all communications making it easier for BBW to meet their monthly contractual SLA performance metrics.

Evidence obtains that BBW has implemented lean visual communication and leadership boards behind the reception desk, though limited in function; this is an area that can be continuously improved upon. Furthermore, the NOC has visual controls, visual office,

visual machines and guarantees, such as telephones and the CAFM systems in place, and the building engineer uses a PDA system connected directly to the NOC's CAFM system. The advantage for the building engineer having access to a PDA is their ability to receive work order tickets, make comments and close out tickets. This makes them more responsible for their individual assignments.

It was established that the internal university customers seem comfortable with the facility and how BBW is providing valued based FM services. Their concerns are more with red tape and cultural issues of old and new workflows between the university and new offsite facility. The university itself is going through a huge restructuring programme and haven't quite dealt with the idea of change management and administering a new high profile media educational facility. The workplace barriers that BBW face are more internal to the university and the university's own value stream.

4.8 Chapter Four Conclusion

The exemplary case study phase one research concluded that it is the main university's systems that are intruding on a successful FM practice for the third party outsourced service provider. The old and new processes and procedures are not intertwining, it has not been well thought out by the main university FM leadership. Furthermore the facility is not fully utilized by students and faculty; they come to class then leave. The university needs to embrace further utilisation of the offsite building. This would form part of the university's lean continuous improvement and change management plan, which was never formulated.

Furthermore, visuality is limited in the open office areas, it is rather difficult for BBW to develop visual communications in such a sterile environment. They could add more visual displays illustrating performance, daily work activities and sharing of operations and maintenance information. This case study demonstrates that lean visual management can be productively used by a third party outsourced FM services provider successfully linking their operations to the university's mission, vision and strategic plan. This is validated by BBW's outsourced FM services and use of lean principles and visual technologies such as: value stream mapping of all processes and procedures; hiring multi-skilled workers; using one point of contact for work order tickets and building issues; establishing an operations centre in close proximity to FM contracts; monitoring all job

performance based on performance metrics, and visual standards through service level agreements and key performance indicators; using visual communications boards; establishing 5-S systems; and establishing visual creativity and visual controls at the reception area.

Chapter Five will explore the main university's facilities management department to establish if there is any correlation of lean principles and visual management technology integration similar to BBW's adaptation. Lean concepts that will be considered are value based FM services such as: value stream mapping, continuous improvement cycles, and one point of contact and multi-skilled workers. Visual workplace management technologies that will be evaluated are: visual displays, performance metrics and standards; visual order and visual foundation technologies; and visual controls, visual office, machines and guarantees. It should be noted that any facilities management department can gain knowledge from what Belfour Betty Workplace established as a third party outsourced lean facilities management service provider. They created an efficient lean visual facilities management workplace and knowledgeable staff, linking FM operations to the university's mission, vision, and strategic plan.

CHAPTER 5
EXPLORATORY CASE STUDY TWO: ASSESSING THE LEANNESS OF A UNIVERSITY ESTATES DEPARTMENT

5.1 Introduction

Chapter Five is comprised of research exploratory case study two. The exploratory case study's research logic is comprised of three phases that follow the design science research (DSR) with an action research (AR) approach framework that was developed and illustrated in Chapter Three, Figure 17. The exemplary research took place in Chapter Four, case study one, where the evidence of lean principles and visual management technologies integrated in a third party outsourced facilities management services provider, Balfour Beatty Workplace was presented. The research study continues through Chapter Five, a continuation cycle in design science research phase one, exploring the leanness of the main university's estates and property services department transformation programme. Case study two adheres to the same format as case study one, as the main exploratory constructs will be evaluated and compared.

Chapter Five's exploration of the main university's facilities management department establishes correlation of lean principles and visual management technologies integration in comparison to BBW's adaptation. Value based FM services will be considered, as well as, lean principles and concepts such as value stream mapping, continuous improvement cycles, one point of contact and multi-skilled workers. Visual workplace management technologies that will be compared are: visual displays, performance metrics and standards; visual order and visual foundation technologies; and visual controls, visual office, machines and guarantees. Additionally, workplace barriers that are effecting the working environment will be considered.

During DSR phase two a design artefact was developed based on identifying a real life organisational problem. In DSR phase three, the designed artefact is implemented in to the case study and ARA cycles began to take place. Once the artefact is integrated, the outcomes and intervention starts to become more visible and evaluated in DSR phase three. Case study one revealed that lean principles and visual management technologies could be implemented successfully in an outsourced facilities management department. The question in case study two is: Can lean principles and visual management

technologies be integrated in a university estates department with success? And, what lean principles and visual management technologies become integrated, with or without success?

In phase three, the results of the designed artefact in the facilities workplace was explored. The researcher became an employee within the estates department during the planning stage of DSR phase two, and was affected directly by the events that transpired afterwards. The employee's roles and responsibilities added another dimension to the research as they were able to participate more fully in action as an employee, not just as a researcher. Together, the researcher advocated for visual artefacts and co-created artefacts that would add value and efficiency to the university's facilities management functions. DSR phase one: identify problem, forms part of the action research cycle category: observation, illustrated in Figure 23.

Design Science Research: Phase One Identify Problem
Action Research Cycle: Observation

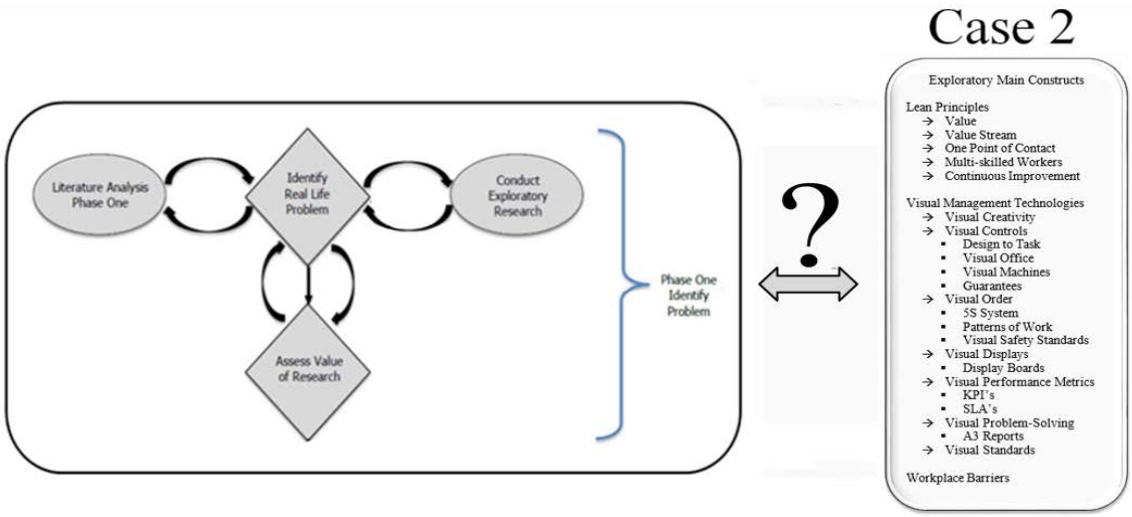


Figure 23: Design Science Research Phase One Identify Problem, Action Research Observation Cycle

5.2 Phase One: Identify the Problem by Conducting Exploratory Research

The starting point of the research exploration was conducting a thorough literature review and performing an exemplary research study prior to this case study. The main university's facilities management department was going through a departmental reorganisation that had lean elements written in their Business Case and Project Initiation Documents. This study will seek to understand if the main university facilities

management department is applying lean principles and visual management technologies to establish a value added facilities management department that is linked to the university's strategic plan.

Key point of contacts were the associate director of operations and facilities; university surveyor; and head of administrative services. Archived documents about past transformation efforts and background information regarding current state of operations was gathered. The researcher worked closely with the head of administrative services. They would provide an array of documents needed, and set up times that the researcher would interview reception/helpdesk support team associates, and shadow a multi-skilled electrician to learn more about the facilities management operations.

In phase one research, there were 15 estate and property services employees involved; employees where observed, conversations and unstructured interviews took place, and field notes written. The following operatives were key in this research phase: reception/helpdesk support team associates; one multi-skilled electrician; head of administrative services; associate director of operations and facilities; university surveyor; and the support team supervisors, plus an array of employees ranging from multi-skilled technicians, to building managers and team leaders.

The case study explores a UK university's estates and property services (E&PS) department that provides support services ensuring that the university's mission, vision and values are being met. At the time of the research study E&PS employed approximately 350 people, 240 were full time employees. Estates and property services provide the following facility management services for the university:

- Campus security services (at the time of this case study) were provided for approximately 69 buildings that covered 70 hectares, or 172 acres.
- Caretaking, cleaning.
- Environmental and energy management.
- Mail services.
- New build and capital planning programs.
- Parking monitoring and transportation services.
- Reactive and planned maintenance (building, engineering and landscaping).

- Refurbishments and minor works.
- Strategic estate planning and space management.

The performance of E&PS influenced the university's sustainability efforts and success by providing quality building maintenance, health and life safety, and landscape services campus wide. E&PS contributed to the university's efforts in developing partnerships with local businesses, city agencies, city councils, regional government agencies and local community. Additionally, they safeguarded sustainable resources and environmental responsiveness.

5.2.1 University Transformation Programme

Economic factors and insufficient resources were fundamental issues hindering higher education organisations in England. As a result, the UK parliament established government reform in 2009 curtailing capital expenditures, restructuring higher education, and instituting value for money programs. Many UK universities who rely heavily upon government funding for student attendance and capital expenditures were significantly affected. Particularly facilities management departments since they manage the campus estate, which accounts for the second highest university expense. The university's vice chancellor stated in an internal communications directive that (Hall, 2013):

> *"We are facing serious financial challenges brought about as a consequence of a number of factors, including a drop in our student numbers and the overall impact of Government policy on our sector…we continually look at our operating cost to identify greater efficiencies and cost savings"* (Hall, 2013).

As a result, the university observed was going through a major transformation programme and directed estates and property services to restructure their organisation and "provide a much greater standardisation and consistency of process" (Benton & Large, 2011, p.4). E&PS was instructed to cut costs, work more efficiently and review all facility management services using '*value for money*' criteria and benchmarking data; such as key performance indicators (KPI's) and service level agreements (SLA's). Table 9, illustrates the designation of hard and soft facilities management services that E&PS provides for the overall university campus.

Table 9: Estates and Property Services Hard and Soft Services Delineated
(Source: Benton & Large, Business Case Document 280911, 2011)

Hard FM Services	Soft FM Services	
Long Term Maintenance	Reception/Help Desk	Pest Control
Building Maintenance	Cleaning Services	Recycling & Waste Removal
Ground Maintenance	Mail Delivery/Sorting	Utilities Management
	Furniture Re-use	Parking Management
	Tenant Services (Technology House & Jack Goldberg Nursery)	Porterage and University Moves Security Services

As a result of the university's new strategic planning initiative, E&PS in autumn of 2009, started to review all facility management services and set up a university wide customer survey team that established internal and external focus groups and quality circles, this had never been done prior. The customer groups would inform direction and advancement for quantifying customer satisfaction. This is linked to lean principle, pull, whereas the customer sets standards and pulls services through the value stream. Though, pull is not one of the lean principles concentrated on during this research effort, this is a good example of lean pull systems in facilities management. The customers partake in setting up facility service standards and influencing how to measure value and services provided.

By the autumn of 2010, all internal divisions except security services had been restructured. The next strategic initiative was developing "Service Level Agreements for hard and soft services" (Benton & Large, 2011, p.4). Three years later, in 2013 when this case study exploration ended, E&PS continued to manage organisational changes. Per the associate director of operations and facilities the new performance services developed were looked upon as 'added value' initiatives. Prior to this effort no known service level agreement or key performance indicators had ever been put in place to measure facility management services. Performance indicators and service level agreements developed were benchmarked against British Services Institute BS EN 15221 services for all hard and soft facility management services.

5.3 Assessing the Leanness of a University Facilities Management Department

During the university wide restructuring efforts, the word ‘transformation’ and ‘lean approach’ was introduced in bulletins, directives and newsletters. Numerous employees immediately thought of layoffs, or in UK employment terms 'redundancies'. A negative sentiment was expressed throughout the workplace that would continue to evolve. There had been a considerable job task and role reallocation resulting in various employees leaving, taking early retirement and severance packages. The largest reallocations of responsibilities were made in combining the helpdesk activities and expanding the role of the handyperson/porterage services. Though, according to the Lean Enterprise Institute (2012) “lean must never be seen as a tool for headcount reduction or mindless cost-cutting. This fundamentally misses the purpose of lean, which is to create value through eliminating waste. As companies improve their processes they should be able to reallocate their productive resources to new value-creating work” (Lean Enterprise Institute, 2012, website).

In starting any lean initiative it’s advisable to assign a point of contact or ‘change agent’ to educate and direct the lean programme activities. This was done by E&PS in 2011, a project board that would be responsible for authorising the Facilities Product Delivery Programme (FPDP) reorganisation initiatives and project scope was appointed. It was discovered while going through E&PS’s transformation documents all new business related initiatives were to be signed off by project board members (Benton & Large, 2011, p.17). Individual names are withheld for privacy, but titles maybe indicated. Regrettably efforts of the entire project board signing off on lean initiatives were not carried forward. When executive leadership and management were asked about this effort, they didn’t seem to recollect any such activity. In respect to individuals interviewed, the majority of the Facilities Product Delivery Programme documents and lean initiatives were developed by the previous director of operations and facilities. They were no longer with the uniersity at the time this research took place. It seemed, as you read through this chapter and analysis that many specific ‘lean initiatives’ stopped when the former director of operations and facilities left the university.

5.3.1 Key Objectives of Business Case and Project Initiation Documents

Business Case and Project Initiation Documents terminology described the restructuring efforts as ‘value added’ initiatives and a more ‘transparent’ working environment (Benton

& Large, 2011). In developing any lean enterprise transparency becomes a major progression as you begin to look at the organisation, its employees, and customers and supply chain as an integrated system. According to Womack and Jones (2003) all of the employees who are part of the whole system, the value stream, need to know every step involved with each system and understand how it all links to the vision and core values of the organisation holistically. This was not the case and turned out to be one of the main problems affecting E&PS.

The reorganisation of the university's estates and property services departments' main emphasis was to support the functions of the university's Strategic Plan, Transformation Programme and Lauwery Report. These highlight the need for more consistent facility management service processes and measuring performance of services rendered (Benton & Large, 2011, p.4). The main objectives of E&PS's Business Case documents as well as Project Initiation Documents (PID) are as follows (Benton & Large, 2011, p.5; Benton & Large, 2011, p.6):

- To enhance the overall campus experience and support improvements to student and staff experience.
- To enhance the environment for staff, students, and visitors.
- To deliver the service catalogue relating to building and grounds, operations & facilities maintenance services in a prompt, reliable and high quality matter.
- To deliver transparent and competitive pricing structure for facilities management services.
- To enable benchmarking for each service provision, ensuring efficient use of resources.
- To provide one point of contact for all facilities management services.
- To adopt a lean approach to delivery of services, identifying and removing waste activities where possible during the process mapping exercise.
- To promote good environmental practise in all aspects of ground maintenance activities (e.g. recycling and onsite composting); engage with university led initiatives aimed at improving the diversity of the estates flora and fauna and to provide a good visual impact in tune with the master plan.

- The security team will be restructured and the role of security contractors will be reviewed, with the aim of providing a customer-focused, cost effective and flexible service across campus.
- E&PS will provide an intranet based furniture re-use and recycling service. This will provide a value for money service which also provides a more ethical way of disposing of furniture (Benton & Large, 2011, p.5; Benton & Large, 2011, p.6).

Adopting a lean approach, identifying and removing wasteful activities, process mapping and transparency are all components of developing a lean enterprise. There is a clear understanding of lean principles at the executive leadership level. Though *the notion of training staff in lean principles and techniques had not been considered*, this developed into the case studies problem statement. E&PS Transformation Programme Project Initiation Document Facilities Product Delivery Programme is illustrated in Table 10, not necessarily executed in order of task sequence. After each project initiation, a six month review was planned for each task. Each time a new document came out explaining what had transpired since last communications, the sequence of numbers would change per initiative. One document would mention '6.1.3 Modify role of the helpdesk staff' one month; and six months later the initiative is renumbered. It was a bit confusing even for a researcher, reading the archived PID Facilities Product Delivery Programme communication documents; there was a lack of consistency in communication of transformation issues.

Table 10: Transformation Project Delivery Programme
(Source: PID Facilities Product Delivery Programme Document Tue 09/01/12, p.1)

Estates and Property Services PID Product Delivery Programme	
6.1.1 Production of monthly Performance Indicators (PI's).	6.1.7 Through multi skilling issue 20% of reactive repairs to handyperson.
6.1.2 Increase use of electronic web based facilities helpdesk.	6.1.8 Produce and implement grounds maintenance programme.
6.1.3 Modify role of the helpdesk staff.	6.1.9 Introduce systems and procedures to ensure E&PS comply with new client funded works policy.
6.1.4 Operation of the helpdesk role 24/7/52.	6.1.10 Implement Security Services restructure.
6.1.5 Reduce Planned Preventive Maintenance (PPM).	6.1.11 Furniture re-use and recycling: Produce an E-brochure for re-use of furniture.
6.1.6 Training in new processes, systems and ways of working.	6.1.12 Benchmarking exercise.

E&PS Transformation Programme Facilities Product Delivery Programme's (FPDP) sequence of events started with planning initiatives and setting objectives. They organized the FPDP in to seven phases of process focused practices. A lean management structure "consists of the discipline, daily practices, and tools needed to establish and maintain a persistent, intensive focus on process. It is the *process focus* that sustains and extends lean implementations" (Mann, 2010, p.7).

The first phase started roughly around March 2010. E&PS reviewed FPDP task 6.1.7 multi-skilling activities by transferring reactive repairs from multi-skilled technicians to building handypersons. In Chapter 4, BBW used lean multi-skilled assignments for handyperson/porterage staff successfully. In this case, one multi-skilled operative was released for a £30,000 annual savings. This did not sit well with employees; they started to link multi-skilled activities to potential layoffs and more individual assignments. Simultaneously, task 6.1.8 a new grounds maintenance programme was produced and implemented. All current grounds and maintenance workflow activities were reviewed.

Phase three started inwards of July 2011, four tasks were identified to start simultaneously; FPDP task 6.1.1 design and development of performance indicators; FPDP task 6.1.3 modifying the role of helpdesk staff; FPDP task 6.1.5 reduction of planned preventive maintenance (PPM); and FPDP task 6.1.8 produce and implement grounds maintenance programme. A critical review of FPDP task 6.1.5 all planned preventive maintenance (PPM) was initiated. E&PS looked at prioritising the PPM schedule, minimize travel time, and remove unnecessary workflow activities. Next the computer aided facility management (CAFM) system database was updated to incorporate the revised PPM schedule. Quality services and monthly audits were formulised in accordance with SLA's. Maintenance schedules and audits started to be measured and integrated in to monthly performance reports.

The fourth set of initiatives started October 2011; FPDP task 6.1.6 training in new processes, systems, and ways of working; FPDP task 6.1.9 new client funded works policy, procedure and systems; and FPDP task 6.1.10 the start of restructuring security services. A draft of FPDP task 6.1.9 new client funded works policy; procedures and systems were issued to the university executive committee and a Capital Investment Group for approval. Monitoring performance against new policies was initiated. School

owned rooms were linked to a new long term maintenance plan. Campus user groups were organised by each building manager and stakeholder engagement was initiated.

Task FDPD 6.1.10 business case for security services restructure was approved and meetings were organized to start shared discussions with staff and the trade union. The campus library became a 24/7 operation, and one of the main buildings on campus that was normally open at night for students and faculty would close early. This resulted in £100,000 annual savings and reduced energy operating cost. E&PS started to review the idea of bringing security access systems, CCTV, and intruder alarm maintenance systems back to in house operations. This could realise an additional cost savings of £40,000 - £70,000 annually.

The fifth phase FDPD task 6.1.2 increase use of electronic web based facilities helpdesk started approximately in November 2012. The initiative was to have students who live in university accommodations input their own work orders and track them through close out. The help desk and student accommodation facilities manager and facility supervisor were overwhelmed with daily calls from students. They set up a working group to identify the benefits and value this would bring both to the students and estates and property services staff. The researcher was responsible for programing the CAFM electronic web based system for integrating approximately 1500 student accommodation units that led to the students' ability to input and track their own work orders. In DSR phase three, AR planned cycle, the researcher designed an instruction sheet artefact that was posted in each student accommodation explaining how to input and track work orders. Phase six started FDPD task 6.1.12 benchmarking exercise. E&PS selected a peer group of FM industry professionals and commercial facilities management companies to partake in a benchmarking activity.

Lastly, phase seven FDPD task 6.1.4 operation of the helpdesk role 24/7/52. E&PS reviewed existing out of hour's systems and procedures, implemented training of staff, then purchased and installed new phone system software. The role of after hour helpdesk operations was assigned to night time security. This insured 24/7/52 operations of the helpdesk role. Not only did security personnel answer the reception/helpdesk telephone after hours; they followed proper procedures for implementing work orders and contacting multi-skilled technicians on emergency duty. Any night time occurrences were

communicated to helpdesk staff the next morning. Any follow-up needed was automatically the responsibility of the reception/helpdesk support team staff.

5.3.2 Assessing the Value toward the End User

A critical starting point for a lean vision is value (Womack & Jones, 2003). E&PS interprets value from several different perspectives. According to executive leadership objectives of the new transformation programme are to track performance indicators; benchmark systems, and review all FM service provisions using value for money criteria (Benton & Large, 2011). This forms part of E&PS's customer service objective. Their FM Services Business Case document 280911 for soft services stated "value may be predicated with confidence of certainty, not affected by external factors" (Benton & Large, 2011, p.13) and "may be predicted on the basis of someone else's experience or based on historic trends" (Benton & Large, 2011, p.14).

According to Alexander (2012, p.156) "value drives" entirety of services that an FM department provides for the reason that "value (is) in the collaboration" between the customer and service provider. In other words value in a service industry such as facilities management should be co-created amongst all stakeholders. It's a collaborative effort between the customer (both internal and external) and FM service provider to establish service expectations. This is exactly what estate and property services ensured was part of their transformation initiative.

Prior to 2009, they had never set in place customer expectation strategies that could facilitate feedback channels for measuring customer satisfaction. At present, a customer satisfaction and perception survey is sent out quarterly to a select number of customers. Additionally, a customer satisfaction survey was implemented during the work order phase. A customer's name and e-mail is entered into the computer aided facility management system during the origination of a work order (WO) ticket. When the WO issue is rectified and closed, a survey is automatically generated and sent directly to the customer. An example taken from the monthly customer satisfaction report is illustrated in Table 11 and graphed out in Figure 24. This forms part of their new monthly measurements report.

Table 11: Customer Survey Response, 1 of 9 Survey Questions

Estates and Property Services offer great value for money		
Answer Options	**Response Percent**	**Response Count**
Strongly Agree	9.2%	17
Agree	26.1%	48
Slightly Agree	26.1%	48
Slightly Disagree	11.4%	21
Disagree	16.3%	30
Strongly Disagree	10.9%	20
	answered question	**184**

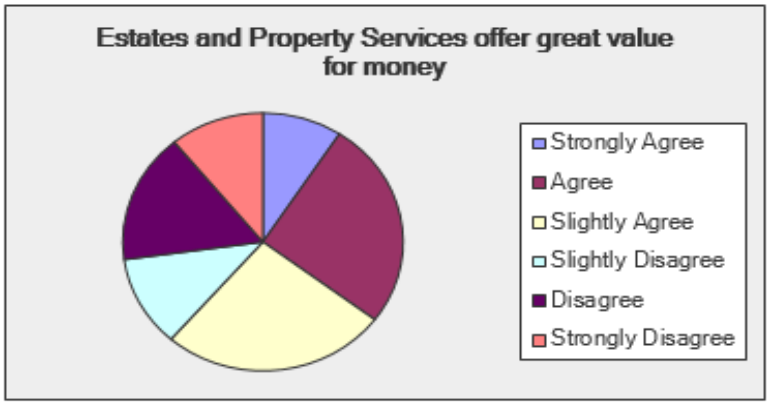


Figure 24: Estates & Property Services Customer Survey Feedback August 2010

The customer survey results are only as good as the information collected. For instance, if the customer's name and e-mail is in the university's database, it is automatically entered into the WO document during the generation of the ticket. When the WO is completed and closed out, a customer survey will be sent automatically. On the other hand should that person be a third party contractor to the university, part time employee, student, or new employee than most likely their e-mail is not in the system. Hence, no e-mail record would be available to generate a customer survey. Therefore, insufficient data exists in the monthly customer survey reports. Unless the reception/helpdesk support team associate asks for the callers e-mail, they comply with the request, and the e-mail is entered in to the system during WO origination.

As mentioned previously the restructuring of E&PS preceded to the development of service level agreements for all facilities management services. Simultaneously, process mapping 'as is' and 'to be' state for all hard and soft services rendered was completed.

Resulting in the benefits and value added initiatives for both hard and soft services illustrated in Table 12 and Table 13.

Table 12: Estates and Property Services Benefits of Value for Soft FM Services (Interpretation from Source: Benton & Large, 2011, p.13-15)

E&PS Soft FM Services	Benefit Type	Nonfinancial/Nonmonetary
Definite	Value is not affected by external factors; it is predicted with confidence of certainty.	The introduction of real time performance indicators, such as Service Level Agreements and performance criteria will be measured.
Intangible	Value is anticipated yet difficult to validate.	Improved customer perception of services and expectations that are provided throughout the university. E&PS staff's knowledge of the lean journey initiatives.
Expected	Value is predicted on the basis of experience or grounded based on historic trends.	Benchmarking services by way of Service Level Agreements (SLA's) and Key Performance Indicators (KPI's) will identify scope for additional savings and business needs.
Logical	Value is anticipated, measured, yet not predicted.	Improved customer service satisfaction at all levels is anticipated.

Table 13: Estates and Property Services Benefits of Value for Hard FM Services (Interpretation from Source: Benton & Large, 2011, p.12-14)

E&PS Hard FM Services	Definition	Financial/Monetary	Nonfinancial/Nonmonetary
Definite	Value is predicted with confidence of certainty, not affected by any external factors.		The facility management team that had prior responsibility for student accommodations was reassigned from student life to E&PS operations and facilities department. Through the introduction of Service Level Agreements' and performance management efforts, actual performance can be measured. Work that is completed in a timely manner as agreed upon in the SLA, results in the schools meeting their business needs. Level of student and staff satisfaction is expected to improve.
Expected	Value is predicted on the basis of experience, and/or grounded based on historic trends.	Transfer work from trade staff to handy person, will result in a 20% savings when trade staff undertakes work that was previously scheduled to private sub-contractors. Trade staff will be freed up to work on backlog of maintenance. And have more time to respond to complete work quickly, with a total savings of approximately £136,000.	Through the introduction of (SLA's) and performance management initiatives, staff productivity is expected to increase which in turn will improve customer service and satisfaction. Key Performance Indicators (KPI's) have been set at 90%.

To narrow down the focus the researcher concentrated efforts on operation services such as the helpdesk role where some of the biggest changes in workflow activities took place. According to Hodges (2004, Module 7, p.4) “the work reception (helpdesk) area are the eyes and ears of the facility department. It is the single point where all, or nearly all, facility services are received, prioritized, tasked, coordinated, and evaluated. This is the department that carriers out the day to day duties, and is the most important managerial function of the Facility Manager’s efforts” (Hodges, 2004, Module 7, p.1). In reviewing the reception/helpdesk support teams workload, E&PS made sure to link all work activities against newly created SLA’s and KPI’s.

5.3.3 Value Stream Mapping Current and Future State

The second step in developing a lean enterprise according to Womack and Jones’s (2003) lean principles is to visually map out all workflow activities and identify where waste in the system exits and can be eliminated. In accordance with Womack and Jones (2003) “the *value stream* is a set of all the specific actions required to bring a specific product or service” (Womack & Jones, 2003, p.19) to fruition. In case study one, BBW had value stream mapped all processes and procedures prior to starting their FM services contract. In case study two the university’s main facilities management department started to map out their value stream two years after the lean transformation programme commenced.

Womack and Jones (2003) refers to the value stream as mapping out all current state activities from start to finish of a product or in this case a service; than eliminate the steps that are wasteful and don’t add value to the workflow. E&PS comprised value stream maps of all operational service provisions using ARIS Platform software. Not being familiar with Womack and Jones lean principles they labelled current state ‘as-is’ and future state ‘to-be’. They split their process mapping efforts in two business case directives, soft FM services and hard FM services. Examples of the helpdesk answering the phone activity ‘as is’ and ‘to be’ value stream are displayed in Figure 25 and Figure 26.

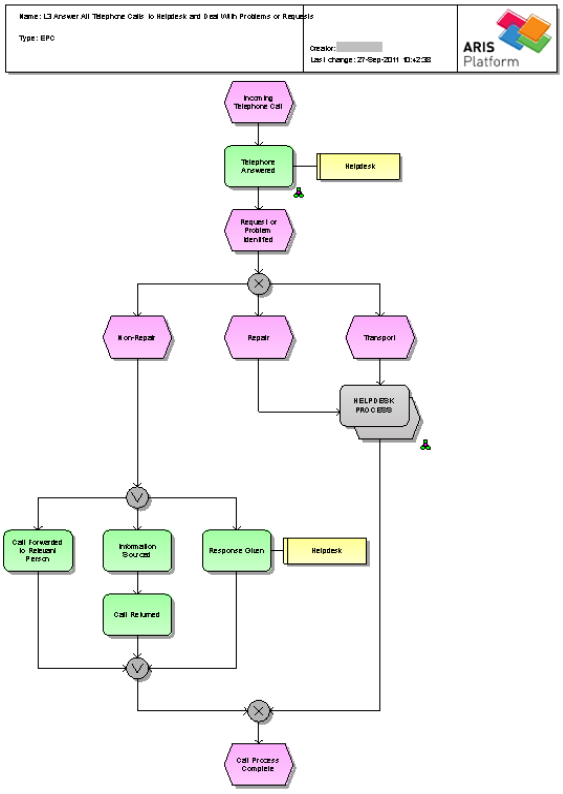


Figure 25: Value Stream Map for Answering Telephone Calls ‘As Is’ State

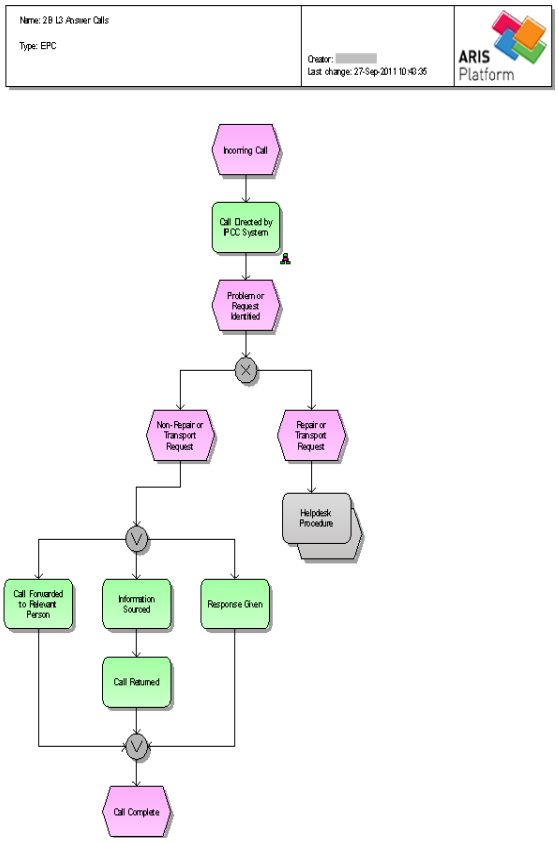


Figure 26: Value Stream Map for Answering Telephones ‘To Be’ State

For FPDP task 6.1.11 furniture re-use and recycling, E&PS consulted with building managers, university colleges, schools, and support services to identify available furniture storage space. Then they mapped out the value stream of procedures for acquisition and disposal of all unwanted furniture. As a result, an intranet furniture catalogue was designed, introduced and launched throughout the university.

After the value stream mapping exercise, it was noted that many soft FM services were not being monitored through the CAFM system, causing insufficient work order statistics. In the 'to be' or future state the reception/helpdesk support team will have a larger role in acting as one point of contact for all customer requests, and assigning work orders to the appropriate multi-skilled tradespersons. They will ensure that the flow of information to and from the customer is acceptable. The reception/helpdesk associate will additionally be responsible for monitoring outstanding work orders and making sure all work is consistent with SLA's and performance indicators. This is in line with FPDP task 6.1.3 modify role of the helpdesk staff.

The value stream maps of E&PS's current state have been in place since fall of 2011, it is time (again) to reassess the 'to be' processes and make necessary adjustments. Process mapping, referred to also as value stream mapping, is not a onetime activity; it needs to be a continuous effort of constant improvements: plan-do-check-act. Making continuous adjustments in workflow processes will bring forth a more efficient facilities management system. In Chapter Four, case study one, BBW was already starting to reassess their value stream six months in to their contract; while E&PS had not reviewed their value stream in almost 5 years, since fall 2011.

Another result of value stream mapping was the lack of consistency in the work order process. Once the WO was generated in the CAFM system, it was not being monitored and closed out in a timely manner. In the new future state, (which started August 2011) the work order created by reception/helpdesk support team staff would be automatically issued to a specific multi-skilled tradesperson directly through e-mail. If the service request is an immediate emergency or an eight-hour urgent required fix, the reception/helpdesk support team associate would call them directly. Simultaneously, the WO would be routed directly to the multi-skilled tradesperson scheduled for emergency

fixes. Whereas in the previous (existing state) process the work order was issued to team leaders who would then issue the work order to a tradesperson.

In the newly created (future state), the reception/helpdesk support team is responsible for monitoring the progress of work orders and following up to make sure that the work is being done with in the specified key performance metrics time frame. An additional value added concept was the use of smart phones. E&PS purchased and distributed cell phones to each multi-skilled tradespersons. Once a work order ticket is issued in the CAFM system and assigned to a particular tradespersons, they receive an e-mail through their smart phone. If the WO is an emergency and needs to be mitigated within 1-8 hours, the helpdesk associate will call the multi-skilled tradespersons on emergency duty directly.

At the time of this case study, multi-skilled tradespersons were only able to view work order tickets on their phones, they could not manipulate the document, it is read only. When this study was being done, it had been twelve months after the ‘to be’ state was established and the CAFM system was being updated to CAFM Explorer 2012. One of the new future initiatives will be a CAFM mobile tool. It is envisioned that the multi-skilled tradespersons will be able to interface directly with the work order tickets and report their progress, as well as close work order tickets, put them on hold or take them off hold, track travel time, activity duration and inscribe comments. Towards the end of this case study five new CAFM licenses were purchased and four building managers and one campus manager were given CAFM access to create, close, assign and manage individual work order tickets. The process and logistics were being worked out. Three years after this study in 2016, the smart phone initiative had started to be implemented, and tablets where purchased for use in the field, as well.

A value stream map was created that identified additional workflow activities that could be assigned to building handypersons. In line with FPDP task 6.1.7 training multi-skilled technicians in new processes, systems, and ways of working; E&PS identified training needs for multi-skilled technicians such as fixed wire electrical testing, changing out light fixtures and suspended ceiling installation. The training was to be rolled out on a priority basis once a suitable training provider was located.

5.3.4 Visual Displays, Performance Metrics and Standards

An industry peer group was developed that helped determine facility operations benchmark parameters; they gathered industry data, reviewed results, making amendments and revisions. The outcomes were evaluated, published and conveyed through an internal communications management strategy document. As a result, monthly key performance indicators of hard and soft FM services are compiled in to a report. Every six months customer feedback reports are assembled. All performance indicators are targeted between 90% and 100%, with the exception of health and safety (Benton & Large 2011). This has been an extremely useful visual management tool for the department to measure their transformation progress and current and future state. It's a great example of how visual performance metrics and standards can be implemented in to a university facilities management department. The department vision behind monthly performance reporting is to be recognized for delivering the best customer service experience and visually communicating performance to all E&PS staff, customers and university leadership. The monthly report tracks all hard and soft FM services including administrative services, and sickness and absenteeism, illustrated in Table 14. The reports introduce new systems and procedures that ensure SLA's are audible in terms of service delivery against new performance metrics.

Table 14: Facility Management Services Tracked on a Monthly Basis

E&PS Monthly FM Services to be Tracked	
Building Maintenance (Excluding Student Accommodation).	Building Maintenance (Student Accommodation).
Cleaning.	Grounds Maintenance.
Energy and Utilities.	Health & Safety.
Furniture Collection and Recycling.	Porterage and University Moves.
Mail Service.	Security Services.
Sickness and Absence.	Reception/Helpdesk Staff.

As a result of FPDP task 6.1.3 role of the helpdesk staff responsibilities were modified to "fulfil a service desk role" (Benton & Large, 2011, p.22). Their new title was categorised as reception/helpdesk support team staff and they became the new point of contact for all customer services. They would manage the flow of information between the customer

and E&PS using the CAFM system web interface. Historically team leaders managed some of this work, resulting in inconsistent performance levels for the department.

Fittingly, reception/helpdesk support team staff began to manage all reactive repairs, and work order tickets based on key performance indicators. Additionally, they became responsible for monitoring amber alert tickets. An amber alert ticket is when a work order has gone beyond its performance indicator dates to be closed out. According to university standard operating procedures, a typical new work order ticket is in the green stage. When it gets close to the performance end date allocated for the specified task it becomes yellow, meaning caution it needs to be completed and closed promptly within a few days. If the work order is not completed and closed out in the CAFM system with in the SLA performance metric timeframe it is red tagged. This means that it is now in the amber alert stage; the ticket is past due and exceeds performance metrics. The WO will then show up on a report that it exceeded the performance metric set forth for that activity. This means it has failed to be mitigated in the time frame allotted. Everyone involved in the process of the red WO is consulted about the issue and looked upon as failing to meet key performance criteria.

The reception/helpdesk support team staff communicates to all involved if any work is delayed due to contractor snags, and parts and equipment issues. This is a good example of multi-skilled training of the reception/helpdesk support team staff in their new role. At the time of this research study, they were all being trained on the updated CAFM system; how to manage the work order lifecycle, and new SLA's for facilities management services and performance metrics. Their job become more operational as they became lead point of contacts for all work reception management responsibilities.

5.3.5 Visual Order, Establish a Visual Foundation

Visual order was not actually something that has been thought about in the new transformation programme. Setting up a 5S System to organise and declutter hadn't been initiated throughout the university. Walking around the university and observing certain areas such as storage closets, janitorial closets, under stair cases, open floor areas near back elevators, loading docks and reception areas; there were many locations that could use a good sort, shine, set in order, standardise and sustaining effort.

In the university executive office building reception area the researcher came across a closet full of items from broken glass containers (some still had liquid in them), cleaning supplies, furniture, and signs and buckets. It was in total disarray. In the same building, the researcher was told that during their shift they can hang their coat in the janitor's closet. When the janitors' closet door was opened they cast their eyes upon chemicals and cleaning supplies in the mop sink, dirty brooms and mops, and a mop bucket full of some sort of grey cloudy water. There was a dirty stench in the closet. The researcher was not about to hang their coat or anything else in that closet, and it was stuffed to the gills. Several loading dock areas had broken chairs and furniture, unorderly boxes and equipment.

Furthermore, when the researcher had time in between reception/helpdesk duties, they cleaned out cabinets and drawers at all five reception desk areas. Documents from as far back as 2007 were found along with old documents, papers, folders, binders, AV equipment and unorganised office supplies. At the reception area in the university executive building, there was even a broken letter opener that all reception/helpdesk support team staff used daily to open the mail. All it took was an e-mail and telephone call from the researcher to their supervisor and within a few days they received a clean, unbroken letter opener. *There didn't seem to be a sense of employee ownership and pride in ones work ethic*. The majority of reception/helpdesk support team staff and cleaners are part time employees. It seemed to make a difference in how the reception and storage areas were organised, set up and sustained.

In the facilities management supply stores, there were indications of patterns of work through labelling containers of different size bolts and screws. Some shelving storage units had labels on them too. On the other hand, work uniforms for the multi-skilled workers were located in 4 separate areas around the stores and light bulbs seemed to be randomly placed. The delivery and pickup entrance area had piles of boxes, material, equipment and items that didn't even belong in the stores. *Visual controls, establishing a visual foundation, safety solutions, 5S systems and patterns of work are definitely an area that could be looked upon for further development within the university facilities management department.*

5.3.6 Visual Controls, Visual Office, Machines & Guarantees

As a result of the transformation efforts, E&PS was responsible for five reception areas located in five separate buildings, throughout the university campuses, in which to provide reception and helpdesk activities. This would improve customer services immensely. Based on FPDP task 6.1.4 operations and helpdesk role 24/7/52 initiative, a Cisco telephone communications system was integrated at all five helpdesk reception locations and main security office. This allowed all telephones to be networked and all incoming calls answered at any one of the five reception locations. Cisco refers to this new process as 'intelligent call routing' (Cisco, 2012), where calls are routed between reception areas based on availability. If an associate is on the telephone when an incoming call comes in, the call will automatically be routed to the next available telephone. This has significantly reduced customer waiting and helpdesk response times (Benton & Large, 2011, p.22).

Prior to the additional reception areas and new phone system, staff assigned to reception desks did not log work orders, assign and close them out, had no access to CAFM systems and no communications with multi-skilled technicians. If there were reactive repair issues they too would call the helpdesk. Now all five reception desk locations are part of the reception/helpdesk support team. They not only do reception type duties, they are part of the facilities management team and provide full work reception/helpdesk communications. Furthermore, outside of core university business hour's telephone calls are routed through to the security officer on duty (Benton & Large, 2011, p.10).

This coincides with FPDP task 6.1.10, the restructuring of security services initiatives. Ensuring that customer calls are always answered and taken care of even after core business hours, 7 days a week, 24 hours a day, 52 weeks a year; combined with FPDP 6.1.4 operations and helpdesk role 24/7/52. An additional Cisco telephone communications system was installed in the main security office. Calls that come through the reception/helpdesk phone system after university standard business hours are routed to the security office. Security officer on duty that night is responsible for answering the calls, documenting issues and contacting multi-skilled emergency technicians on duty if necessary. There is always a multi-skilled technician on call to take care of customers, building and campus wide emergencies 24/7. The security officer on the night shift must notify the morning reception/helpdesk support staff of any incoming calls and issues

mitigated the night before. This forms part of a lean transparent working environment and sharing of information between staff.

As a result of installing the Cisco telephone system, since November 2011 the percentage of phone calls answered in 15 seconds was up from 88.9% to 93.3%. Furthermore, the number of calls answered at the time of this case study was at 97%, well above the 90% target performance indicator compliance goal set forth in the new SLA. This information has become part of the monthly performance reports distributed to all E&PS staff, customers and university leadership.

5.4 Phase One: Identify Real Life Problems

In phase one the case objective was to assess the leanness of a UK university's estates and property services department's transformation using the main exploratory constructs from case study one as a standard. Research efforts concentrated on the same lean principles and visual management technologies that Balfour Beatty Workplace had implemented in their facilities operation. Estates and property services restructuring program was aimed at establishing a lean approach and identifying waste in workflow activities through value stream mapping. Overall department objectives introduced a more transparent workplace, elimination of waste, increased efficiencies, and a commitment and approval for business change. Although, lean is mentioned in Transformation Programme documents, the *one problem that stood out most was the fact that most employees did not know what lean meant, even management and executive leadership*. *The word lean was not verbalised* and *the notion of training staff in lean principles and techniques had not been considered*, this forms the main problem statement for case study two.

Visual management concepts put in place at the time of this research exploration were mostly operational, and fit in to visual management technology category: visual displays, performance metrics and standard work. Visual technologies integrated without an understanding of visual management were process mapping, key performance indicators, monthly performance reporting, and service level agreements. E&PS co-created customer surveys and performance metrics that are included in monthly reports, along with benchmarking, which stress the importance of value toward the end user. Prior to the transformation programme, process mapping, performance indicators, service level

agreements and monthly performance reports did not exist. There is limited evidence of visual controls such as the 5S systems, which is highly visible in case study one. There are work areas around main campus that are far from being sorted, shined, set in order, standardised and sustained.

On the other hand, there are illustrations of continued efforts of a lean transformation business case. The fact that E&PS restructured their department, was process focused, value stream mapped all hard and soft FM services, developed service level agreements, and key performance indicators is an accomplishment with in itself. The new Cisco phone integration and continued development of CAFM Explorer system have resulted in a better performing, more transparent organised reception/helpdesk function that uses a lean multi-skilled workforce and one point of contact.

By transferring 20% more responsibility from multi-skilled trade staff to handypersons has resulted in a savings of £136,000. E&PS was contemplating releasing one more tradesperson which would save an additional £30,000. The shift in job responsibility has given more scheduled time for preventive maintenance and work backlog to the trade staff. On the other hand, this was a tremendous change for the handypersons staff. There is reference of handypersons and multi-skilled tradespersons undergoing cross training. Handypersons are now expected to be painters, electricians and porters; this has been detrimental to employee performance and time allotted for new tasks sometimes take longer. It was observed on occasion that a multi-skilled technician had to be called in to finish the job that was assigned to handypersons. Furthermore, certain building managers supported the handypersons not taking on additional workload as planned and ended up calling the helpdesk to have the tasks reassigned. This was the opposite of the new transformation strategy.

This is an example of what would transpire: A work order ticket would be assigned to a handypersons, the handypersons or their building manager would call the helpdesk stating that it was not their job, or they could not fix it, instructing the reception/helpdesk support team to reassign the work order ticket to a multi-skilled tradespersons. This continued back and forth between the handypersons, building managers, multi-skilled tradespersons and reception/helpdesk support team staff, continuously.

One can argue that certainly by adding 20% more responsibility to the building handypersons and cutting one multi-skilled technician is a value for money savings of £166,000. Which is 17% (16.6%) toward the £1 million that E&PS was directed to reduce from their operating expenditures. Nevertheless, is it really adding value to the end user and better yet the internal customer when there is constant bickering going on between staff and managers? When reactive repairs are taking longer to fix because they are assigned to a handypersons who lacks the skill and devotion necessary to fix the repair, the WO has to be reassigned anyway. There is an unwillingness to change and accept new responsibilities and work standards, not only from the handypersons, but the building manager who supports their behaviour. This situation has contributed to animosity between facilities management staff at many different levels. At the time of this case study initiative FDPD 6.1.7 multi-skilling issue of reactive repairs to handypersons, is not actually adding value, it is a major workplace constraint that hasn't been fully acknowledged.

The commitment of time was another unproductive aspect of the lean restructuring case that occurred. With all new processes, procedures and standards, more use of CAFM systems, new Cisco communications system and reporting procedures, *training and development of current and new staff was gradual*. According to the associate director of operations and facilities, in the "*length of time it takes to implement change, and wait for improvements, (it is easy) to lose momentum*". It is the researchers' observation that *more effort on training and developing staff across departments is advised*, this forms part of the problem statement.

Although, the university's transformation programme coincided with the reorganisation of facilities management services, many limitations arose. One limitation that affected the reception/helpdesk support team is the fact that E&PS can only hire part-time temporary staff to fulfil this role. As soon as reception/helpdesk support team staff is trained and up to par, they end up leaving finding more permanent work. Then the training starts all over again. This is an area that requires improvement, especially with such a critical role in operations and performance of facilities services.

A board of change agents was created to assist in the communications of new organisational initiatives; board efforts were not consistent and sustained. As a result of

developing monthly performance indicators and service level agreements, an organisation becomes more transparent as they track operations on a monthly basis seeking where efforts of improvement are needed. In the areas of performance metrics and process and procedures, continuous improvement was being done. Then again, when it came to value stream mapping for each FM service provided, they value stream mapped each service once (4 ½ years ago) and never looked back. This is an area that can be greatly improved upon. Table 15 is a summary of lean terminology and lean concepts that E&PS put into practice that formed part of their transformation documents. This aligns with a formal lean visual management transformation programme.

Table 15: Estates and Property Servicers Lean Visual Management Practice Concepts

Lean Terminology in Transformation Documents	
Added Value	Process Mapping
Continuous Improvement	Transparency
Efficiency	Waste
Lean Concepts and Visual Management Technologies Implemented or Not	
Continuous Improvement Plan → Lacked a consistent continuous improvement plan. → What was already put in place would continue to be "as is".	Monthly Performance Indicators, KPI's and Service Level Agreements (Standards). Multi skilled workers, handyperson/porters and reception/helpdesk support team. → Successful for reception/helpdesk support team. → Not successful for handyperson/porters.
Lean Leaders and One Point of Contact → Original transformation documents assigned a lean board. → Did not continue and current management and executive leadership seem not to remember this had happened, nor have they instituted it. → One Point of Contact for all work orders, customer issues, reactive repairs, by reception/helpdesk support team.	Process Mapping/Value Stream Mapping → Did activity once, never continued to improve upon original value stream, for 4 ½ years +. New Process and Procedures → Continued improving services based on the Transformation Project Initiation Document (PID) Facilities Product Delivery Programme (FPDP).

Phase one study contends that the university's estates and property services department is in the middle of a lean transformation programme; adding value to employees, internal and external customers, and to university students, and staff. They are a long way from being a total lean enterprise. Lean approach objectives have been established and review of workflow activities to identify areas of improvement had been sorted. Further emphasis on lean principles and concepts, visual management technologies, training and educating staff, and developing a continuous improvement plan and learning environment will be key to E&PS's perpetual success.

5.4.1 Exploratory Case Study Problem Statement

It was surmised that E&PS is in the early stages of a strategic lean transformation effort. Business case documents express transparency and a lean approach that is value added. The problem statement is: *Estate and property services department have not properly trained employees in lean principles and visual management technologies that are warranted in order for E&PS to sustain their lean transformation efforts.* What they do know are the terms: transparency, value for money, value added and added value.

This precedes to the next part of the problem that *training and development of current and new staff has been gradual*. As mentioned previously, training and developing staff across departments is highly recommended. The next phase of research is to design an artefact that could solve the research statement problem. The researchers' goal was to introduce a clearer understanding of value added and lean transformation concepts to university facilities management department. As a result of the problem statement, it was suggested that E&PS management staff read the following book by Liker, J.K. (2004). *The Toyota Way*. New York: The McGraw-Hill Companies. This book describes everything you need to know about the Toyota Production System and development of a lean enterprise, though this is not enough to develop further lean knowledge, it's just a starting point. The next section expands on the research and presents Phase Two Design Solution, Design Artefact, illustrated in Figure 27.

Design Science Research: Phase Two Design Solution
Action Research Cycle: Planned

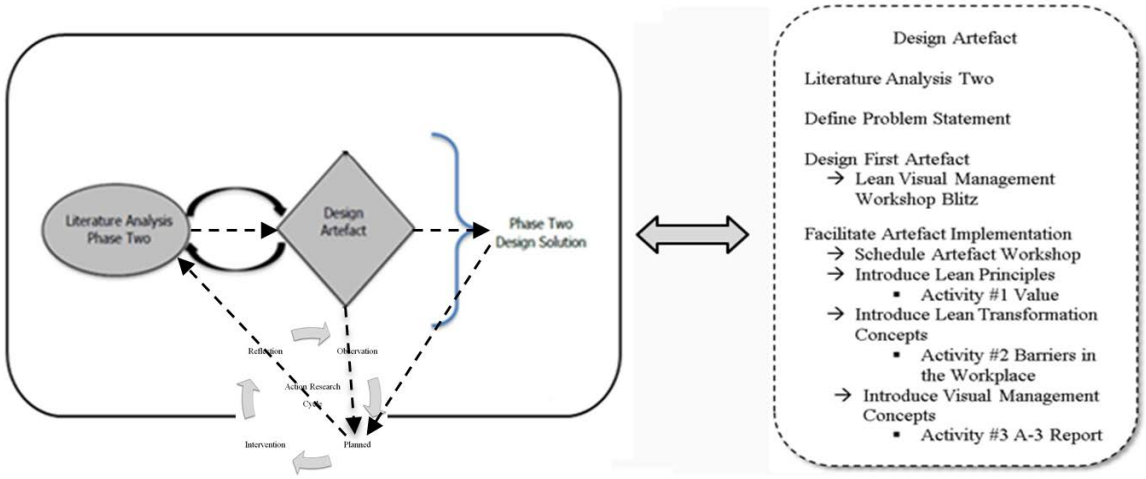


Figure 27: Phase Two Design Solution Action Research Planned Cycle

5.5 Phase Two Design Solution: Affirming the Real Life Problem Statement

The evidence revealed in phase one, identify the problem for case study one exploration that a real life organisational problem existed within the university estates and property services department. The university was in the middle of a major transformation program and directed estates and property services to reduce their operating budget by £1 million pounds. In order to abide by university policies E&PS entered in to their own restructuring program. When planning their transformation strategies, the previous director had a vision of developing a lean approach and value for money facilities management operations. Though current employees lacked knowledge of what lean principles, concepts and visual management technologies were.

The action research planned cycle starts the analysis of the problem statement and initiates the researcher to design a solution to potentially fix the problem. The researcher recommends some type of improvement artefact based on the research findings in phase one. At this point the theory development is predominantly in the design of the artefact, not necessarily how the artefact is created. The more important aspect is what will the designed artefact become and how will the artefact be used to solve the real life organisational problem.

Literature indicates that companies establish lean training sessions in the form of a workshop or kaizen blitz. A kaizen blitz or workshop can take many hours, sometimes an entire week to teach lean concepts. They are time consuming and take the employees away from daily work activities longer than management would like. This could be the solution for an untrained staff. Not an entire week of change, perhaps a one day event that would bring all levels of the facilities management department together for improvement training.

The first designed artefact would be a lean transformation visual management workshop blitz. At the core of lean transformation efforts are lean management systems that will be introduced during the workshop blitz. The lean transformation visual management workshop blitz artefact will not only introduce lean principles and transformation concepts; it will concentrate on the core of a lean enterprise and introduce visual management technologies, the 5S system, and the philosophy of creating a lean visual workplace management system. A lean visual workplace management system is

knowledge based, emphasises transparency, productive and sustainable work habits. Where employees take pride and ownership in their job activities and workplace, sharing information and teaching others across the board.

In exemplary case study one, Balfour Beatty Workplace, benefited from visual creativity and visual management techniques. The literature concedes that visual management technologies set the foundation for a visual workplace environment where information needed to do assigned tasks presents itself through visual devices. A visual workplace creates an unspoken language, a vocabulary of visuality that eliminates barriers and envelops sustainable improvement initiatives forming visual order and the foundation of a lean enterprise (Galsworth, 2005). The aim and objectives of the designed lean transformation visual management workshop blitz artefact is to:

- Introduce lean principles, lean transformation concepts and visual management technologies to estates and property services facilities management staff.
- Explore how estates and property services staff perceive added value in the workplace.
- Identify the barriers in the workplace that interfere with creating added value services to the end user.

The workshop designed consists of visual power point presentations, learning activities, group discussions and corresponding material to hand out for future knowledge development. In Appendix B there is a copy of the artefact agenda. The actual layers of the process of designing the workshop artefact, in the form of a check list of actions that highlights the creation of the designed artefact workshop blitz can be viewed in Appendix C. Workshop attendees consisted of sixteen facility management professionals; fourteen were from main university estates and property services department; one facility manager was located at the newly constructed off site facility; and the third party outsourced facility manager from Balfour Beatty Workplace. The workshop attendees consisted of: multi-skilled tradespersons, building managers, facility managers, administrative supervisors, campus managers, campus quantity surveyor and associate director of operations and facilities. The event took place in a high tech conference room on the main university campus. It was a one day, seven hour scheduled event.

The workshop blitz artefact was divided in to five layered actions; presented in Appendix C. After the workshop the case research continued to measure E&PS's lean transformation journey through the next DSR/AR phase three evaluate the research exploration in action. Phase three research considered the following questions:

1) Do employees have a better understanding of lean transformation principles?
2) Has any additional lean principles been introduced in to the facilities management workplace since the workshop blitz?
3) What visual management technologies have been adopted, created and integrated in to the workplace?
4) How successful was lean visual management integration in facilities management systems after the workshop blitz?

The lean visual management workshop documents can be can be found in the Appendixes: workshop blitz agenda in Appendix B, group activities in Appendix D, presentations in Appendix E, and a sample of handouts in Appendix F.

5.5.1 Designed Lean Visual Management Workshop Blitz Artefact

After welcoming attendees, formal introductions, and reviewing the agenda, first question asked was: what expectations does everyone have for the workshop? Facilities management employees came with an "*open mind*" and wanted to "*improve how they work, perform, and manage FM system*." The majority of attendees had never heard of the term lean prior to the workshop invitation. It was there "*first interaction with lean*." Listed below are a few remarks:

My expectations today are to be
"*introduced to lean and how to incorporate it to improve.*"

To learn "*how we deliver our systems and how lean will help us.*"

"We have done a lot of performance indicators, how can we apply what we have done?"

The workshop was organised with an active learning environment philosophy. Attendees would participate in discussions, writing exercises, problem solving assignments and

group activities that enabled them to analyse, evaluate and better absorb workshop content. After each lecture an interactive action took place that focused on the topic that was presented. After each activity, there were discussions to reinforce learning and understanding. The lean visual management workshop blitz was designed to stimulate knowledge and reinforce content. Figure 28 illustrates the design science phase of inquiry and the action research cycle of intervention that forms part of this segment of the study.

Design Science Research: Phase Three Evaluate
Action Research Cycle: Intervention

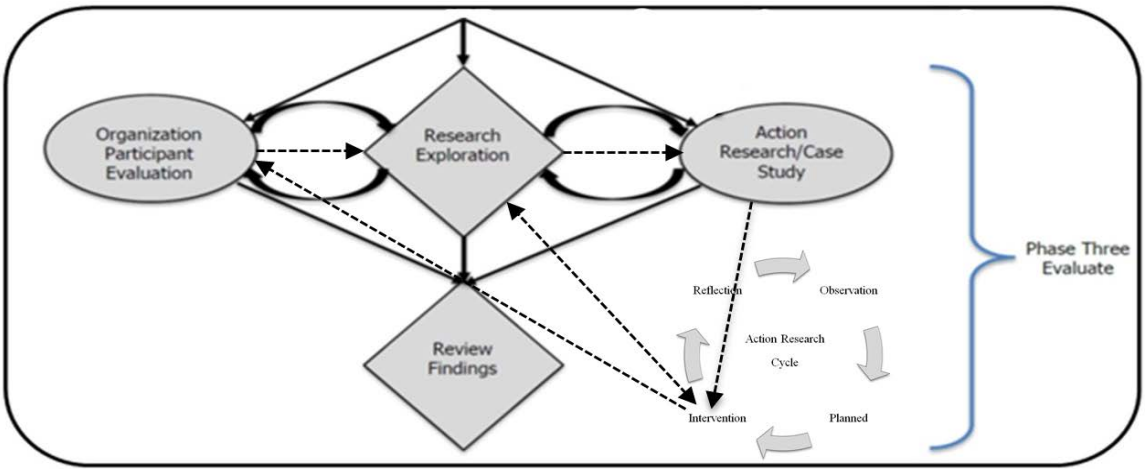


Figure 28: Phase Three Evaluation Action Research Intervention Cycle

5.6 Research Exploration Implementing the Designed Artefact in Action

The first presentation would advocate lean transformation strategies. In view of the fact that the university is going through a major strategic transformation programme and E&PS is in the middle of their own transformation initiative. Employees were not educated in lean principles, concepts and lean terminology. The designed power point visual presentation artefact introduced these lean principles and lean transformation concepts from an organisational viewpoint. All workshop designed power point presentation artefacts can be viewed in Appendix E.

The first presentation began. Imagine the researcher standing in front of the room presenting lean transformation concepts to E&PS operatives; almost every slide has the word ‘transformation’ written across the title. As explained previously, E&PS and the university were going through a transformation programme; this is what occurred and was reflected upon by the researcher.

Action Research Reflection: ARR #1

While introducing the first designed power point visual presentation artefact; E&PS staff started to shout out loud, "*we don't like the word transformation*" and "*we don't use the word transformation*." Even though the word *transformation* is plastered all over their department Project Instruction Documents, furthermore the document starts with two words, *Transformation Programme*. The fact remains that the university has labelled their restructuring efforts as *The University Transformation Programme*. The research validated that E&PS staff did not view the word '*transformation*' in a positive manner.

Prior to this event the researcher had not been aware of the negative connotation of the word *transformation*. This was perplexing given the amount of time spent observing, interviewing, casually talking with E&PS staff, and reading university and department documents. The designed power point visual presentation artefact was labelled, *Lean Transformation, How do we get started*.

The reflection questions developed into the following:

→Why does E&PS not like the word *transformation*?
→Why did E&PS not mention this fact sooner?
→Could it be a lack of trust?
→Could it be they didn't want to share the information because they felt it wasn't necessary?
→Why did I need to know they didn't like the word *transformation*?

It seemed logical to create a visual presentation to introduce lean transformation concepts given the fact that the university as a whole, and E&PS are in the middle of a major restructuring programme. Nothing in the research to date correlated with not using the word *transformation*. At this point there wasn't anything that could be done, except to acknowledge their wishes, continue the workshop and presentations. Not speaking the word *transformation* again throughout the rest of the workshop blitz, and beyond.

*Note taken, no more use of the word *transformation* shall be used in conversation or written documentation during research with E&PS staff.

Action Research Learning: ARL #1

What did I learn from ARR #1?

The word *transformation* meant change. Estate and property service employees related *transformation* with something they were all uncomfortable with. “Behaviour is a function of how people react to their environment. Put another way, to change behaviour you have to change the environment” (Foretel Limited, 2008, p.19). According to Vicher (2012, p. 128) “employees are likely to express resistance to that which is new and unknown.” Vicher’s (2012) research developed stages of workplace change. The following bulleted points are taken from Vicher (2012, p.128) with the researchers own reflection.

→Fear of loss:

Researchers’ reflection: There were some employees that were made redundant and others left their jobs on their own. This made current employees fear a sense of loss of a peer and perhaps loss of their own job. Since the workplace processes, procedures and standard work were changing, employees felt a fear of the unknown. The workplace was not familiar anymore. And there was fear that they could potentially lose their job too.

→Mistrust of supervisor:

Researchers’ reflection: A recent situation occurred in the mail room, while undergoing the case research exploration. A conversation took place between the researcher and a lower level operative in the mail room after the operative insisted that they were not going to help the researcher with the case study because, “*I don’t trust management*.” The researcher wasn’t part of the management team. They did work with the university facilities management department as a reception/helpdesk support team associate. Apparently, they were seen as a potential threat in the eyes of the operative, who didn’t trust the researcher, because they didn’t trust management.

→Identify a champion:

Researchers’ reflection: Original transformation documents identified a lean board of associates that would be key in E&PS’s lean *transformation*

programme, though it was not sustained. Perhaps a 'change champion' or more than one, change champions are needed to continue the momentum. They will become change role models and lead the facilities management department to great success in developing value based FM services through lean principles and visual management technology integration.

→Too much change going on:

Researchers' reflection: Many E&PS employees were very set in their ways, too much change was taking place and it made them feel very uncomfortable. One particular multi-skilled joiner would always tell the researcher, "you're not going to change anything", and "they're not going change". They definitely knew something that the researcher was not privy to, and most likely, they were not going to change either.

→Engage employees in the process:

Researchers' reflection: The lean visual management workshop blitz artefact is one example of engaging a group of employees in the process of change. This started the development of a second designed research artefact that established a process for employees to become more engaged in the new workplace. The researcher also noted that if E&PS had a change agent, or a lean champion, it would be their responsibility to establish an open dialogue with employees, creating transparency, improving communications, and engaging employees in the lean journey.

→Manage any cost involved: Not Applicable.

→Learning new processes

Researchers' reflection: The lean visual management workshop blitz artefact is one example of employees learning new processes. The handouts would introduce additional information that employees can use for future change. Continued efforts are needed for E&PS executive leadership and management to educate and communicate change, restructuring efforts and lean principles and visual management technologies to employees.

(Bulleted topics taken from Vicher, 2012, p.128)

The presentation continued and there were a few more power points on subjects such as introducing value, waste, and value stream mapping in real estate and facilities management. A third presentation presented visual management technologies. The first learning activity to be assigned was an A3 visual management problem solving exercise. All workshop activities can be viewed in Appendix D.

5.6.1 Activity #1: Visual Analysis, Creating an A3 Report

One of the workshop objectives was to introduce visual management technologies in the facilities management workplace. What better way to introduce visual management then to have the workshop attendees participate in an actual visual management problem solving activity in an open and creative learning environment. The design behind the A3 visual management exercise was to help employees recognise problems and analyse and improve business operations through visuality and identification.

The attendees were divided into teams of four. Subsequently the BBW facility manager and one of E&PS's facility manager working offsite at the new university facility had a specific issue in mind that they wanted to mitigate and split up in to their own team of two. This resulted in five teams, in lieu of the planned four. An A3 report was to be created along with a short presentation for discussion. Each team was to come up with a typical problem statement for facilities operations or one would be selected for them. Supplies necessary to create a problem solving A3 document were provided to all teams; A3 instruction guide, coloured markers, pens and A3 sheets of paper, which are typically 11 x 17 in U.S. measurements. The first 15-20 minutes were set aside for discussion of the problem statement, the background and current state. Then the teams had two hours to complete the visual A3 exercise, working through lunch.

This was the first time that E&PS staff was placed in teams to do any type of visual exercise, let alone participate in a group workshop environment. Observing every level of staff working together collaboratively to mitigate a workplace issue was extraordinary to watch. The teams came up with five problem statements:

1) Issues with jobs on hold.
2) On hold (work order) tickets.
3) Optimizing space for non-academic events.

4) Estates and property services value for money.
5) Customer engagement.

At first the attendees were a bit apprehensive having never done a visual exercise before. They didn't quite know what to do and how to get started. Let alone working in teams with co-workers of various employment levels. For example, one group had a multi-skilled electrician, stores manager and associate director of operations and facilities. Another team had a multi-skilled carpenter, building manager and campus manager. Once everyone started discussing the issues and putting thoughts down on paper, the ideas started to flow and collaboration started to take place. During the activity, the researcher went from team to team reinforcing the objectives, answering questions, and making sure teams had everything they needed to create their A3 visual reports. Here are some comments from the discussion that took place after the activity was completed:

"The A3 exercise was thought provoking, it gave me the opportunity to link the presentation to our workplace and what actions I will take forward."

"The A3 planning provided a new way of thinking."

"The (A3) breakout session went really well and is something that I hope we use internally in the future."

After lunch the teams presented and discussed their A3 reports. Following the activity the researcher collected all of the A3 reports. A pile of A3 reports are illustrated in Figure 29. The researcher, a professor, and international Ph.D. scholar examined the five A3 reports and selected the best report that visually displayed a clear understanding of a problem and how to mitigate it. The winning A3 Report is shown below in Figure 30.

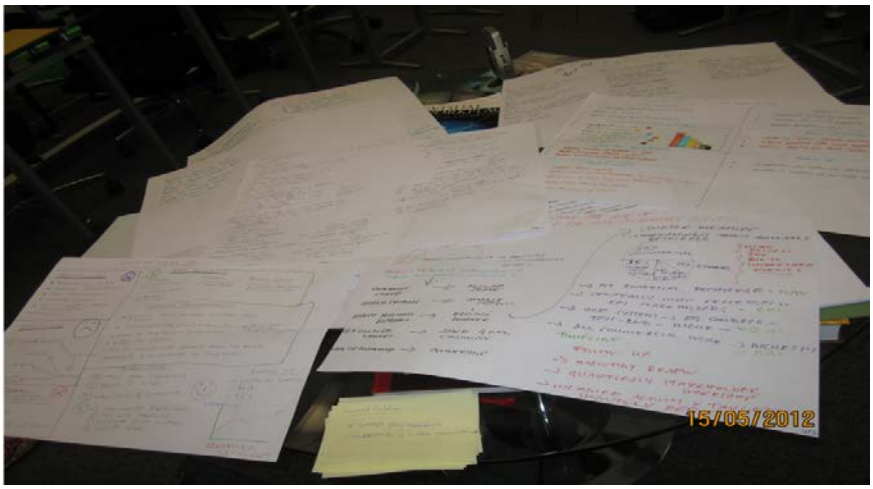


Figure 29: Activity #1: A3 Visual Reports

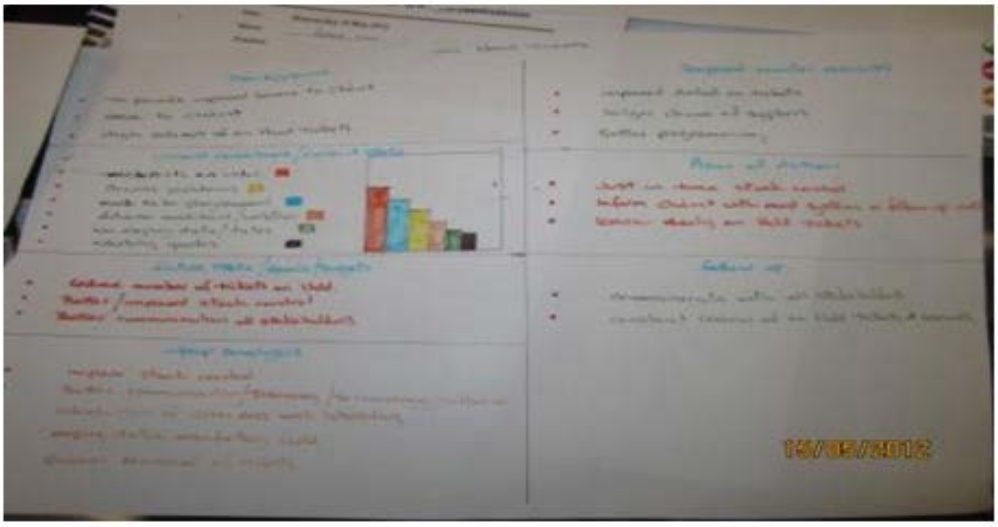


Figure 30: Activity #1: Visual Analysis, Creating an A3 Report Winner on Hold Tickets

Producing an A3 report for workplace issues provided an innovative way for employees to engage in creative thinking. Thought provoking discussions about the barriers that FM service providers face day in and day out were brought to the forefront. The introduction of visual management technologies provided key resources for weighing barriers in the workplace and seeking resolution. The A3 report is part of visual management technology category: visual displays, performance metrics and standards. It represents a visual problem solving tool that can “minimize or eliminate the condition” (Galsworth, 2005, p.146), or problem.

5.6.2 Activity #2: Added "Value" to the End User/Customer

The second activity was presented to start the discussion about everyone's perception of value toward the customer. The purpose of this activity forms the basis of Womack and Jones lean principles of adding value to the end user. By interpreting the topics that were discussed in the workshop it is envisioned that each attendee will develop their own theory of 'adding value' to the end user. The exercise intended for all associates to be in line with what value means as an estates and property services facilities management employee. There were two parts to the activity. In the first part of the exercise, the group defined their three customers/end users which were:

1) Students, 2) Staff, 3) General Public/Community.

Three sticky post-it notes where handed out to each individual and they were asked to write down what value means to them in regards to the three end users defined. The post-it notes where then placed on three separate easel boards under the appropriate customer heading, this can be viewed in Figure 31. A fifteen-minute discussion took place about perceived value towards the different end users.

Figure 31: Activity Two: Determine Value for the End Users

The post it notes were collected and evaluated after the work shop. Table 16 represents a summary of the post-it note activity and how the workshop attendees perceived value per customer.

Table 16: Perceived Value to End User Activity Summation

Staff	Students	General Public/ Community
Provide a safe working environment.	Improve working environment.	Increase financial in put in to the community.
Good communications throughout the task.	To be able to study in a quiet, safe environment with access to affordable, quality teaching.	More local projects at MediaCityUK, general public engagement.
Personal touch, keep facilities well maintained.	Value for money and well maintained facilities.	Provide jobs/potential employer for local community.
They are important and they make a difference.	Going above and beyond expectations.	Well maintained facilities.
Remove the internal red-tape, multiple systems, convolute way of day to day workload.	To feel listened to and valued.	Safe and welcoming environment.
Going above and beyond expectations.	Personal touch.	Better communications about university plans.
Health and wellbeing, social and support networks.	Provide a seamless service.	Being treated equally.

The second part of the activity was a hand out that provided instructions explaining the purpose and approach to the activity and asked the attendees to answer the following questions:

- First Question: Who is your customer?
- Second Question: In your opinion, how do you perceive 'Added Value' from your customers' point of view?
- Third Question: In your opinion, how do you perceive 'Added Value' as an internal customer (an employee) of the organisation?

The hand outs were collected and summarised. As mentioned prior the customers were defined as students, staff, community and public. It was unanimous that value was perceived as providing quality work, in a safe, efficient and cost effective manner along with good communications. A multi-skilled tradespersons added this very relevant answer for the third question: In your opinion, how do you perceive 'Added Value' as an internal customer (an employee) of the organisation?

"To leave the job (site) as you found it regarding cleanliness. To be kept up to speed of the job, i.e. if material needs to be ordered, just kept in the loop. To be spoken too in polite and friendly manner."

One of the team leaders added:

"As an employee 'customer service' is a top priority, good communications and a helpful and 'can do' attitude is essential. With also providing a safe environment in which staff, students and the public can feel relaxed and happy."

To sum up activity two the associate director of operations and facilities clearly stated:

"I believe that the customers' point of view will vary from customer to customer dependent on their view of 'value added'. However typical examples could be:"

- *Work carried out to a high Service.*
- *Listen to the needs.*
- *Continuous improvement.*
- *Quick response (time).*
- *Engagement.*

"As well as employers engagement with staff, good communications and the opportunity for internal learning and social activities."

5.6.3 Activity #3: What are the Workplace Barriers and How to mitigate them?

The purpose of the third activity was to understand the barriers that prevent E&PS staff from performing their work functions. Employees know best how their position should operate. Lean and visual management integration generates knowledge that can empower employees to design and create their own visual workplace. The attendees were asked to answer the following questions:

1) In your opinion, what are the barriers that prevent you from doing your job to the fullest and adding value to your customer(s)?
2) How can we mitigate the barriers? What is the answer?

What surfaced during the activity was the daunting issue of temporary support team staff. These are part time staff hired to perform the reception/helpdesk support team function. In relations to the university's own *transformation* programme the position can only be filled with temporary part time staff employees. The director of administrative services wrote:

> *"Too many temporary staff in the support team. Expectations of the support team/ helpdesk are increasing, but with 'transient staff'. It is very hard to start adding value when you continually have to bring in and train new team members. This frustrates permanent team members, as it puts extra pressure on them."*

Besides the temporary staff issues the other main barriers E&PS are confronted with is the need for improved communications between internal staff. There are further barriers pertaining to operation and maintenance manuals, parts required to fix building issues, not having the ownership of keys to get access into buildings, and lack of equipment, materials and supplies when needed. Yet again a lack of communications, especially on the coordination of large installation jobs. Furthermore, when interacting with university systems there are inconsistent processes. The processes are complex, slow and there is a lack of resources. One of the facilities managers' summed it as:

"The barriers that prevent me from doing my job to the fullest are central functions such as IT (information technology), HR (human resources), financial (and too much) paperwork. How we can mitigate?:"

- *Transfer function to local contractors.*
- *More efficient processes.*
- *Decision makers – bold decision!*
- *Take <u>RISKS.</u>*
- *Red tape reduction.*
- *Resources.*
- *Flexibility.*

Another facility manager surmised, "*make decisions and communicate effectively"* and we need to, "*learn from these mistakes and move on*." That is relative to Womack and Jones fifth lean principle striving for perfection, interpreted as continuous improvement. Learn from mistakes, communicate and move on, yet still remember to go back and start the loop all over again, a continuous work in progress. This was one of the problem issues

that developed from the research investigation, there was a lack of continuous improvement efforts.

5.6.4 Phase Two Design Solutions: Lean Visual Workshop Blitz Artefact Assumptions

The lean visual workshop blitz artefact became an educational fact finding mission. Not only were lean concepts, such as lean *transformation* strategies, value, and visual management introduced and deliberated, an open forum took place. Discussions revealed who E&PS interpret their customers to be and how their department, as a whole, adds value to the end user. The next section evaluates what transpires after the workshop blitz in the design science research phase with action research cycle reflection, illustrated in Figure 32.

Design Science Research: Phase Three Evaluate, Review Findings
Action Research Cycle: Reflection

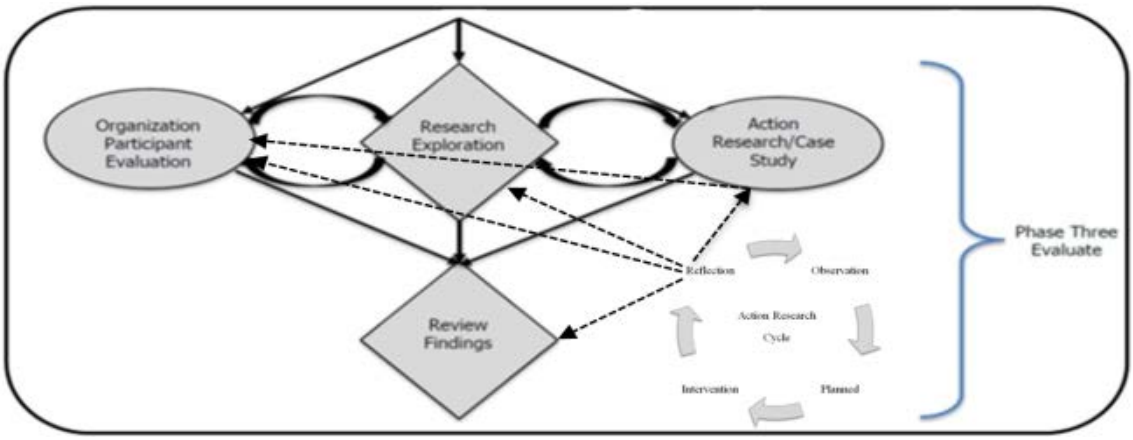


Figure 32: Phase Three Evaluate Action Research Reflection Cycle

5.7 Phase Three Evaluate the Research Exploration through Action Research

Phase three focused on the outcomes of the lean visual workshop blitz by observing the participants after they had a better understanding of lean principles and visual management technologies. During the workshop blitz the researcher proposed that E&PS start a lean library of books to continue the effort of educating staff about lean and visual management. The books suggested are illustrated in Figure 33.

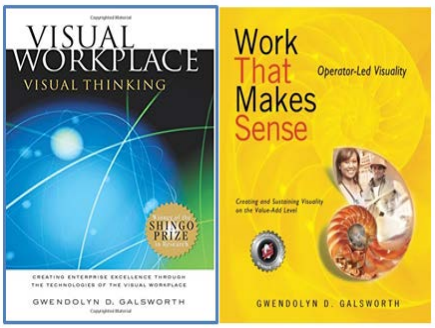


Figure 33: Suggested Visual Management Books for Continued E&PS Staff Learning

E&PS started a lean visual management library for employees. Administrative staff ordered the recommended book '*Visual Workplace, Visual Thinking*'. The researcher had several copies on hand of the second book, '*Work that Makes Sense*' and presented E&PS with a copy for their library. Both books had won A Shingo Prize, which is a prestigious award in the lean manufacturing industry. The two books where chosen for the reason that author, Dr. Gwendolyn Galsworth, has spent over 35 years researching, developing and training international corporations in the visual workplace and visual thinking. She is the founder of the Visual-Lean Enterprise Press. The second book, which was published more recently, '*Work that Makes Sense*', is written specifically for the laymen, the lower level employees that the author considers operators of the workplace, Galsworth (2011) considers them 'added value employees'. The books are easy to read and have numerous visual examples of integrating visual management technologies in the workplace, the before and after.

5.7.1 Phase Three Evaluate: Organisation Participant Evaluation

The workshop gave the attendees an interactive team experience and helped them work through real life facilities management issues collaboratively and visually through an A3 report activity. The designed lean visual management workshop blitz artefact was a positive experience for most participants. Part of design science research phase three evaluate stage is to have the research participants evaluate the designed artefact. In this case, a feedback questionnaire was passed out after the workshop blitz; the document can be viewed in Appendix G. The questionnaire asked the evaluators: What went well during the workshop? What could we have done better? And what activity or aspect of the workshop did they like best and not like? The results of the organisation participant evaluations are as follows:

- 15 out of 16 or 94% of attendees turned in a Feedback Form.
- 13 out of 15 or 87% enjoyed the A3 activity; many would like to continue doing an A3 report for internal work related issues.
- 8 out of 15, or 53% enjoyed group discussions and interactions.
- 2 attendees or 13% would have liked more detailed material on lean, and would have liked to know more about the workshop prior. They felt that more people might have participated if more information was received.
- 2 attendees or 13% thought that the technical aspects of lean were skipped, they wanted more of an explanation about lean principles, and what lean tools could be implemented in the workplace.
- 2 attendees or 13% thought the workshop was overwhelming and too formal.
- 2 attendees or 13% would like to see another workshop in the future, one mentioned to bring in other departments across the university to participate.
- 1 person or 7% didn't like filling out all the forms, too much writing.
- 1 person or 7% mentioned that we did not have enough food.
- 1 person or 7% thought the room was a bit cold.

One participant thought that there were too many forms to fill out. Basically there were sticky post-it notes (3 each) in activity two; activity three had a form with questions to answer; and the final workshop blitz participant evaluation form. The rationale behind this and a point to make is that since this was a research based workshop, and there was 16 facility management participants in a room, this was an opportune time in which to collect as much research data as possible. In the past, many E&PS staff was unwilling to fill out questionnaires and answer research questions. What they would send back is a questionnaire with their name, date, signature authorizing participation consent, but no information would be filled out. This was very perplexing, that E&PS staff was unwilling to share information. Some forms were designed as qualitative questionnaires and ended up as qualitative unstructured face to face interviews using an administered interview questionnaire and a more casual approach. The information was all confidential; this was spelled out in the documents and mentioned to the participants.

The researcher needed to take on a less formal tactic. E&PS staff was unwilling to share information, data found that many different versions of the same event occurred. This was interpreted as a lack of trust and not wanting to share information, or be a part of the

research. Additionally, after interviews and observations took place the findings were summarised, then the researcher would go back to the individual and ask if the information was correct. On occasion the participant would say no, that is not how it happened, this is the way it happened, or you forgot this. When the researcher went back to their field notes or interview question data to double check their findings, no mention of the current data could be found. Or the participant said that something never happened, when the researcher had in their notes that it had. This was a very perplexing consistent action that occurred throughout this case. Nonetheless, the researcher became more aware of the boundaries people set, what they are willing to share, their interpretation of events, and adapted to the given circumstances. In Appendix H is a copy of a feedback form that was handed out a year after the workshop blitz, and in Appendix I is a copy of the research participant consent form. The next phase of research was the evaluation and observation phase after the workshop artefact was integrated in facilities management systems, refer to Figure 34.

Design Science Research: Phase Three Evaluate, Review Findings
Action Research Cycle: Observation

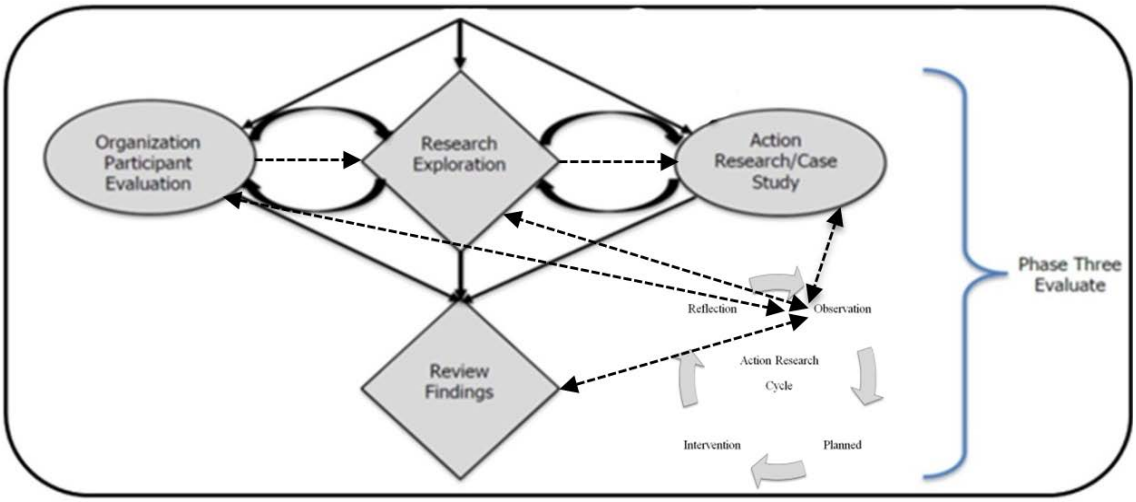


Figure 34: Phase Three Evaluation Action Research Observation Cycle

5.8 Speaking the Language of Lean Visual Management and Go See

Within a few weeks after the workshop, senior management would comment in passing that they are going on their gemba walks. Gemba is a Japanese term that means actual location or, “the real place” (Mann, 2010, p.23). In terms of lean facilities management it means to go see where value is being created in the workplace. In lean manufacturing it

would mean going to the factory floor, and going to the job site for lean construction. Employees actually get out of their office and in to the field to observe what's going on, they are better equipped to address issues and discover where value is being achieved.

The associate director of operations and facilities and university surveyor were getting out of the office and doing daily gemba walks checking up on current issues. They were very proud of their gemba walks. Mann (2012) suggests that "when the person in an organisation can teach lean principles, expects to see them applied, and is able to evaluate progress on site, the chances for sustaining a lean initiative are much better than when the initiative starts somewhere in the middle" (Mann, 2010, p.124). The associate director of operations and facilities and university surveyor continued to have meetings outside of the office and spend time walking around campus, even conversing more with staff they would see while on their gemba walks. Some of the operatives where surprised to see executive leadership spend more time walking around campus. Multi-skilled technicians embraced this new ritual and thought it was a good idea for executive leadership to get out from behind their desk and embrace sensei. "Sensei is a Japanese term for one who has gone before, or teacher. The sensei is the master in the master-apprentice learning model for lean management" (Mann, 2010, p.269). Gemba walks are classified as part of visual management technology category: visual order and establishing a visual foundation. It forms part of the visual foundation and developing patterns of work in a visual workplace.

Action Research Reflection: ARR #2

As a researcher you can read all the books, peer reviewed journal papers and articles about gemba walks, sensei and going to see where value is added in the workplace. Nothing is more assuring and factual then hearing it from industry itself. The researcher was a panellist at a facilities management forum held on November 18, 2014, at Pratt Institute, New York, NY. The event was sponsored by NY Commercial Real Estate Women (CREW), titled, '*Facilities Management Today: Trends and Challenges*'. The question asked by the facilitator was: What advice do you have for new and upcoming Project Managers and Facility Managers? One of the panel members, Michael Aisner, a Portfolio Property Manager with RXR Realty Trust answered, "Go see, get out and walk

the site, go see what is happening, get out there". In other words, go to the gemba, start the sensei.

To hear a real estate, facilities management professional in the industry speak of gemba and going to see, reiterated the importance it brings to adding value to the profession. Furthermore, the literature acknowledges the importance of gemba walks and sensei, and this is why it was introduced to the case participants in the workshop artefact blitz.

Action Research Learning: ARL #2
What did I learn from ARR #2?

The researcher learned that what was introduced to the research participant's was in fact a fundamental concept of teaching lean visual management concepts in facilities management systems. It was a simple technology to grasp and first outcome of the workshop blitz. The gemba walks started directly after the workshop blitz artefact. Going to the gemba is where a facility management professional will start to understand the issues that are prominent in the workplace; they will observe more in relation to their surroundings as they walk to the place, "where humans create value" (Womack, 2013, p. xix). Transparency and teamwork will start to occur as the sensei (manager, leaders) requires gemba walks with employees involved in direct situations. It is additionally a great team building activity and gets leadership out of the office.

While in the (supply/equipment) stores it was noted that the book, '*Work that Makes Sense*' was on the manager's desk. The stores manager was additionally using a white board to visually track merchandise and stores issues. The continuation of lean learning was basically at executive leadership and middle management level; lower level operatives were not continuing the lean visual management learning process after the workshop blitz. This result is opposite of developing a lean enterprise where employees are constantly learning. Liker (2004) concedes that the foundation of a lean system is built upon creating a learning environment that extends beyond continuous improvement efforts. Is this where continuous improvement ends with E&PS?

Periodically throughout a year, from May 16, 2012 thru to May 2013, the researcher checked in with E&PS participants who attended the lean visual management workshop

blitz to follow up. Was E&PS implementing lean, performing visual management activities, or had a chance to read any of the books since the workshop. Building managers and multi-skilled tradespersons all commented that they did not have time to continue any lean thinking or visual activities after the workshop, as they were all too busy working and putting out fires. Mostly, executive leadership and a few middle management level employees such as team leaders, started to use lean vocabulary and visual management technologies. They were going on their gemba walks, few were writing on the white board and few were reading visual management books.

5.8.1 Visual Displays, Performance Metrics and Standards Outcomes

After the workshop, E&PS started to plan their relocation of all facilities management support functions to various locations around campus. When the main facilities management administration office moved to their new location, additional visual communications started to take place as they started to organise the new office space. The following sections are dedicated to a collection of visual communications and technologies that were created, co-created and integrated in to the facilities management workplace after the workshop blitz.

5.8.1.1 Visual A3 Reporting

Management was creating A3 reports in meetings to mitigate internal issues. They would make known that they are working on their A3's. The A3 is a good exercise for solving problems and setting up new standards of work, as well as visually looking at company strategy and vision, whether to go after a RFP, write a proposal, or project status reviews. The A3 exercise gave E&PS a visual tool to add to their meeting activities. Furthermore, it is a good exercise for staff collaboration and was a successful activity during the lean visual management workshop blitz.

5.8.1.2 Visual Display Boards

After the workshop, it was noticed that a large blank white board was in the middle of the office floor. It had been confiscated from a previous department that didn't need it anymore. Team leaders and administrative management mentioned that they knew that the white board could be integrated somehow yet they didn't quite know what to do with it. The researcher explained that it would make a great visual communication board for

tracking work order tickets, PPM, or scheduling and mitigating additional building issues. This was also introduced in the workshop.

Months after the workshop team leaders started to write on the white board. Visual communications started to take place and team leaders where proud of themselves for starting to communicate visually, refer to Figure 35. Some of the issues communicated were: Taps in Allerton Building Reception will be done 5/10/12; Maxwell Building 621a ladies replace cistern; Revolving door Allerton Building; Maxwell Building Ladies 1st faulty tap. Although there was no structured organisation to where and how the building issues where written, it was a start to their visual communication efforts. Someone even drew a happy face on the board.

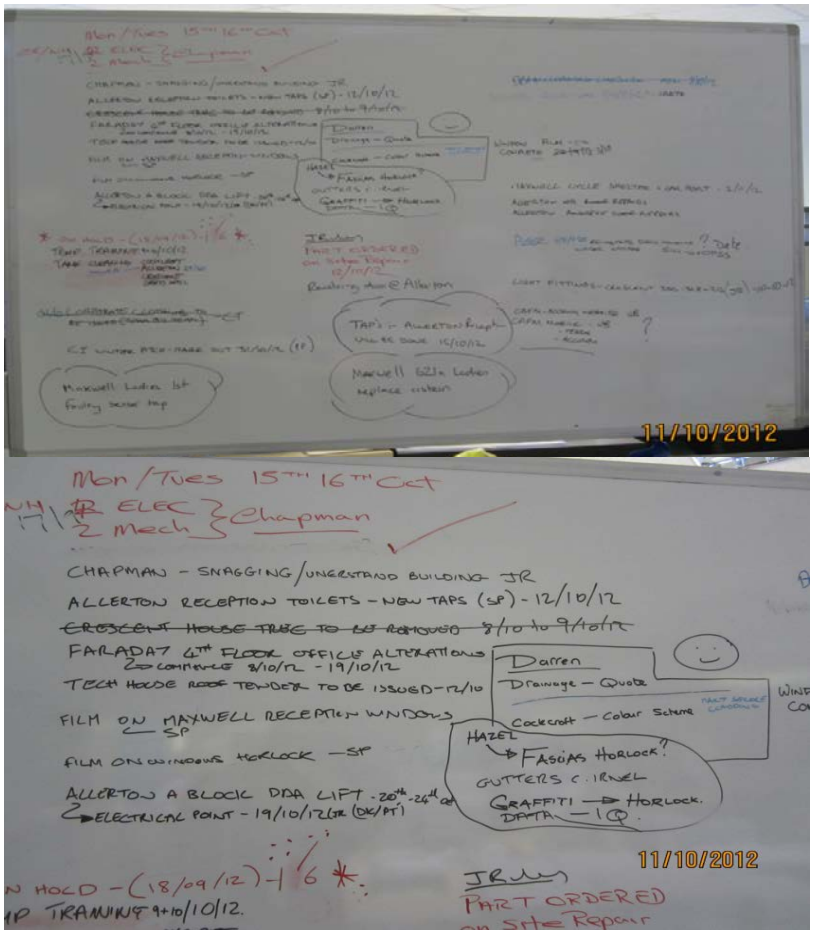


Figure 35: Estates and Property Services White Board Communications

Action Research Reflection: ARR #3

Within six months after the lean visual management workshop blitz artefact visual communications begins to take place, as building issues are visually communicated on a white board and a happy face is drawn. Could this be a sign that E&PS team leaders are happy with the results of visually communicating using a white board? Or is this just someone's way of mocking the notion of visual communications on a white board? Will we ever know?

Originally, the white board had been confiscated from another department space; it had been left behind after a move. The head of administration placed the white board near the trades' team leaders' desks. No one knew what to do with a blank white board, and it sat there blank, for months. Once visual technologies were introduced, the idea of how to use the board became known. This is another progression up the ladder on their lean journey as they embrace visual communications and visual displays with or without a happy face.

Action Research Learning: ARL #3
What did I learn from ARR #3?

The researcher can only speculate it may be a combination of both, on one hand team leaders of the various trades are visually communicating building issues. On the other hand, they are expressing a humorous expression. They may want attention and be noticed for their visual communication efforts. Also, make note the information that they are communicating has no organisation, it is just building issues and comments written on a white board, wherever there is space. On the other hand, as a researcher it is a valuable outcome to see visual communications in a facilities management office that had none previous to the lean visual workshop blitz.

Another major workplace transformation began to take place. The existing building that housed all main facilities management support functions such as: finance, joiners (carpentry) shop, landscape supplies and equipment, mail room and stores, would be demoed. New student accommodation buildings would be built in its place. All departments housed in that building would be relocated across campus in various locations. Team leaders that managed the multi-skilled technicians would be separated

from main facilities management staff. The mail rooms' new space would be half the size of the existing location, same with the joinery shop and especially the stores. The stores would be relocated in to a space that was approximately 1/3 of the existing space.

After the facilities management's department offices moved, the white board could not be located. To conclude the visual display integration: white board use, as of the last check in with E&PS staff in May 2013, ceased to exist. No thoughts of purchasing a new white board had even been thought about, and no continuous effort for improvement was noted.

5.8.1.3 Student CAFM Net Accommodation Instructional Sheet

The university owns and manages over 1500 off campus student accommodation units. There is a separate facility manager, assistant facilities manager, multi-skilled technicians and a receptionist's team assigned to student accommodations. They have been over whelmed with the inundation of work order issues on a daily basis. All accommodation issues still need to be entered in to the CAFM (computer aided facility management) system by a main reception/helpdesk support team associate. Issues could be anything from broken hobs, hot water not working in the showers, leaking toilets, and lights not working in the units, building entrances and hallways. The value added strategy was to have each student accommodation unit responsible for entering their own work order issues in the CAFM system and track them through completion. This is in line with FPDP task 6.1.2 to increase use of electronic web based helpdesk and review mechanisms for students to report faults. The task was assigned to the researcher; the researcher was given programming rights and tasked with encoding all offsite student accommodation units with managerial CAFM responsibility. This would allow the students to enter all accommodation issues and keep track of the work order status through completion.

Once all accommodation units were programmed to have both implementation of work order and issue tracking accountability, the researcher designed a two page coloured visual instructional sheet artefact, printed copies (two sided) and laminated them. All work order ticket CAFM instructional sheet artefacts were hung in each offsite student accommodation unit. The second designed artefact after the workshop blitz artefact was the Student CAFM Net Accommodation Instructional Sheet artefact which can be viewed in Appendix J. Although the researcher designed the artefact, the initial process starting with the CAFM programming effort was co-created between the researcher and E&PS.

Once the process and procedure went live, most students were entering and tracking their own work orders. They had no issues or complaints concerning the instructional sheets. This new value added process and procedure freed up staff and gave them more time to deal with additional issues and work on preventive maintenance. A copy of a one month student CAFM Net User Work Order Activity Report document, 1/4/2013 thru to 4/5/2013 can be found in Appendix K.

A few months after this went live; a follow up conversation with the assistant facilities manager in charge of student accommodation operations and maintenance took place. They alluded that this new procedure, "*cut out workloads for the reception*" staff and they were able to get, "*job reports faster*". The value added initiative would go 100% live later in the year because work orders are lighter when school is not in session fewer students are on campus. They will have a chance to "*iron out the bugs*" prior to the fall semester starting in September, when the "*proper launch*" would take place.

5.8.2 Visual Order, Establish a Visual Foundation

Patterns of work began to take place in the new facilities management administrative offices. The new offices where designed as agile open office spaces, with no assigned desks and everyone would get a locker and movable pedestals, except for administration and finance. Everyone else could sit where ever they wanted to, or an assigned desk area and pedestal would be given to them daily. It became a prototype of open office space for the university; they called it an 'agile' office. Other departments and visiting subcontractors could use the space if there were open desks that day. The area was new, sorted and shined. The follow sections are an account of what visual technologies commenced after the lean visual management workshop blitz artefact and relocation to new open office space.

5.8.2.1 Colour Coded Cabinet Doors and Keys

Part of the responsibility of the reception/helpdesk support team assigned to the new main reception desk was to lock up certain items in the cabinets at the end of the day shift, such as the telephone and computer keyboards. The newly installed cabinets where all white and each cabinet had a different lock and key. When assigned to that location, the researcher (who was a part-time reception/helpdesk support team staff member) would use the cabinets to lock up personal belongings such as a backpack, house keys, handbag,

wallet, and school items. Since each white cabinet had a different lock and key; it was confusing as to which key opened which cabinet. Every time you needed to get in to a cabinet, or close up at the end of your shift, it took extra time. You would be fumbling the keys, trying to place them in the correct lock to open the cabinet and relock the cabinet when finished.

Figure 36: Colour Coded Key Set

Figure 37: Colour Coded Dots: White Cabinets with Blue Dot, Red Dot and No Dots

In order to rectify this workplace issue, key rings with colour coded tags and matching sticky dots were purchased. Coloured coded dots were placed on the corresponding

colour coded key ring tags, refer to Figure 36. Corresponding coloured coded dots were placed next to the cabinet lock that a particular key opened. The key tags were also labelled to communicate which cabinet door it unlocked. For example, a red colour coded key set, illustrated in Figure 36 opened the white cabinet door with a red sticky dot near the cabinet lock, refer to Figure 37. Colour coding is a typical visual order technology that sets up patterns of work and information sharing. This starts the 'I' driven approach where visual communications in action starts to occur in the workplace.

5.8.2.2 Visual Safety Solutions, Door Release Button/Panic Button

The main FM reception desk is located in a lobby in front of a secured office. Only employees that are assigned to work in the main FM office have secured access rights to enter the office. To enter the office, employees scan their ID cards in front of a card reader. If a person other than a main FM office employee needs access in to the office, the reception/helpdesk support associate assigned to the reception desk, has to leave the reception desk area to open the door from inside the office. In order to unlock the secured door, the reception/helpdesk support team associate exits the reception area thru a door behind the reception desk that leads into the office area. Turns left walks perpendicular to the wall through the office toward the main reception door, opening the door from inside the office, letting the person(s) enter the office area. Then walks back the way they came to the reception desk area.

This caused several concerns; the fact that the main reception/helpdesk support team associate had to leave the reception area for a few minutes was an issue. Additionally, if the phone rang they are supposed to answer the phone within 15 seconds based on service level performance indicators. The reception/helpdesk support team associate not only had to leave the reception desk unattended, they had to walk behind the reception desk, through a door in to the FM office area to open the secured door for a contractor, FM staff, third party contractor, or university employee other than a main FM office employee.

The researcher suggested that if a door buzzer was installed this would alleviate the reception/helpdesk support team associate from leaving the reception area and not being able to answer the phone within the 15-second rule. This idea forms part of the visual control, visual safety solutions. Within a month of the suggestion, a door release button

was installed by one of the in-house multi-skilled electricians. An illustration of the door release button and visual label with time of operations placed above for the reception/helpdesk support team associate to buzz non-main FM employees in during daily operating hours in shown in Figure 38.

Figure 38: Door Release Button and Label

This became a real visual order safety solution necessity. If someone was walking toward the door, visually the reception/helpdesk support team associate would be able to spot them coming and press the door release button prior to their entrance. This would additionally lessen the motion of the person walking toward the door pushing on an unlocked door trying to open it, not realising that the door was secured. The reception/helpdesk associate did not have to leave the reception area and the phone call answering time metric stayed within service operating performance levels. The efficiency of buzzing visitors in as they approach the door to the main FM office saved motion, time, and improved visual security efforts.

5.8.2.3 Identifying through Labels

At the same time that the door release button was installed, two security alarm buttons were also installed that connected the reception desk to main security in case of an emergency. The two security panic buttons were colour coded with red labels. This is a good use of visual safety solutions for the reception/helpdesk support team associate who can press both red panic buttons and all security around campus will be notified. The red labelling of the security panic buttons took place in the new main FM reception area, yet had not been advocated in the other four reception/helpdesk locations.

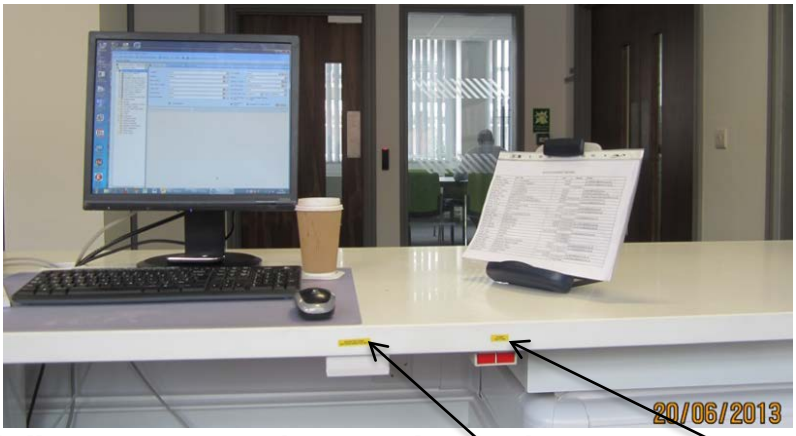


Figure 39: Labelling Reception Desk Door Release and Panic Button

An additional outcome surfaced; in labelling the door release and security panic button, viewed in Figure 38 and Figure 39, notice that the labels are a yellow background with black text. This is highlighted in the suggested reading material, *Visual Workplace, Visual Thinking*, book that E&PS purchased. "Research shows that bold black letters on a crayon-yellow background are the most readable colour combination" (Galsworth, 2005, p.51) for labelling visual control devices. This means that E&PS staff are using the visual management books as a guide in developing a visual foundation and visual safety solutions.

5.8.3 Visual Controls, Visual Office, Machine and Guarantees

Visual controls, visual office, machine and guarantees when implemented in to the workplace will support the behaviour of the office workers. It can strengthen the workplace culture and aid in answering core questions such as "how many or how much and when or how long" (Galsworth, 2005, p.152). An additional benefit of visual control technologies is that they are "close to the process whose performance they reflect" (Mann, 2010, p.79). These are core elements that employees use or need in order to perform their responsibilities in accordance with any performance metrics set forth.

5.8.3.1 Data/Phone Cables

Each night at the main facilities management office reception area the telephone had to be unplugged and securely locked in a cabinet. In the morning the reception/helpdesk support team staff would unlock the cabinet, take out the telephone and plug in the phone cable and data cable before operations could start for the day. It was not known which jack went in to which receptacle; trail by error would begin a morning ritual. Motion was

held up and the start of FM operations such as the CAFM system, telephone support system, and work orders couldn't be started prior to the cables being plugged in. As a result of the workshop and lean visual management books, the telephone and data cables were colour coded with pink and blue laminated tape, illustrated in Figure 40.

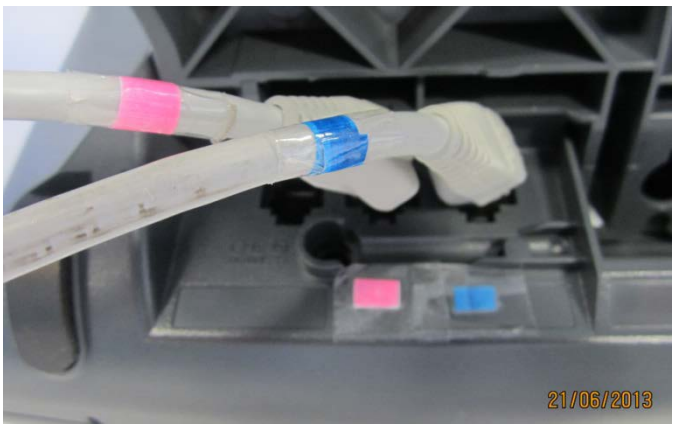


Figure 40: Colour Coded Data/Phone Cables

This was a real time saver and eliminated wasted motion and frustration. The reception/helpdesk support team associate became more efficient and was able to set up the telephone quickly, for daily operations to start. There was no question as to which cable fit in to which jack. Colour coding data and telephone cables are organised under visual technology category: visual controls, visual office, machine and guarantees. It refers to a critical office machine, the telephone and cisco operating system, that is needed in order for the main reception/helpdesk associate to perform their duties in accordance with SLA's and performance indicators.

5.9 Phase Three Outcomes

Phase three outcomes after the lean visual management workshop blitz artefact corresponds with E&PS's lean transformation journey through Phase Three Evaluate, by answering the following questions:

1) Do employees have a better understanding of lean transformation principles?
    a. The employees who attended the lean visual management workshop blitz have a better understanding of lean concepts

and visual management technologies. Not all employees continued lean visual management efforts after the workshop. Executive leadership and middle management have a better understanding of lean transformation principles and started implementing visual technologies in the workplace.

2) Has any additional lean principles been introduced in to the facilities management workplace since the workshop blitz?
    a. Section 5.8 presents the gemba walks, lean terminology, and visual management technologies that were introduced in the facilities management workplace after the workshop blitz. In a conversation with management a year after the workshop, no new additional lean principles had been introduced. The few administrators, campus managers, facility managers, multi-skilled technicians, and team leaders who attended the workshop are not practicing lean transformation principles.
3) What visual management technologies have been adopted created and integrated in to the workplace?
    a. In Section 5.8 Speaking the Language of Lean Visual Management and Go See, visual technologies that were created and adopted in to the workplace are discussed. Table 17 summarises the visual technologies created after the workshop.
4) How successful was lean visual management integration in facilities management systems?
    a. Were they successful, yes, estates and property services was 75% successful in implementing lean principles, concepts and visual technologies in the workplace. The researcher gave them a 25% margin deduction for lack of consistency and lack of a continuous improvement plan. Momentum of lean principles and visual management technologies discontinued within a year after the main FM administrative offices relocated. And two years after the workshop, no new lean or visual management technologies were created, implemented since the end of the research study.

b. It was noted that four years after the initial workshop, in 2016 additional lean visual management technologies started to take place. Multi-skilled tradespersons received new smart phones and tablets. Visual displays and workflow charts started to be exhibited on a back wall in the main FM administrative offices.

Transformation and change in the workplace takes time. The original lean visual management workshop blitz artefact took place in May 2012. Lean and visual management integration took place in the next year after. Than in 2014, lean and visual management integration took a hiatus and stopped until 2016, when additional visual management activity started up, again. The initial university transformation programme had started in 2009, with most of the facilities management operation functions being reorganized in 2011. Estate and property services have been transforming their facilities management operations for over five years. They continue to make strides toward a lean visual management enterprise.

Below is a recap of DSR phase three evaluation and action research observation phase. Senior leadership and management started to get out of the office and go see the issues first hand that were affecting operations. They would openly communicate that they are going on their gemba walks. If the researcher ran in to them around campus they confidently mentioned that we are on our gemba walk. This seemed to be a positive occurrence for senior management to not always be in their office and physically go see the value in the workplace. Sometimes they would find additional issues as they walked around campus, such as moss growing on stairwells and loading dock areas that needed to be cleaned up. Lean visual management vocabulary started to be spoken, words such as visual management, lean and visuality and of course gemba walks were verbalised. Visual standards of work such as A3 reports started to be used in management meetings to rectify departmental issues. Management came out of their meetings making a point to let the researcher know that they were doing A3 activity reports, with a smile, they were very proud of their new visual reporting. This all has become standard operating procedures and continued over the last four years.

After the workshop, team leaders started visually communicating current building issues by writing them on a white board. Consequently, when the main FM office relocated, the

team leaders offices where segregated from the main facilities management administrative office. Not all team leaders offices where set up when this case study ended in June 2013. As a result, the white board that everyone started to use could not be located. The team leader of the stores and mail room kept his white board and had it hung in his new office area. Visual communications for them were more in line with their own work responsibility, not necessarily used for open visual communications with employees, it was more personal. A year later, in June 2014 the effort of visual communications through the use of a visual display technology was not sustained. However, in July 2016, two years later, visual displays technology started again. Large workflow charts and project information started to be displayed on several walls in back of the main FM administrative offices. Progress is being continuing, slowly.

Together the workshop blitz and lean visual management books instilled a creative flow of lean principles, concepts and visual technology development and implementation. The director of administration managed FPDP task 6.1.2 that increased the use of electronic web based facilities helpdesk and students housed in offsite accommodations. This task provided students in university accommodations to implement and manage their own work orders. The director of administration and researcher co-created this effort bringing it to fruition.

Additional visual outcomes were colour coding keys and cabinet doors with coloured dots and matching key tags. The telephone and Cisco data cables where colour coded. This generated a more efficient workflow activity for the reception/helpdesk support associate. They were able to determine which cables went in to which jacks, saving time and motion in their morning responsibilities. A door release button to the secured FM office entrance door was installed along with a security panic button. Both where visually labelled using a yellow label and black text. This particular pattern of colour coding is considered the most prominent visual method of labelling items. The visual technologies created after the lean visual management workshop blitz artefact are categorised in Table 17.

Table 17: Visual Technologies Created after Workshop Blitz Artefact

Lean Concepts and Visual Management Technologies Implemented after Lean Visual Management Workshop Blitz Artefact
Visual Communications ▪ Speaking the Language of Lean and Visual Management. ▪ Reading books on Visual Workplace, Visual Thinking.
Visual Controls, Visual Office, Machine and Guarantees ▪ Data/Phone Cables.
Visual Order, Establish a Visual Foundation ▪ Gemba Walks, Go See, Pattern of Work. ▪ Colour Coded Cabinet Doors with coordinated coloured Key Chains, using Colour Coded Dots. ▪ Visual Safety Solutions, Door Release Button and Security Panic Button. ▪ Identifying through Labels.
Visual Displays, Performance Metrics and Standards ▪ A3 Report. ▪ Visual Display Boards. ▪ Student CAFM Net Accommodation Instructional Sheet.

The next design science research phase and action research cycles examined two internal departments within estates and property services. The design science research phase three, action research cycle continues for another full sequence of action research case study exploration, illustrated in Figure 41.

Design Science Research: Phase Three Evaluate
Action Research Cycle: Planning

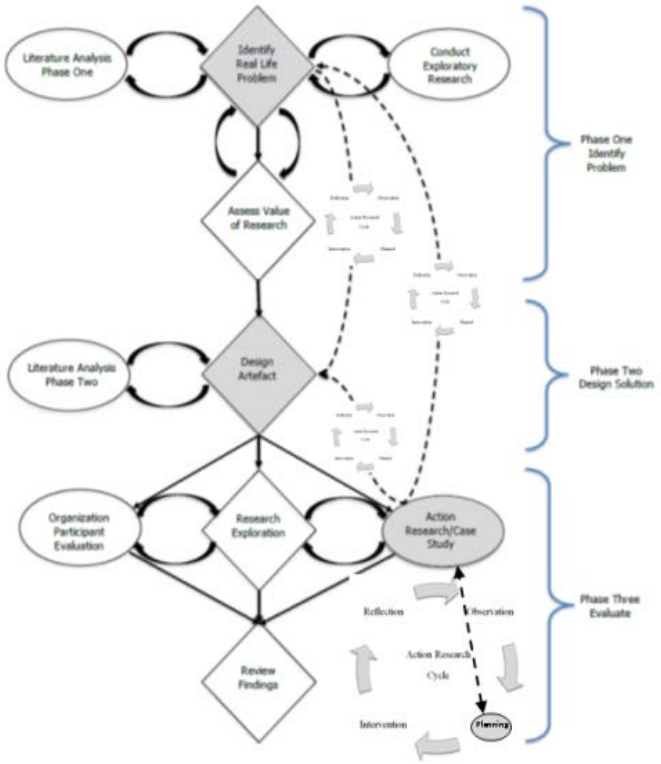


Figure 41: Phase Three Evaluate Action Research Planned Cycle

5.10 The Third Designed Artefact: A Lean Management System

The research undergoes another cycle of action research planning, that flows between design science research steps of: action research and the case study; back to the beginning of the research cycle to identify another real life organisational problem, then back to the design and implementation of a third designed artefact. It was noted that a large percentage of lean systems integration was in the operations portion of the facilities management function. The landscape department, mail room, supply stores and joiners workshop had not been considered areas to receive new lean concepts or visual management technologies. Therefore, the mail room and supply stores were selected to be the next area of research. There was one manager for both departments and they had attended the original lean visual workshop blitz. A mail room and supply stores are similar to manufacturing settings where lean and visual management integration has been proven to be successful. Additionally, the supervisor of both sites had been integrating visual management technologies in his work routine, and using a white board to display work activities, orders, and current issues.

The theory behind design artefact three was to provide a lean visual workplace management project delivery system that can be arranged in to a check list, which estates and property services could use as they continue their lean visual management journey forward. E&PS could select a point of contact, such as a lean champion, or visual change agent to follow through on all new initiatives. This person selected could be the manager of the mail room and stores, they had already attended the lean visual management workshop, they were reading the visual management books, and they were integrating visual technologies. The challenge for E&PS was “to develop a holistic approach that looks not only at technical solutions but also at all aspects of project delivery” (CH2M HILL, 2000, p.6).

The main construct of the first design artefact was an introduction to lean principles, concepts, terminology and visual management technologies. The third artefact would be a project management delivery cycle to track implementation of lean principles, concepts and visual workplace management technologies; this can be viewed in Figure 42 and a larger copy is in Appendix L.

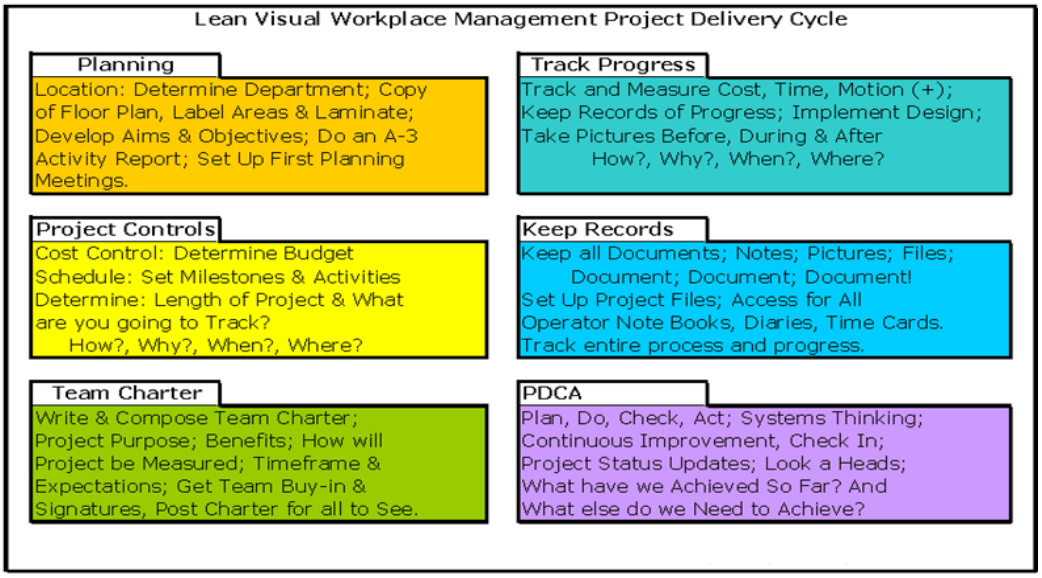


Figure 42: Lean Visual Workplace Management Project Delivery Cycle

The lean visual workplace management project delivery cycle is organised in to six phases:

1) Planning.
2) Project Controls.
3) Team Charter.
4) Track Progress.
5) Keep Records.
6) PDCA.

The phases are colour coded for use in setting up the project documents. The colour coded system can be utilised for labelling documents, project files, and communications, using the same colour as the cycle phase. The phased colour can additionally be visually communicated in newsletters, the team charter and posters around the office. The designed artefact is based on the need for a project delivery system or lean management system to stabilize the effort of change in the facilities management workplace. The colours can be altered based on specific needs and specifications of the organisation. Literature concedes without any formal project management, lean management or change management system in place the lean journey, change, or *transformation* initiative will not be successful.

Phase one is the initial project planning phase to determine lean visual management implementation and location. It could be integrated in to an entire organisation, a department such as human resources, or specific location such as a mail room or supply stores. Once the department and location is determined, a floor plan of the specific area of execution should be gathered. The project team should highlight areas of implementation

and phases of the project by colour coding them on the floor plan, then the floor plan can be hung in the office area for everyone to see; especially in the specific area that will be affected by the change. The floor plan can also be laminated for safe keeping. Project aims and objectives should be discussed and agreed upon. This can be accomplished by developing an A3 visual report in a planning meeting. A project manager, lean visual workplace champion or change manager will need to be selected as the main point of contact. Initial planning meetings would take place in this phase.

In phase two development of project controls, cost estimates and budgets for potential project requirements will need to be developed. A mock schedule should be created with project milestones for review. The proposed length of time it will take to implement the project should be determined at this point. At this stage, the activities of the project that should be tracked, by whom, and how often should be agreed upon. The project questions to asked team members at this phase are: how?, why?, when?, and where?. This should all be determined prior to continuing to the team charter phase.

The team charter phase is where the project aims, objectives, purpose, goals, roles and responsibilities and benefits are developed. An A3 visual report can be used to edit, confirm and finalise the charter. The project timeframe, expectations and measurements are confirmed. Developing a team charter ensures that all team members involved with the project "share the same vision" (CH2MHILL, 2000, p.81).

"The term "charter" is borrowed from the British sovereign system, where the king or queen granted, or chartered, certain rights or privileges on an individual. Today, the concept of chartering a team in an organisation has a similar meaning. The organisation confers certain authorities and resources to the team and team members. In return, for this authority the team is responsible for generating certain results" (CH2MHILL, 2000, p.79-80). It is suggested that all team members involved with the project agree upon the scope of work by endorsing the project charter with signatures. The endorsed charter can be laminated and posted around the office for all to see.

The track project phase is very important, this is where projects lose momentum when no one is assigned to focus on the process, or the person in charge is not sustaining the effort forward. Cost, time, quality, and motion are measured and constantly reviewed and

updated. The projects progress is recorded through photographs of before, during and after. Meetings and meeting minutes will help determine project questions such as: how will you track the progress?, why will you track the progress?, when will you track the progress?, and where will the project be tracked? This leads in to the next phase of record keeping. It is very important to document, document, and document all project progress through notes, pictures, files, and correspondence. Project files will need to be set up and can be colour coded to match the different project phases. A project website can also be developed and all documents can be organised and posted on the website. All parties involved will need to access project documents, which may be in the form of note books; daily, weekly and or monthly diaries, project binders, computer electronic files and time cards.

The final phase is part of the lean continuous improvement cycle, systems thinking, and uses the Demining cycle philosophy of plan, do, check, and act. Posting the project information around the office for all to see (visually) does not sustain the project going forward. The PDCA cycle needs to be put in motion to track project performance and continuous improvement efforts. Additionally, the headings of an A3 report can be; plan, do, check, act or adjust. This “reinforces what the process should be. You need to select the right team, and do the correct analysis. By documenting this on an A3 reinforces the discipline of doing each phase” (interpreted from Productivity Press, 2006, p.112).

The lean visual workplace management project delivery cycle is not complete, it was designed for this research study. It should be a continuous work in progress and projected to be expanded upon during the research exploration, evaluate phase. Each company can update, edit, and change actions with in each phase to enhance their lean visual management program. “Many organisations undergo change, but few develop a system that fully supports their new direction. Instead they settle for incremental changes to their” (CH2MHILL, 2000, p.xi) workplace initiatives, transformation efforts, or new strategies. Developing a structured project delivery system will provide organisations, and their business units, with long term tracking resources and the ability to sustain new processes and procedures (CH2MHILL, 2000), while developing employee knowledge and ownership.

Design Science Research: Phase Three Evaluate
Action Research Cycle: Intervention

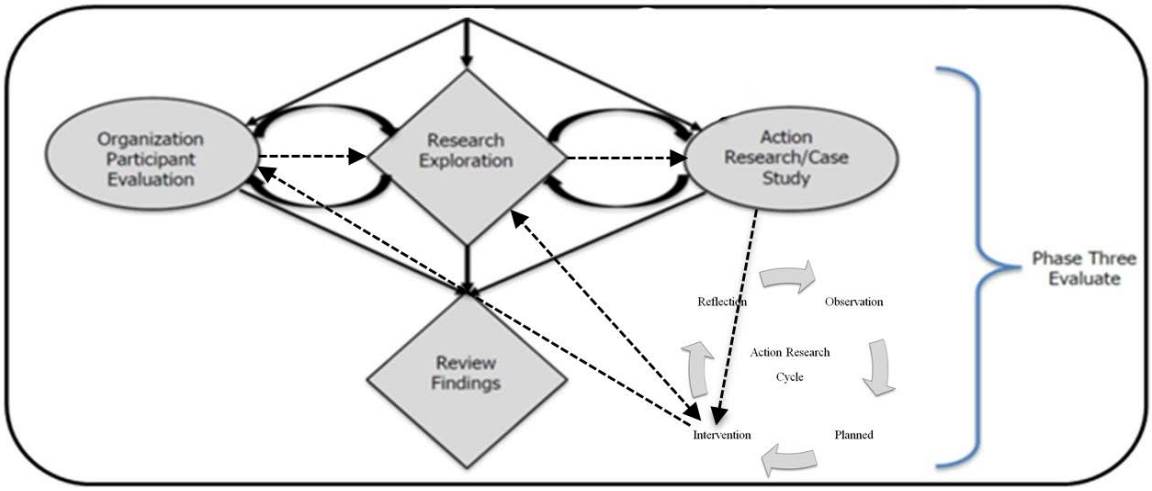


Figure 43: Phase Three Evaluate Action Research Intervention Cycle

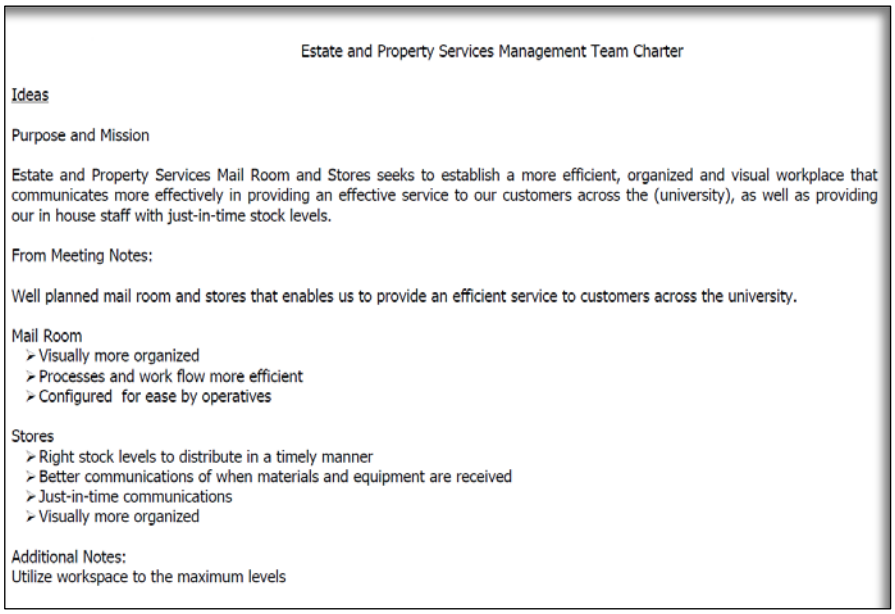
5.10.1 Third Artefact Implementation

After the lean visual workplace management project delivery cycle artefact was designed meetings with estates and property services executive and middle managers were scheduled to set up the continuous research case study. The phase of research inquiry is illustrated in Figure 43. The research project was exploring lean visual management technology artefact development in the facilities management mail room and stores. The case study exploration was designed to go phase by phase to test the validity of integrating lean principles and visual management technologies using the structure lean visual workplace management project delivery cycle artefact. The designed artefact was modified six times prior to the final design illustrated in Figure 42.

The first scheduled meeting minutes can be viewed in Appendix M: Lean FM Exploring a Lean Visual Workplace Meeting Minutes. The location determined for the visual workplace management research study project was the university mail room and stores. A copy of existing floor plans would be provided by E&PS and forwarded to the researcher. Aims, objectives and case study project would all be developed by the researcher. An A3 report was not needed for the said project. Project budget would be reviewed once the designs of additional visual artefacts were presented to the management team. The researcher would devise the schedule of activities and milestones, which can be viewed in Appendix N. The length of the proposed case study would be in two phases. Phase one would be developing a lean visual management mail room; project duration from October

2012 to December 2012. Phase two would be developing a lean visual management supply stores, scheduled from January 2013 to March 2013.

A project charter was designed by the researcher and presented in a meeting. Once the charter was approved by E&PS management staff, e-mails and several meetings took place to get endorsement and signatures. The final project charter enforcement and signatures never happened. E&PS management staff would not commit to the project charter, though they insisted that they were still interested in developing one. They were obviously just agreeing and going along with the researchers process, with no intentions of follow-thru. The researcher continued to quester E&PS management staff about completing the research project charter. An illustration of the project charter can be viewed in Figure 44.



Estate and Property Services Management Team Charter

Ideas

Purpose and Mission

Estate and Property Services Mail Room and Stores seeks to establish a more efficient, organized and visual workplace that communicates more effectively in providing an effective service to our customers across the (university), as well as providing our in house staff with just-in-time stock levels.

From Meeting Notes:

Well planned mail room and stores that enables us to provide an efficient service to customers across the university.

Mail Room
- Visually more organized
- Processes and work flow more efficient
- Configured for ease by operatives

Stores
- Right stock levels to distribute in a timely manner
- Better communications of when materials and equipment are received
- Just-in-time communications
- Visually more organized

Additional Notes:
Utilize workspace to the maximum levels

Figure 44: Lean Visual Workplace Management Team Charter

Meetings with the mail room employees were scheduled by the mail room manager to explain project details. The same manager was in charge of the mail room and university stores. The researcher envisioned the mail room and stores operatives being involved in the design of their own lean visual management workplace. Value added employees at the lower level know how their workplace functions better than anyone else.

The researcher would only be able to meet with mail room and stores operatives during quiet business hours. The first meeting took place in the mail room to introduce the

research project to mail room operatives. Project handouts were distributed to the mail room operatives, and the research project and philosophy behind the project would enable the operatives to design their own visual workplace, co-create visual artefacts for their workplace, and develop a list of needed supplies that would help them perform their job functions more efficiently.

The researcher explained in the first meeting that each operative would get an assigned number and that all information and data collected would be confidential. No names would be used, not even management would know who the numbered operatives were. A mail room operative that had worked for the university for twenty years, excitedly screamed out; "*I want to be operative one, I'm operative one,*" and they were labelled operative one for research purposes.

After the first meeting, the researcher went to Staples and purchased small black n' red journals and file folders for all operatives who would form part of this research study. When you open up the journal, first page, on the front left side of the each journal a label was placed with the researchers point of contact information and some questions for the operatives to think about when redesigning their new visual management workplace. A number was given to each operative and the file folders were labelled with each operatives number. Periodically, when the researcher was in the main FM office, they handed out the journals and files to each operative. This occurred prior to the second meeting.

The second meeting took place between operative one and the researcher in the mail room. At the time of the meeting there was a university cleaning associate on her morning break having a cup of tea and biscuits. As soon as the researcher came in to the mail room, put her personal belongings aside and started to get ready to observe and ask questions, operative one proceeded to say, "*I'm not going to help you with your research, you can follow me around and observe me, but I'm not going to answer any of your questions*". The researcher explained her research aim and objectives and gave the operative a short background of the case study. Explaining how they (the mail room operative) would be able to redesign their own workplace. The researcher proceeded to ask operative one why they would not help with the research and operative one stated: "*I don't trust management and I'm not going to help you*".

Action Research Reflection: ARR#4

This goes back to Action Research Reflection: ARR #1, when E&PS did not share with the researcher that they never liked, or used the word *'transformation'* in the office. The researcher proceeds to review ARR #1 and dive deeper in to change management and cultural issues.

Action Research Learning: ARL #4
What did I learned from ARR #4?

Circle back to ARR #1 and review. Vicher (2012) attests that employees do not like change and will "express resistance to that which is new and unknown" (Vicher, 2012, p.128). According to Mann (2010) office workers are not used to being accountable for their work activities. "The amount of rework and non-value-adding activity in office (type) processes may contribute to the tendency for office workers to resist increased accountability that comes with lean and lean management systems" (Mann, 2010, p.107).

Additionally, "It is very important to remember that making changes to someone's work space and procedures, and not managing these changes will mean that the individual is likely to oppose, and in some cases even sabotage the proposed changes" (Bicheno & Holweg, 2009, p. 203). This is exactly what was starting to happen in this case study.

The researcher graciously thanked operative one for their time, gathered their belongings and proceeded to find operative one's direct supervisor for clarification of this issue. One more observation took place; the researcher spoke with the other mail room operatives to see if they would participate in the research. Apparently, operative one had already voiced his opinion to his peers and instructed them not to participate in the research study. This was noted in a conversation that took place between the researcher and several other mail room operatives.

In weeks that followed, the mail room manager meet with the researcher in the mail room and lightly informed them that nothing is really wrong with the mail room, it operates

well, and that the proposed lean visual workplace management research in the mail room will not continue. On the other hand, the researcher can continue in the stores; however the stores would be relocating to a smaller space within the next 90 days. This basically concluded the research on the development of a lean visual mail room. Even though an opportunity existed for the mail room to become visually organised, more efficient in process and workflows, reconfigured and designed for ease of operation by the mail room operatives themselves. The research project, exploring lean visual management technology artefact development in the facilities management mail room, stopped abruptly.

Design Science Research: Phase Three Evaluate
Action Research Cycle: Planned

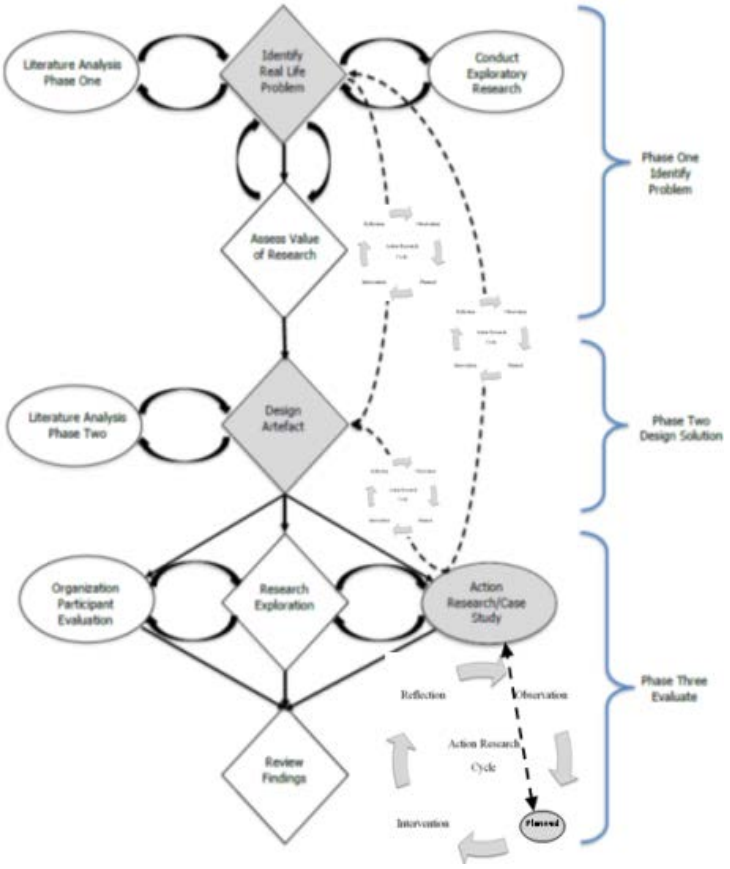


Figure 45: Phase Three Evaluate Action Research Planned Cycle

5.10.2 The Stores Case Outcomes

The researcher circled back to the action research planning phase and continued onward with the research concentrating on the stores, refer to Figure 45. Since the university stores would be relocating to smaller accommodations, the researcher developed a

questionnaire directed at reallocating store supplies from the actual stores to other potential storage areas around campus. The stores questionnaire developed can be viewed in Appendix O. The questionnaire was sent out to approximately 31 operatives: multi-skilled technicians, building managers, campus managers, handypersons, administrative personnel, the stores manager and the one full-time stores operative. Building managers and multi-skilled tradespersons would be most knowledgeable in advising the best alternative spaces to house the overflow of supplies, equipment, fixtures and tools. The building managers had expertise in their building layouts, and the multi-skilled tradespersons worked in the buildings everyday mitigating work orders or preventive maintenance issues.

The researcher received back only a few questionnaires. The same scenario that occurred in earlier research phases, the questionnaire was handed back to the researcher with just Part 1: Background Information filled out, or nothing at all. This was frustrating for the researcher, estates and property services employees were apprehensive and not willing to share information, and partake in the research study. E&PS executive leadership and middle management were on board with the research study, not the rest of the employees.

The researcher was in constant contact with the stores manager, university surveyor and head of administration, they were aware of the lack of employee participation. Nothing was being done about it, management did not seem concerned if the research project continued or not. The researcher was the only person concerned about continuing the research project. On one occasion, three multi-skilled tradespersons dropped off their filled out questionnaire at the main reception help desk for the researcher. The reception/helpdesk support team associate on duty that day put the questionnaires in an envelope with the researchers name on it, wrote confidential across the folder, sealed it and slipped it in to a draw at the reception desk. They sent an e-mail to the researcher letting them know that there was an envelope with their name on it, in the left side middle drawer.

The drawers to the reception desks were kept locked at all times the only people who had keys where the head of administration and the reception/helpdesk support team assigned to the reception desk that day. A few days later, the researcher came to pick up the envelope with the questionnaires, and could not find it. Every day that the researcher was

assigned to that particular reception desk they would search for the documents. This went on until the facilities management office relocated across campus. The reception/helpdesk support team associate that took the original questionnaires let the researcher know the names of two out of the three multi-skilled tradespersons who dropped off the questionnaires. The researcher approached the two multi-skilled tradespersons and asked them if they would be willing to fill out another questionnaire, they agreed, but never did. For this part of the research there was limited data collection.

In hind sight, perhaps the researcher could have tried to pick up the folder with the questionnaires the next day, rather than waiting a few days. Although, they were assigned to work at another reception location and had student obligations. The researcher now felt like operative one from the mail room incident: not only do they not trust management, they felt that they could not trust any estate and property services employee to provide honest and correct research data. It was a very bizarre incident and the researcher was not really sure what to make of it. What they did recognise is that it's part of the data collection phase of this thesis, it cannot be ignored.

Design Science Research: Phase Three Evaluate
Action Research Cycle: Intervention

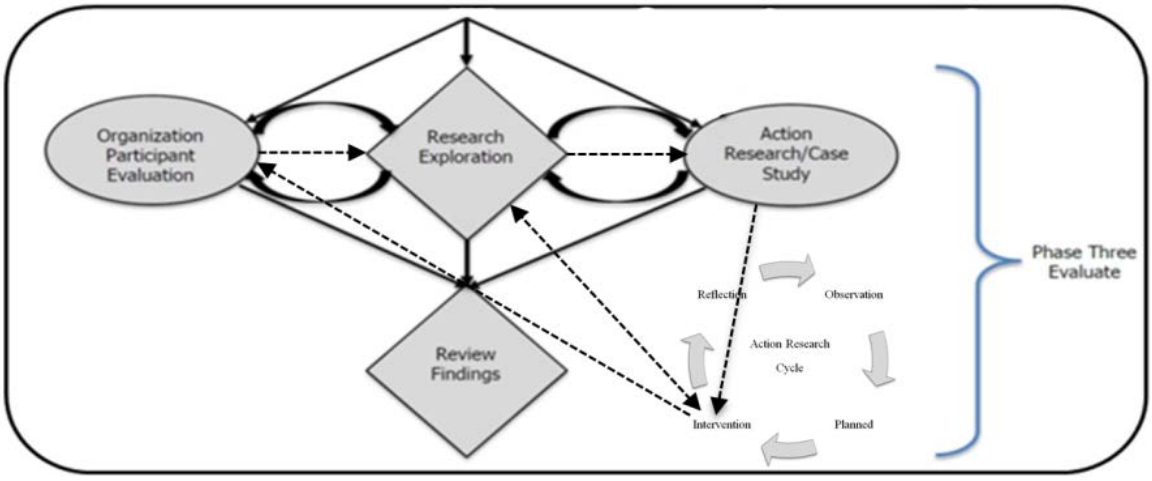


Figure 46: Phase Three Evaluate Action Research Intervention Cycle

5.10.3 The Stores Intervention

The extended case did not stop there, the design science research phase and action research cycle continued on with the stores, refer to Figure 46. Since the stores was relocating to a much smaller location within 90 days, the researcher worked closely with the main stores only full-time operative in space planning the new stores location. There

was a computer aided design program uploaded on the stores computer. The stores operative measured shelving units, bins sizes and took stock inventory. Between the researcher and the operative a new space plan started to take shape based on the new stores location and existing inventory and layout.

The relocation of the stores took longer than expected due to unforeseen conditions. While demoing a wall they found asbestos, and pipes and control valves no one knew existed. The construction was stopped for several months as the asbestos was remediated. Once the construction site opened up again, the researcher met the stores operative at the construction site with the proposed floor plan. They viewed bin and shelve locations and looked at existing conditions and discussed the new layouts.

The researcher taped yellow borders on the floor outlining the proposed location of bins and shelving units according to the proposed floor plan and existing conditions. The intent here was for the stores operative (and researcher) to visualise how the new proposed stores design would layout, refer to Figure 47. According to Galsworth (2011), placing borders in designated locations makes a strong case for the ownership of that area. Without borders the area “looks unclaimed, not available, and up for grabs” (Galsworth, 2011, p.125). Once the borders were taped out we were able to visualize what would work and what needed to be reconsidered. The stores operative went back to his office and revised the schematic floor plan to reflect final bin and shelving unit location. They labelled the floor plan and linked it to the bins, shelving units, equipment, and packed boxes and containers that would be moved to the new stores location.

Figure 47: New Stores Proposed Visual Tape Planning Method

There ended the lean visual workplace extended case study for the university facilities management stores. A few months after the border taping at the construction site, the stores finally relocated. The stores manager stated that the move went very smoothly. He was impressed with the stores operatives knowledge of the new site, and how well organised and methodical the move went. The stores operative was able to direct the movers where to place everything. He visually knew where everything went, based on the initial construction site visit and construction tape planning method, revised design development space plans, and move management coordinated labelling system.

Design Science Research: Phase Three Evaluate
Action Research Cycle: Reflection

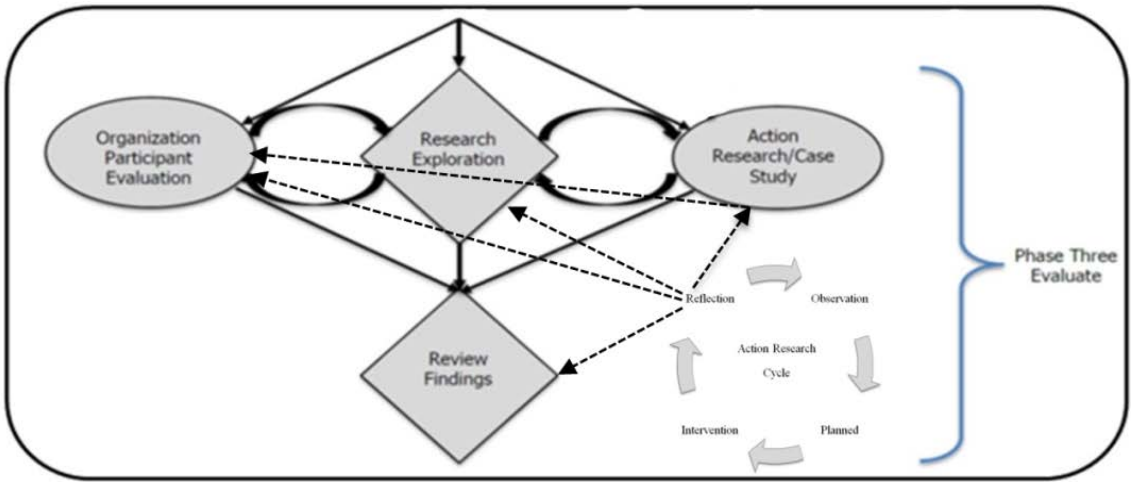


Figure 48: Phase Three Evaluate Action Research Reflection Cycle

5.10.4 Third Design Artefact Findings

A third artefact was designed in the form of a lean visual workplace management project delivery cycle. The project delivery system was designed as a project management tool for E&PS to further their lean visual management implementation. E&PS was informed that they could develop a more holistic approach throughout their facilities management department by incorporating the mail room and stores in their restructuring programme. The researcher was given the green light to continue the research and met continuously with management staff over several months. Unfortunately, the lower level operative in the mail room wanted no part of the continued lean visual management research effort. They voiced their opinion to the researcher and management halting the research exploration in the mail room. They additionally intimidated their mail room peers to not associate with the researcher and to not assist her with the research study.

On the other hand, minor accomplishments occurred in the stores research exploration. They were in the middle of relocating to a smaller space across campus, when a disruption in the construction due to unforeseen conditions occured. The construction site had to be closed for sixty days which delayed the research even further. The researcher was able to work with the stores operative in designing a new space layout. They set up a site visit meeting with the stores operative at the new construction location. The intention for the meeting was for the operative to visually get a better sense of the new location, size and existing conditions; by standing in the new space, feeling it, and seeing (visually) the space. During the construction site visit, the researcher border taped the new bin and shelving unit locations on the floor for the stores operative to asses. This ended the stores research study.

The mail room and stores would not become a better organised and visually efficient operation and the lean visual workplace management project delivery cycle designed artefact was not tested. The research exploration did however validate that change in the workplace will effect employees behaviour. Office workers have a tendency to struggle with accountability of their work activities. Change and reorganisations bring about job reallocations and redundancies, which can develop in to employees mistrusting management. It's not just about refocusing efforts on a leaner visual workplace; it's about managing change in the workplace and reinforcing employee behaviour. According to Bicheno and Holweg (2009, p.203) "the effectiveness of change (E) is the product of quality change (Q), times the acceptance of change (A): E = Q x A" (Bicheno and Holweg, 2009, p.203). The change equation must be in unison, in other words, quality of change will not ensure change without effectiveness and acceptance collectively. This is a subject that requires further research.

5.11 Chapter Five Research Case Study Two Exploration Conclusion

Chapter 5 case study two followed a three phase design science research framework with an action research cycle approach. The case exploration went through three action research cycles of: observation, planned, intervention and reflection. There were four action research reflection cycles, three out of the four reflection cycles revealed employee resistance to change and behaviour issues not considered prior to the action research learning reflections. Action research reflection cycle one, AAR#1 reviewed Vickers theory of workplace change (noted in Section 5.6) in which employees' are inclined to

resist anything new, such as a transformation or reorganisation of standard work, processes and procedures. When change occurs, employees develop a fear of loss and have a tendency to mistrust authority figures, such as management and academic researchers. Or any authority figure that poses a threat to the old way of working. This started to become an emerging theme during case study two and demands further investigation.

The leanness of estates and property services facilities management practice was observed and compared to exemplary case study one, third party outsourced facilities management service provider, Balfour Beatty Workplace. The main constructs that were contrasted were lean principles, concepts, visual management technologies, value and workplace barriers. The problem statement was identified in section 5.4 and 5.4.1. As a result a lean visual management workshop blitz artefact was designed and executed to sixteen estates and property services facilities management staff. The designed artefact workshop blitz was validated by case study participants after integration. After the workshop the visual management concept of gemba walks started to become a weekly ritual. Visual management technologies where created and integrated in the workplace.

An unstructured interview follow up was conducted one year after the original study, it was discovered that there had not been any additional visual artefacts designed or lean concepts initiated. The continuation of estates and property services lean journey momentum stopped. Everything stayed as it was for several years. According to Kurt Lewins (Cameron & Green, 2015) three step frozen theory of organisation change; once you unthaw the existing ‘as is’ state, you create the new proposed state and only when the new ‘to be’ state of affairs is developed do you refreeze the organisation. The research concludes that E&PS may never achieve the ability to refreeze themselves, since they have not come to terms with new ‘mind sets and habits’ (Cameron & Green, 2015, p.36). They are in constant flux.

An additional lean visual workplace management project delivery cycle was designed with the expectation of having another successful design artefact implementation. The implementation process was stopped by a disgruntled employee. An E&PS lower level mail room operative was not willing to participate in the research study and pressured the other mail room operatives to go along with him. This concept could be further developed

in another facilities management research study. What did develop is an additional theory that had not been researched up until this situation occurred. Employees get very used to their surroundings and are not always willing to change when the organisations needs them to change. They meet with resistance and embody a force field around themselves and their workplace, not letting anyone in unless they pass their trust marker. In order for this situation to change, it is going to take a strong manager who is extremely knowledgeable about change management concepts and can embrace the situation with a light touch and very positive visual communications. Then again, if the research study is not continuing, does it really matter if the employee changes with the transformation efforts, or not? Will E&PS ever get refrozen in to the new 'to be' state?

The next chapter will cross analyse the two case studies and artefacts designed. Lean principles, concepts, and visual management technologies in facilities management will be discussed and recommendations for integration will be recommended. Further discussion on the research framework and action research cycles will be presented.

CHAPTER 6
CROSS ANALYSIS DISCUSSION, RECOMMENDATIONS AND PROPOSED FUTURE RESEARCH

6.1 Comparative Analysis of Exemplary Case Study One and Exploratory Case Study Two

In exemplary case study one, a lean facilities management third party outsourced service provider had just won a contract to manage a new offsite university facility. The case assessed the leanness of their facilities operation against the visual workplace management building system developed in Chapter Two (Figure 6, Section 2.7). The research exploration considered the lean visual management technologies that Belfour Beatty Workplace integrated as a comparison for assessing the main university facilities management transformation programme. BBW is managing only four stories of a high profile newly constructed building for the university, compared to the 70 hectare, (172 acres), 69 building campus that E&PS is managing, with additional buildings under construction. Though BBW's building is small in contrast, E&PS, or any facilities management department could benefit from integrating lean facilities workplace management technologies in to their system.

For instance, one point of contact is a prime example of an efficient, motion saving work process. Both, BBW and E&PS are utilizing this lean concept and it has been beneficial. It saves time, communications, and cost in managing the work order lifecycle. BBW has one planning and dispatch coordinator off site at a National Operations Centre assigning all building issues and communications to the one building engineer, and calling on contractors if needed. E&PS has instated the same type of strategy with the reengineered reception/helpdesk support team associate role. There are five reception areas spread out around campus. The reception/helpdesk support team associate manages the entire work order life cycle against service level agreement metrics, as does BBW's planning and dispatch coordinator. The point to make here is that BBW designed their FM operations to run like this from the very start of their contract, whereas E&PS has just started to implement the new role of the reception/helpdesk support team associate. The responsibility of the reception/helpdesk support team associate is still evolving. Once the new CISCO phone system was installed, they acquired additional reception areas to manage and was able to increase the responsibility of managing the work order lifecycle.

Resulting in more calls being answered, more work orders implemented, tracked and closed out, better communications with in house staff, and one point of contact for customers. It has evolved in to a standard process driven task.

Another lean concept was value stream mapping. Once again, BBW value streamed mapped all processes and procedures prior to the start of their FM services contract. Six months after the building had opened, they were going back to revalue stream map all workflow processes. E&PS value streamed mapped all workflow processes in 2011 and never went back to re-evaluate. It has been approximately 5 years since the first value stream mapping was completed. With the amount of work issues and PPM planning that the facilities management department handles, value stream mapping to discover wasted efforts, streamline processes, and continuously improve services should be done at least once a year.

This leads into the next lean principle of continuous improvement efforts, literature conceded that this is an area where most organisations lose momentum in their transformation efforts. It is suggested that a lean champion, lean agent, or lean manager, or whatever the company would like to label this position, be nominated to enhance collaboration and communications between the estates department, offsite facilities, the different colleges, schools and university administration, to ensure utilisation of all assets are maximised. This is the beginning stages of lean facilities management adoption in a complex university FM practice. Evidence of a system of continuous improvement has not been sustained. The framework for the start of a constant learning organisation has been created. It is acknowledged that this forms part of an on-going continuous improvement value creation concept that is consistent with lean visual management thinking.

It is envisioned that an employee is nominated to manage the continuous improvement effort. Without this position, the lean efforts will never stabilise. Furthermore, the FM department will never completely research their goal of being a lean visual workplace. Putting out fires will always be their mantra, instead of running an efficient visual facilities management workplace that is process driven, customer oriented (both internal and external), where the workforce is educated and confident. The customer and

executive leadership will notice the difference and facility managers can be the model of change.

Multi-skilled workers are a significant lean concept. Especially in the FM and real estate industry where employees are tasked with everything and anything, you can imagine in order to manage real estate assets on a daily basis. One day they may be setting up for an event, the next day hanging wall mounted file sorters. The next day fixing some furniture and perhaps even painting the walls in the C-suite. BBW's handypersons/porters are tasked with every type of job you can think of and they welcome the opportunity, and do their job well. As for E&PS, this is an area in need of improvement. Their internal transformation program initiative estimated a £136,000 savings, equalling a 20% overall savings could be justified by transferring specific workflow activities that were performed by multi-skilled tradespersons to building handypersons staff. It also meant making one multi-skilled tradespersons redundant.

It looked good on paper; in hindsight, it was not as successful as intended. The theory behind the reallocation of workflow activities was that multi-skilled tradespersons staff would be freed up to work on maintenance backlog and respond to work orders more efficiently. They failed to realise that the knowledge, motivation, and skill set of the handypersons were not up to par and they lacked the mind-set to accept their new workload. There was no incentive for handypersons to take on extra work. Their direct reports, the building managers believed that they were unfit to perform the work assigned as they supported the handypersons when they did not want to or could not perform the assigned tasks. It did not help that their direct reports, the building managers, played in to their lack of resiliency to learn new skills. They needed much more training in order to perform certain reactive maintenance repairs then previously realised. Nonetheless, the work order tickets were still being assigned to the multi-skilled tradespersons to mitigate. Multi-skilled workers are still a great asset of any lean facilities management department. The case studies revisit Alexander's (2003) theory that facilities management encourages employees to create a more positive workplace when process and procedures are improved, this is not always the case.

The trendiest word in FM today and what lean and visual management stand for is 'value'. How do we as FM professionals instil value on our customers, our workers, the

supply chain and especially the C-suite. This subject has been researched and discussed in the boardroom since FM's conception. Steven EE (2015) recently published a quick reading book on 'value-based' facilities management. His theory is parallel to lean visual management integration. Knowing your business and scope of services, understand your internal and external clients, "adapting to organisational change" and "enhancing business performance" (EE, 2015, p.42) are all components of a lean visual workplace management system. If a facilities manager is practicing lean visual management systems, they are practicing value based FM, linking their operations to the organisation in a more holistic way, and getting noticed at the same time.

The literature review generated emerging constructs such as visuality, visual communications and visual creativity, classifying visual management themes in to visual technologies, and the theory behind a visual workplace. The researcher created the visual workplace management building system based on the literature emerging constructs. Most of the technologies are being implemented in manufacturing, IT, and construction industry with value added realisation. The main fundamentals of FM are linked to a social system composed of people, places, processes, and technology, governed by work standards, service level agreements, and key performance indicators. This can all be tracked and openly communicated through the integration of visual technologies. This is where FM can get noticed, establishing themselves as a visual technical industry.

In comparing visual technologies between BBW and E&PS; BBW made use of visual communication boards, organised and labelled working files and placed them in specific locations for all employees to gain access to. There receptionist colour coded work related clipboards with university logo's and student instructions. On the other hand, E&PS started their visual order integration only after the first designed artefact was introduced and integrated. They did not sustain the use of visual white boards for facilities operations. Both FM departments can gain knowledge from using the visual workplace management building system. Lean principles, lean communications and visual management technologies that both FM departments integrated are organized in to Table 18. This table is a guideline of what lean principles, concepts, and visual management technologies are possible in facilities management systems.

The FM department manager can make a copy of the visual workplace management building system and Table 18, and post it in the office for all to see. Place a laminated copy near their desk, or slip a copy in a plastic sheet protector sleeve and make it accessible for all FM employees. Any new lean principles, concepts, and visual management technology creation and integration should be added to the list.

Table 18: Guidelines for Value Based Visual Facilities Management

Recipe for Value Based FM Department Lean Concepts and Visual Management Technologies for Successful Integration in Facilities Management Systems
Lean Principles ▪ Value based FM. ▪ Multi skilled Workers. ▪ One Point of Contact. ▪ Value Stream Mapping. ▪ Continuous Improvement Cycle. ▪ Appoint a Lean/Visual Manager or Champion. ▪ Reading books on Visual Workplace, Visual Thinking.
Visual Communications ▪ Visual Creativity. ▪ Establish a lean visual knowledge based work force. ▪ Speaking the Language of Lean and Visual Management.
Visual Controls, Visual Office, Machine and Guarantees ▪ Design to Task. ▪ Colour Coded Data/Phone Cables. ▪ Reception/Helpdesk Staff 24/7/52. ▪ CAFM Systems or CMMS Systems. ▪ Intelligent Call Monitoring Phone System. ▪ IPD and Smart Phone or Tablet use in O&M ▪ Furniture re-use and Recycling E-brochure for re-use. ▪ Colour Coded Clip Boards, easy access in lieu of files.
Visual Order, Establish a Visual Foundation ▪ 5S System. ▪ Pattern of Work. ▪ Security Panic Button. ▪ Gemba Walks, Go See. ▪ Colour Coded Cabinet Doors with coordinated coloured. ▪ Key Chains, using Colour Coded Dots. ▪ Visual Safety Solutions, Door Release Button and Security. ▪ Identifying through Labels, black letters/numbers with yellow background, best visual colour combination.
Visual Displays, Performance Metrics and Standards ▪ A3 Report. ▪ Benchmark Systems ▪ Visual Display Boards. ▪ Visual Problem Solving. ▪ Service Level Agreements. ▪ Key Performance Indicators. ▪ Restructure Security Systems. ▪ Monthly Performance Reports. ▪ Comply with Customer Funded Works Policy. ▪ Reduce Planned Preventive Maintenance (PPM). ▪ New Standards of Work and Processes and Procedures. ▪ Student CAFM Net Accommodation Instructional Sheet.

To summarize visual communications in the workplace, it's not just about efficiencies in the workplace and visual displays, performance metrics, workflow processes and standards, visual controls, visual office, visual machines and guarantees, patterns of work, visual order, and visual transparency; it's about building a culture of change agents, and building knowledge and a learning environment. Mestre, Stainer, Stainer, and Strom

(1999), advocate that visual communications in the workplace brings about four social rewards that transforms a typical workplace in to a visual workforce, such as (Interpreted from Mestre, Stainer, Stainer, & Strom, 1999, p. 36):

1) Assimilation: Where visuality is integrated in to the workplace and a visual unspoken language begins to occur.
2) Exposure: Brings about transparency in to the workplace and reinforces visuality, making employees more comfortable, due to repeated exposure.
3) Evoking: Visuality is advocated in the workplace and it becomes second nature. It helps employees react to the changing environment and they feel more at ease.
4) Unifying: Visual communications through accessibility to information and learning tools.

Visual communications is embedded in the foundation of Japanese business culture and ethics. In Western organisations, there is a tendency toward promoting the idea of visual communications rather than embed it in to the mission, vision, culture and ethics of the organisation. Embracing operational transparency through visual communication and visual technology integration, can bring about positive change in the workplace. Mestre, Stainer, Stainer, and Strom, (1999) advocates the integration of the following seven functions in to the workplace to bring about positive attitudes when implanting new lean and visual management strategies (Interpreted from Mestre, Stainer, Stainer, & Strom, 1999, p. 38):

1) Get group membership buy in.
2) Acquaint members with corporate mission and culture.
3) Maintain corporate vision.
4) Communicate to new employees of all changes in the workplace.
5) Manage human relations.
6) Provide avenues for employees to express their opinions and suggestions.
7) Transform the corporate paradigm.

This can all be linked to organisation culture through its strategies, mission, vision, and goals. Understand that rewards and key functions of a visual workplace can contribute to

a value based FM department that will become a prototype for change in the organisation. The next section will discuss artefacts implemented and key outcomes.

6.2 Lean Visual Management Workshop Blitz Artefact Workplace Overview

The lean visual management workshop was a solution to a problem that existed throughout E&PSs restructuring programme. Employees were unaware of what lean meant although their transformation objective was to improve FM services through a lean approach, added value and process mapping. The workshop artefact was specifically designed to introduce lean transformation concepts, lean principles, and visual management technologies at a level that employees with a variety of skillsets could understand.

In lean organisations companies will start introducing lean through what is known as a kaizen blitz (Bicheno & Holweg, 2009), a visual management blitz, or what Galsworth (2011) considers a visual workplace blitz. A lean blitz is an organized workshop where a group of employees gather to focus on improving parts of the system. It can last a few hours, one day or a week depending on your organisation and how much time leadership will commit too. In estates and property services, Chapter Five exploratory case study, a one day event that would coincide with a typical workday was planned. The topic, events, activities were all designed and developed by the researcher. An active learning approach was implemented where E&PS employees would learn aspects of lean transformation concepts and visual management through lectures, group activities and discussions.

The workshop was layered in to four content areas. Content areas one introduced lean principles and transformation concepts, based on the fact that E&PS was going through a lean transformation programme. Content area two introduced visual management and a visual technology A3 Report exercise. The A3 Report activity provided E&PS an interactive experience where employees of all levels visually collaborated to solve current FM workplace problems. This activity had the most influence on attendees. At first, everyone was very apprehensive about splitting up in to groups, figuring out a current problem, and designing a solution. Then deciding how to illustrate the problem on an A3 sheet of paper, which is only 29.7 x 42.0 cm (UK) or 11 x 17 inches (US). In the end 87% of workshop attendees appreciated the relevance of the A3 activity. The executive level management team continued to use A3 reporting as part of their management tools.

Content area three focused on perceiving value as it relates to E&PS and their three defined customers; staff, students, public and community. A side conversation took place about how value is perceived from a personal point of view as an employee and internal customer to the university and the facilities management department. The goal was to have all estates employees on the same path in understanding value. To ask the questions: what does value mean to me personally?; what value means to E&PS?; and what value means to the customers?. Conversations like this rarely happen in the FM workplace. If it does, it is most likely at the management level. Not at the lower level, the nonprofessional's, and craft workers such as: handypersons, porters, multi-skilled tradespersons, and reception/helpdesk associate level. It is necessary while going through a lean journey for employees to understand how much a part of the system they truly are. That their sense of value, how they perceive value, and entrust value in their everyday work habits is observed by customers and peers. Content area four touched on a discussion and questionnaire concerning the barriers that E&PS employees face in the workplace.

At the end of the workshop vital information was given to attendees such as; more ways to make a lean visual document, a guide for making an A3, along with two different visual workplace handbooks. By presenting the workshop, additional reading material, suggesting books about visual workplace and operator led visuality, the intent was to start to develop a lean FM learning environment. To instil lean concepts and visual management tools and technologies, demonstrating how a simple A3 sheet of paper can improve workplace obstacles. The researcher intended to empower the workshop participants with the idea that they can make change happen, and that change is good. That if employees had access to the right tools and technologies, they could take the initiative to design their own lean visual workplace. All of the workshop artefacts can be viewed in Appendix B thru H. To include the agenda, activities, presentations, handouts, feedback form and one year later check-in questionnaire. Future research integrating workshop material, presentations and structure in FM systems is proposed.

6.3 Third Design Artefact Lean Visual Workplace Management Project Delivery Cycle

Not all research develops the way in which you plan it. After the first artefact was integrated and the workshop blitz was over, the researcher went back to the literature

review and action research cycle planned. E&PS was following through and starting to create visual technologies in the new office area. There was not any evidence of visual management implementation in the other four reception/helpdesk locations. It was observed that not all areas of E&PS had been reorganised. The mailroom and facilities stores had not been identified as needing improvements. After one site visit to the stores it was determined that it was in need of a 5S scrub down. It required sorting, shining, setting orderly procedures, and of course standardise and sustain the new system in place.

Literature proposes that any lean or visual management integration should have a lean management systems approach. Companies put too much emphasis on the implementation of concepts, principles and technologies and little emphasis on the entire process itself. This needs to be considered from a systems thinking point of view, and include a project delivery system to actually manage the transformation and change. After exploring this subject the researcher designed a third artefact, a lean visual workplace management project delivery cycle. The project delivery cycle has six coloured phases that can assist the facility manager in implementing change phase by phase. The designed artefact is illustrated in Chapter 5, Section 5.10, Figure 42, and Appendix L.

It was a short-lived initiative, due to employee resistance and behaviour issues directed at the researcher, the actual implementation stage stopped abruptly. Emerging subject matter takes a different direction. Back to the literature analysis and Bicheno and Holwegs (2009) theory that “making changes to someone’s working space and procedures, and not managing these changes will mean that the individual is likely to oppose, and in some cases even sabotage the proposed changes” (Bicheno & Holweg, 2009, p.203). Schein (In Cameron & Green, 2015) developed an underpinning theory on individuals and change. When individuals are going through change he conceptualises that there are two major influences. There is anxiety “associated with learning something new. Will I fail? Will I be exposed? The second, competing force is survival anxiety. This concerns the pressure to change. What if I don’t change? Will I get left behind?” (Schein, In Cameron & Green, 2015, p.54). This leads to employee resistance and poor attitudes. In order to mitigate employee attitude issues, management has to be cognisant of the individuals ‘resistant to change’ and help them through their anxiety. Shein (In Cameron & Green, 2015) suggests that managers should take on the role of change agents and intervene at different intervals

in hopes that the individual will increase their “sense of psychological safety” (Shein, In Cameron & Green, 2015, p.56).

Surely a change management intervention is well overdue in estates and property services. Several years ago across estates and the university there were customer groups and survey’s done, though a change management plan was not part of the transformation programme. This evolving theme of employees resistance to change and behaviour issues started to develop as the researcher attempted to further the study.

6.4 Design Science Research with Action Research Cycles Framework for Facilities Management

The design science research with action research cycles framework was designed specifically for this case study. The framework used a three phase design science research concept: phase one: identify the problem; phase two: create and design a solution; phase three: evaluate the outcomes. Phase one literature review tracked a UK university estates and property services facilities management department’s lean journey. Their FM services restructuring programme was based on many challenging circumstances that influenced a university wide Transformation Programme and New Strategic Plan that goes in to effect in 2017. UK higher education has been hit hard by economic factors, funding issues, insufficient resources, and increases in student tuition.

As a result E&PS was tasked with cutting £1 million from their facilities operating budget. Their own restructuring programme objective took on a lean approach. The research study investigated what adapting a lean approach really meant for them, when staff at all levels had never heard of lean, let alone process mapping and value added initiatives. Phase one problem was established to assess if E&PS was in fact practicing lean facilities management. It was determined that E&PS had launched a lean restructuring programme. What percentage of a lean programme had been accomplished, or at what stage is E&PS on their lean journey, is something that cannot be quantified. What can be established is that they are far from perfection and will need to focus more on people, process, places and technology if they want to succeed on their lean journey. Additionally, executive leadership and management should reinforce lean implementation, continuous improvement and educating staff in lean principles, concepts and visual management technologies.

In Phase Two, design and create a solution to the problem, the solution designed artefact took form as a lean visual management workshop blitz artefact to educate E&PS staff in lean transformation concepts and visual management technologies. In actuality the development of the lean visual facilities management workplace blitz artefact took almost six months to develop in its entirety. The methodology took on a unique triangulation of research methods, starting with a design science research philosophy, creating a solution to a real workplace problem, and using action research cycles of integration. Combined with the researchers' employment with E&PS, lead to their ability to participate in action during the research exploration.

Action research is based on cycles of research similar to design science and both seek to find a resolution to real life problems. In action research the researcher engages with people very closely, in a collaborative format. Its goal is to self-reflect and enquire at various stages of research to formulate personal discoveries that emerge, and how it affects the researcher or the situation (Ivankova, 2015). Lewins (1948) traditional action research cycle is: plan, act, observe, and reflect. For this exploration, the action research cycles chosen where: observation, planned, intervention, and reflection. The study went through three entire action research cycles and four action research reflection/action research learning cycles.

Design Science phase three evaluated the outcomes of phase two. It reflected back on what transpired once lean concepts and visual management was introduced to estates and property services staff. The outcomes would have been significantly different had the researcher not been employed by E&PS, the case would not have taken on such a personal enquiry, which forms part of an action research approach. A schedule for the case exploration follow up was proposed for 5 months after the initial workshop integration (October 2012), 8 months afterward (January 2013), and one year later (May 2013).

The research strictly followed the research framework designed in Chapter Three, section 3.8, Figure 17. Every step of the study was reflected back to the framework and intervention through action research cycles. It presented a methodical structure and kept the researcher focused. There is a lack of visual identifiers in design science research,

especially with an action research approach. It is the researchers' expectation that the framework designed is carried forward.

6.5 Soft System Methodology Framework

The research followed a soft systems learning cycle of action. An original schematic learning cycle model was designed as the research started to develop relationships. This can be viewed in Chapter Three, section 3.9, Figure 19. The final thesis soft systems methodology model cycles of learning for action is illustrated in Figure 49.

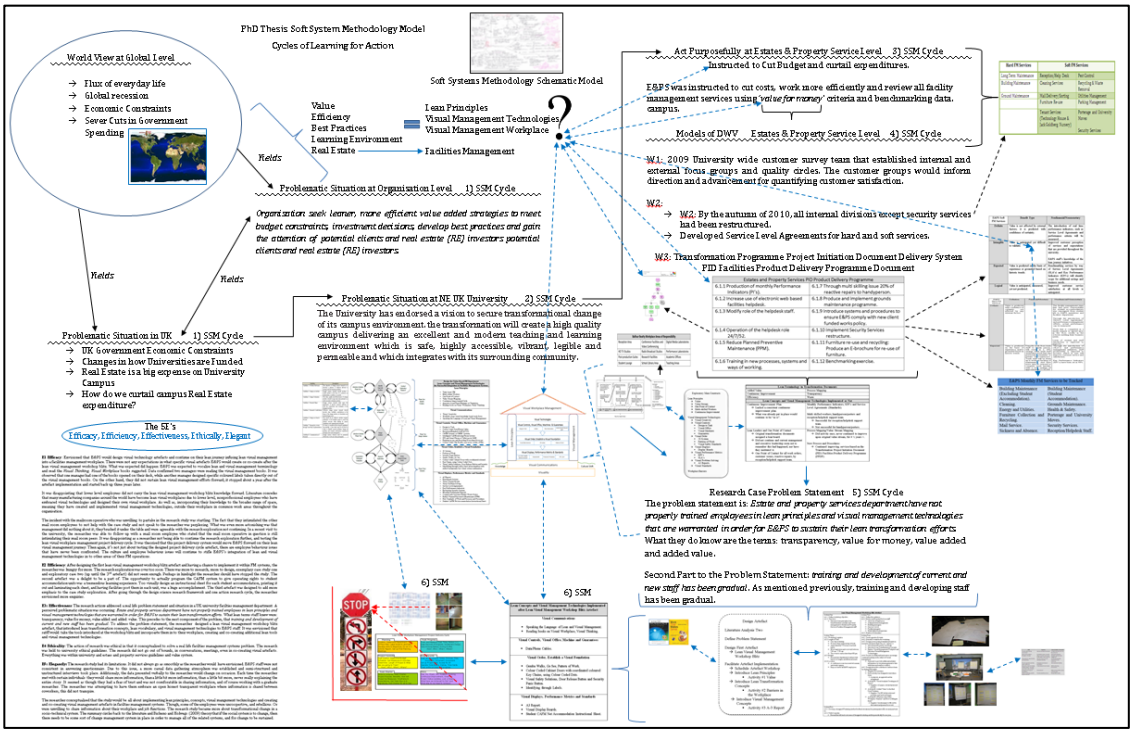


Figure 49: Soft Systems Methodology Model Cycles of Learning for Action

A larger copy is attached in Appendix P for viewing. SSM has several learning in action guidelines to assist the researcher in finding relationships in the research study. Similar to design science research and action research, SSM models search for solutions to solve real life problems. SSM engages the researcher to reflect on the larger picture. The research starts at exploring a worldwide view and then helps in dissecting the exploration in to smaller learning cycles. In any SSM study, three elements link the improvement cycle of problem solving real life situations. The three elements are (Checkland & Poulter, 2006, p.27):

1) Interviewing in the problematical situation.
2) The perceived content of the situation.
3) Follow the SSM learning cycles of inquiry (Checkland & Poulter, 2006, p.27).

The considerations that summarised the SSM cycles of learning for action for this research exploration are the 5E's. It is more common to use the 3E enquiry: E_1 Efficacy, E_2 Efficiency, and E_3 Effectiveness. The additional two E's are added to the research enquiry if more validity is needed, or the researcher wants to build further on the research learning cycles. The SSM 5E concepts for this research study are as follows:

E_1 Efficacy: Envisioned that E&PS would design visual technology artefacts and continue on their lean journey infusing lean visual management into a facilities management workplace. There were not any expectations in what specific visual artefacts E&PS would create or co-create after the lean visual management workshop blitz. What was expected did happen: E&PS was expected to vocalise lean and visual management terminology and read the *Visual Thinking, Visual Workplace* books suggested. Data confirmed two managers were reading the visual management books. It was observed that one manager had one of the books opened on their desk, while another manager designed specific coloured labels taken directly out of the visual management books. On the other hand, they did not sustain lean visual management efforts forward; it stopped about a year after the artefact implementation and started back up three years later.

It was disappointing that lower level employees did not carry the lean visual management workshop blitz knowledge forward. Literature concedes that many manufacturing companies around the world have become lean visual workplaces due to lower level, nonprofessional employees who have embraced visual technologies and designed their own visual workplace. As well as, incorporating their knowledge to the broader range of space, meaning they have created and implemented visual management technologies, outside their workplace in common work areas throughout the organisation.

The incident with the mailroom operative who was unwilling to partake in the research study was startling. The fact that they intimidated the other mail room employees to not help with the case study and not speak to the researcher was perplexing. What was even more astonishing was that management did nothing about it; they brushed it under the

table and were agreeable with the research exploration not continuing. In a recent visit to the university, the researcher was able to follow up with a mail room employee who stated that the mail room operative in question is still intimidating their mail room peers. It was disappointing as a researcher not being able to continue the research exploration further, and testing the lean visual workplace management project delivery cycle. It was theorised that this project delivery system would move E&PS forward on their lean visual management journey. Then again, it's not just about testing the designed project delivery cycle artefact, there are employee behaviour issues that have never been confronted. The culture and employee behaviour issues will continue to stifle E&PS's integration of lean and visual management technologies in to other areas of their FM operations.

E2 Efficiency: After designing the first lean visual management workshop blitz artefact and having a chance to implement it within FM systems, the researcher was hungry for more. The research exploration was over too soon. There was more to research, more to design, exemplary case study one and exploratory case two (up until the 3rd artefact) did not seem enough. Perhaps in hindsight the researcher should have stopped the study. The second artefact was a delight to be a part of. The opportunity to actually program the CAFM system to give operating rights to student accommodation units was a tremendous learning experience. Too visually design an instructional sheet for each student accommodation, printing it out and laminating each sheet, and having facilities post them in each unit, was a huge accomplishment. The third artefact was designed to add more emphasis to the case study exploration. After going through the design science research framework and one action research cycle, the researcher envisioned more enquiries.

E3: Effectiveness: The research actions addressed a real life problem statement and situation in a UK university facilties management department. A perceived problematic situation was occurring: *Estate and property services department have not properly trained employees in lean principles and visual management technologies that are warranted in order for E&PS to sustain their lean transformation efforts.* What lean terms staff knew were: transparency, value for money, value added and added value. This precedes to the next component of the problem, that *training and development of current and new staff has been gradual*. To address the problem statement, the researcher designed a lean visual management workshop blitz artefact, that introduced lean transformation concepts, lean vocabulary, and visual management technologies to E&PS

staff. It was envisioned that satff would take the tools introduced at the workshop blitz and incorpoarte them in to their workplace, creating and co-creating additional lean tools and visual management technologies.

E_4 Ethicality: The action of research was ethical in that it conceptualised to solve a real life facilties management systems problem. The research was held to university ethical guidelines. The research did not go out of bounds, in conversations, meetings, even in co-creating visual artefacts. Everything was within univeristy and estaes and property services guidelines and value system.

E_5: Elegantly: The research study had its limitations. It did not always go as smoothly as the researcher would have envisioned. E&PS staff were not consistent in answering questionnairs. Due to this issue, a more casual data gathering atmosphere was established and semi-structured and unstructured interviews took place. Additionaly, the data presented verbally to the researcher would change on occasion. Each time the researcher met with certain individuals they would share more information, than a little bit more information, than a little bit more, never really explaining the entire story. It seemed as though they had a fear of trust and was not comforatable in sharing information, and of course working with a graduate researcher. The researcher was attempting to have them embrace an open honest transparent workplace where information is shared between coworkers, this did not transpire.

The researcher conceptualised that the study would be all about implementing lean principles, concepts, visual mangement technologies and creating and co-creating visual management artefacts in facilties management systems. Though, some of the employees were uncoopertive, and rebellious. Or were unwilling to share information about their workplace and job functions. The research study became more about transformational change in a socio-technical system. The summary circles back to the literature and Bicheno and Holwegs (2009) theory that if the social system is to change, then there needs to be some sort of change management system in place in order to manage all of the related systems, and for change to be sustained.

6.6 Future Research Opportunities

The entire research exploration and how it relates to the developing constructs of lean principles, concepts and visual management technologies and systems thinking integrated in facilities management systems is relatively a new way of approaching value based FM. The research methodology used was an innovative method that incorporated design science research framework with an action research approach. Combined with soft systems methodology model cycles of learning for action, summarizing the overall research exploration using the 5E approach. It is recommended that one might embrace the following research opportunities for future enquiry.

6.6.1 Facilities Management

Facilities management is an under researched field. Which leads to a greater opportunity for further studies in current trends that will aid today's facility manager's to build a case of quantifying their existence to the C-suite. Far more people in FM are professionals, rather than academics. The trends are moving toward a value based facilities management industry linked to the organisation holistically. In order to highlight their value facility managers should explore creating a lean visual management culture among their workforce. Introducing lean principles, concepts, and visual management technologies in FM systems should be further developed. The technologies, tools, and concepts are in the pages of this thesis. The visual workplace management building system artefact designed is in the early stages of development and offers the field work for other researchers to further advance its limitations.

6.6.2 Lean Visual Management Workshop Blitz Artefact

This research makes the assumption that the results of conducting a lean visual management workshop blitz artefact would conclude different results if tested for authenticity. Future outcomes would depend on business criteria such as: FM services provided, people, processes, places, technology, and workplace culture. It would make a good research study to compare and contrast. Both university FM departments studied were establishing lean integration and formed part of a university wide strategic transformation programme. The workshop blitz artefact was designed to solve a specific real life organisational problem and may not be the same problem in another FM department. Though the workshop blitz artefact can certainly be used to introduce lean transformation concepts, terminology, and visual management technologies in a facilities

management system that is on the verge of change. The outcomes maybe significantly different.

6.6.3 Lean Principles, Concepts and Visual Management Technologies

The leanness of the two case studies were compared based on a set of lean principles and visual management constructs. The visual workplace management building system, illustrated in Figure 6, was used extensively throughout the research and the cases were organised around the visual technology categories. There is an opportunity here to build upon the structure and use of its design application. All of the lean principles, concepts and visual management technologies integrated in FM systems were captured by comparing both case studies FM operations and comprised in to Table 18. The table is a guideline for creating value based lean visual facilities management systems. It can be taken forward and transitioned in to a strategic FM department using the lean visual workplace management project delivery system, which was the third designed artefact. Which can be viewed in Figure 42 and Appendix L. Due to unforeseen conditions it was not able to be validated. This provides the opportunity for another researcher to design a case study around the lean visual workplace management project delivery cycle artefact.

6.6.4 Research Methodology

Design science research with an action research cycle framework in facilities management is limited. Additionally, a three cycle approach is not always taken in to consideration. The literature reveals that many design science research investigations consider a five phase approach. Imbedded in the framework designed for this research study are five steps, within a three phased action research process. More specifically shown are two literature review opportunities and a case participant's evaluation stage. This is where the organisation participants obtain use of the artefact and evaluate it for efficiency, effectiveness, and ethicality. Combining design science with an action research approach worked out very systematically for this particular research exploration. It is recommended that the said research framework be investigated further, particularly in facilities management systems. The combination of a soft systems methodology model, along with cycles of learning for action structure, complimented the design science and action research investigation. SSM is a branch of action research, where a real life problematic situation is perceived and you learn in action cycles. This theory requires further investigation.

To broaden the strategy of the design science research framework for facilities management, a set of design science research guidelines were reorganised, updated and made bespoke to this investigation. The wording was amended to flow with the researches style of investigation. It is surmised that going forward any design science research exploration, especially in FM, should follow these guidelines. They are discussed and illustrated in Chapter 3, section 3.6.1, Table 5.

6.7 Chapter Six Final Recommendation

The researcher used a soft systems methodology model to grasp the entire value of the research exploration. The SSM invites researchers to view the world at a global level and start the research investigation from a worldview perspective. This enquiries learning of action considered the worldview perspective and found that the 2008 global recession still had a profound effect on current international markets. Economic constraints have fostered severe cuts in government spending, which worked its way down to the UK government and universities. On university campuses, managing real estate assets are the largest expenditures. As a result, the UK University studied, developed a strategic plan and a university wide transformation programme. This trickled down to the estates and property services department that manages campus real estate. Estates and property services were instructed to transform their entire FM operations and services provided. The researcher arrives for study and notices that a big opportunity is waiting to be discovered. Hence, the start of the research study commences.

E&PS's entered in to a lean journey and restructuring effort, which had a profound effect on all facilities management standard work processes and procedures. The action cycles take the researcher back to the transformation programme, where lean concepts and value added strategies were implemented in estates and property services. FM is a social technical system made up of people (employees and customers both internal and external); places (the real estate and assets FM's manage); processes (for work orders, preventive maintenance, helpdesk functions and monthly reporting); and the machines and equipment (CAFM systems, tablets, phones, computers, and tools) FM's operate and maintain. All efforts where spent in remediating standard work processes and procedures, developing service level agreements and key performance criteria. What was forgotten is the people equation. At the heart of the facilities management department are the people, the employees feeling this flux. People are very much influenced by all the changing

elements around them. In a socio technical system if one system is off kilter, not working efficiently that day, it throws the entire ecosystem astray.

What was discovered is that lean principles, concepts and visual management technologies are being implemented in hopes of producing a proficient process driven, value based FM services department. Although, employees at every level are still full of anxiety and feeling the stress from the transformation efforts. They lack trust in their colleagues and management, some harass their fellow peers and think of change as the bad guy, because they do. Now everything is gridlocked and the FM department cannot move forward. Many employees are trying to get back to where everything used to be, their comfortable state. It is not all about the lean visual management workplace building system, or introducing the lean visual workshop blitz artefact, and certainly not about the lean visual workplace management project delivery cycle. It is about the people, and some of them are suffering. Which in turn pulls a plug in the FM system and it starts to leak, soon there are many small leaks all over and no one acknowledges them, not even management.

It is about change in the social technical system and how we go about managing people; places; processes and equipment while still managing change. Nobody looks at it from a systemic point of view, even though at the heart and soul of lean and visual management is a systems thinking philosophy. The challenge is to manage and build the workplace through process management systems and designate a lean change agent at every level of the socio-technical system. In other words, nominate a lower level operative in the mailroom as a lean visual change mediator. Designate a middle manager as a visual project delivery facilities manager. At the executive level, appoint a transformation program manager to oversee the entire process, phase by phase. Have the team meet on a weekly, monthly basis and bring questions, ideas, and project challenges to focus. This is fundamental to the overall success and proper implementation efforts. Careful consideration of department culture, policies, and willingness of the organisation to change should be taken in to consideration for lean visual management implementation to be effective.

The original exploratory constructs did not take in to consideration change management. It was during the research case study action research learning cycles that it surfaced.

Three out of the four reflective research cycles dealt with pragmatic people issues. It is recommenced that a further research study collaborates what was done herein and takes it forward exploring change management and systems thinking theory in facilities management ecologies. Management must accept the consequences if they are not willing to except leaks in their system. Minor patching of the symptoms here or there will not sustain the overall lean visual management transformation efforts.

CHAPTER 7
FINAL CONCLUSION

7.1 Introduction

The researcher through rigour has demonstrated the aptitude to independently conduct original research, making a contribution to theory, facilities management practice, design science research, action research and soft systems methodology. The researcher personally developed a design science framework with an action research approach. The framework graphically depicts the different phases and steps specifically one needs to follow in order to carry out a successful case study. Soft systems methodology and the five E's validated the research journey from a global perspective through the research case exploration. As a result of the literature review a visual workplace management building system was visually represented, and tested. The researcher formalized a new theory of facilities management '*that integrates a variety of disciplines and industries in order to manage, maintain, operate and ensure functionality of a sustainable built environment by integrating people, place, processes and technology to encompass a healthy, safe and efficient, value driven workplace aligning the FM function to the enterprise initiatives holistically'*. Overall, the thesis brings about competent, new insight to the field of facilities management.

The final thesis conclusion and contribution to knowledge is presented grounded on the research aim and objectives. Final thoughts on the research journey along with the research findings of integrating lean principles and visual management technologies in facilities management systems are presented. The thesis evaluated the potential of lean principles, concepts, and visual management technologies integration in facilities management systems, creating value based facilities management that improves people, places, processes and technology linking the FM practice to the organisation holistically. In pursuit of the research aim the research objectives validate the research challenge and define the methodology and research approach that constructed the exploration and development of the thesis framework.

7.2 Revisiting the Research Aim

The overall aim of the research was to conceptualise the theoretical and practical understanding of introducing lean principles, particularly visual management

technologies, into facilities management systems. This was accomplished through the literature analyses that identified the main constructs (facilities management, lean, visual management, and organisation change management), linking the research aim and objectives throughout the thesis, and developing research frameworks, instantiations, and artefacts. Chapter Two introduced facilities management as an industry and the relevant theoretical conjectures of how lean principles, lean management systems, and visual management technologies might be integrated in FM systems.

In Chapter Four an exemplary case study was conducted using design science research framework. The exemplary case study compared a lean third party outsourced facilities management services provider against the visual workplace management building system developed in Chapter Two. A second case study, in Chapter Five, assed the leanness of a university estates and property services department. The estates department was transforming their facilities management operations, and had already embarked on a lean journey. Their lean journey was compared with Chapter Four's case study; issues were found such as visual management technologies not being used consistently, and employees were not educated in lean principles, concepts and visual management. A problem statement was formed and an artefact developed as a solution to a real life organisational problem. The artefact was the proposed solution to mitigate the organisational problems that hindered transformation efforts. A lean visual management workshop blitz artefact was constructed and implemented in facilities management systems. The outcomes were assessed and revisited in Chapter Five.

A second visual artefact was co-created with university FM staff; a Student CAFM Net Accommodation Instructional Sheet. It was laminated and posted in all university student accommodation units. A third exploration in case study two, noted an additional problem statement and a third design artefact was created; a lean visual management project delivery cycle. However, it was not tested or implemented due to a confrontational employee and managements lack of engagement. Chapter Four and Chapter Five validated the theoretical and practical understanding of introducing lean principles, particularly visual management technologies, into facilities management systems. The two case studies challenged and defined the philosophy, methodology and research approach that constructed the investigation and developed the framework of this thesis.

7.3 Revisiting the Research Objectives

The research objectives that supported the research journey are revisited:

RO1: To identify current academic research and professional practices of lean principles and visual management in facilities management.

RO2: To conceptualize the theoretical framework of assessing the leanness of a facilities management department.

RO3: To develop, co-create and implement visual artefacts within a facilities management workplace.

RO4: To evaluate the benefits of lean and visual management technology integration in facilities management systems.

RO5: To make recommendations of lean principles and visual management technologies in facilities management system.

Research objective one *(RO1) identifies current academic research and professional practices of lean principles and visual management in facilities management.* This was accomplished throughout the literature review in Chapter Two. A thorough systematic literature analysis of lean principles and visual management in facilities management sectors such as: cleaning/janitorial services, helpdesk/work reception centre, operations and maintenance, real estate/property management and security systems, was conducted. Research findings established that lean principles and visual management technologies has limited application in facilities management systems opening up the opportunity to build a foundation of enquiry in this area. Case study one was selected due to the fact that third party outsourced facilities management service provider was part of a lean organisation.

The study concluded lean principles that are mostly found integrated in FM systems are typically: value, value stream mapping, multi-skilled workers, and one point of contact especially in the role of the reception/helpdesk and work management centre. Value stream mapping is useful in defining new work standards and mapping out existing and ‘to be’ states of work processes and procedures. Some companies are more strategic then others when it comes too continuous improvement planning. The main university facilities management department feel short on the PDCA, continuous improvement cycle.

Most of the visual management technologies implemented in FM systems are in the following categories of: visual displays, performance metrics and standards. The FM case studies are performance based, and process socio technical systems that rely on service level agreements and performance indicators to monitor operations. It makes sense that most visual technologies used are from this category. On the other hand, it limits the use and benefit from the other visual categories. Every FM office can use a good 5S systems integration to sort, shine, standardise and organise work areas, especially the main university's department. Any FM system should integrate visual technologies such as colour coded dots, and labels; patterns of work that can be designed and visual safety solutions that could be in the form of a sign, a hazard sticker, and neo strips on the bullnose of a stairwell.

Research objective two *(RO2) conceptualises a theoretical framework for assessing the leanness of a facilities management department*. Several frameworks were developed for assessing the leanness of a facilities management department. A visual workplace management framework (in Chapter Two, Figure 6) was constructed from the literature analysis to measure the leanness of both case studies; the main universities estates and property services lean transformation journey and their outsourced third party lean facilities management service provider. The main constructs used throughout the research inquiry were: lean principles and concepts; visuality, visual communications, and visual management technologies that are organised in the following categories: visual displays, performance metrics and standards; visual order, establish a visual foundation; and visual controls, visual office, machines and guarantees. The result of applying the visual workplace management framework was discussed throughout the two case studies. The overall results were developed in to a visual management guideline table (Chapter Six, Table 18) that can aid in assessing the leanness of a facilities management department.

Research objective three *(RO3) is to introduce lean principles and visual management within a facilities management workplace*. This is illustrated in Chapter Five exploratory case study two. The case study starts in design science research phase one; conducting exploratory research and a literature review to identify the case study problem. In design science phase two with an action research planned cycle; a design solution in the form of an artefact was planned, created, and implemented. Design science phase three evaluate, and action research cycle intervention, is where the designed artefact was introduced in

action. The design artefact, a lean visual management workshop blitz, introduced lean principles and visual management technologies within a facilities management workplace.

Research objective four *(RO4) was to develop and implement visual artefacts within a facilities management workplace.* As a result of the literature review, a visual workplace management building system artefact was developed and implemented throughout the two case studies. The visual artefact was used to interpret the extent of lean principles, concepts and visual management integration in the two facilities management workplaces. The design science research with action research cycles framework visual artefact was developed and used as the research methodology throughout the case exploration.

In Chapter Five case study in the design science phase two with an action research planned cycle; three visual artefacts were developed. The first visual artefact designed was in the form of a visual management workshop blitz. Visual artefacts were implemented in design science phase three evaluate, and action research cycle intervention after the visual management workshop blitz was presented. The second visual artefact designed was co-created with university FM staff; a Student CAFM Net Accommodation Instructional Sheet. There was a third design artefact created; a lean visual management project delivery cycle. As a result of the first visual artefact implementation the FM department designed and integrated additional visual artefacts in the workplace.

Research objective five *(RO5) is to evaluate the outcomes once lean principles and visual management have been introduced and artefacts integrated in facilities management systems*. This was accomplished throughout Chapter Four and discussed further in section 4.7. In Chapter Five, design science phase three evaluate and action research cycle intervention starting in section 5.6, the outcomes of introducing lean principles and visual management systems were evaluated. In Chapter Six lean principles, visual management, and designed artefact integration was cross analysed and evaluated. Chapter Seven additionally, sums up the research findings of integrating designed artefacts, lean principles, concepts, and visual management technologies in facilities management systems.

7.4 Contribution to Knowledge

The thesis contributes to theory and brings to the forefront methods designed to transform facilities management operations. The case studies reveal how a university facilities management department operated and evaluated the effectiveness of the strategies applied during their lean transformation programme. The thesis establishes the difference between the main university facilities management department and their recently hired 3rd party outsourced lean facilities management service provider.

An outcome of the literature review, was the development of a lean visual workplace management system that merged visuality and visual communications, lean concepts, lean principles and visual management technologies. At the centre are three visual technology categories: visual displays, performance metrics and standard technologies; visual order, establishing visual foundation technologies; and visual controls, visual office, machines and guarantees. The lean visual workplace management system was used to access the leanness of both facilities management case studies lean journey. As a result, additional lean principles, concepts and visual management technology artefacts were introduced. This helped link the facilities management department to the university by establishing a more visible and sustainable value based FM practice.

In theory when this occurs, organisational culture is enabled as employees start to share knowledge by mentoring others and co-creating visual artefacts and efficiencies in the workplace. This was not the outcome that prevailed throughout the research study. University facilities management employees felt vulnerable during the transformation. They were reluctant to share information, to mentor each other, and some were inflexible with the new work environment. It didn't matter if they were directly or indirectly affected by the transformation and lean journey. Theoretically, organisational culture would be embed in the lean visual management integration as the workplace becomes more proficient, organised, and visual technologies capture a more adaptive workplace. Activating a cultural shift as employees become visual thinkers and a learning environment starts to take shape.

Changing a facilities management departments functions, and culture by restructuring the workplace, and not paying attention to the people is likely to develop bad attitudes, such as resistance to change; mistrust of management; and instil fear of the unknown.

Employees have a tendency to resist anything new and can sometimes sabotage the process and become belligerent towards each other. Therefore, it is advocated that a lean project management delivery system and change management plan be part of an organisations transformation and lean visual management integration system. The facility manager needs to be proactive in communicating and reinforcing change, and most of all engage employees in the process so that organisational culture becomes a positive outcome, not a negative.

The main elements of a social system are: performance measurements; responsibilities and work structures. It focus on human engagement, which is central to the achievement of any change management initiative. The challenges of change for FM systems are not just in the building assets, they can be in the form of new technologies, or computer systems upgrades, developing new workflow standards, service level agreements and performance metrics, and transformation programmes.

7.4.1 Contribution to Methodology

The literature acknowledged that there is a lack of extensive research using design science research methodology in facilities management. A unique design science research framework, combined with an action research approach, a soft systems methodology model, and cycles of learning for action were used throughout the case study. This is an emerging theory that has limited application in facilities management. All three research applications (design science research, action research, and soft systems methodology) solve real life problems. Furthermore, design science research and soft systems methodology has an action research approach where the researcher is imbedded in the organisation co-creating artefacts that solve tangible issues. The three methods of research have complimenting research cycles of inquiry that can be linked together in a research study. All designed and implemented research frameworks must be followed in a particular methodical order.

The research methodology framework developed contributes to knowledge in the field of design science and action research: an illustrated framework was created to show all the steps and cycles of research used throughout the exploratory research; a real life problem was identified; visual artefacts were designed and introduced in to the case organisation through action research cycles; and to conclude the research findings were evaluated.

During the action research approach, the academic researched in action, becoming part of the organization, and observing the result of the artefact implementation first hand. In case study two the FM department created visual management technology artefacts to solve real life performance issues.

The design science framework created has a three phase approach: phase one is to identify the solution; phase two is to design a solution based on the problem statement; phase three evaluates the research findings once the designed solution is implemented. The action research cycles of inquiry chosen for this study are: observation, planned, intervention, and reflection. A unique part of the research methodology is not only the combination of design science research with an action research approach; it is the combination of action research reflection and learning cycles. This is when the researcher steps back, reflects and learns from a perplexing occurrence during the case study exploration. The research intervention concluded that three full action research cycles were performed and four action research reflective learning cycles emerged.

The benefit of using soft systems methodology model cycles of learning for action brought the entire thesis in to perspective. It forces the researcher to analyse the bigger picture, from the global world view, to the individual cycles of knowledge, through to the final conclusion. SSM is a systems thinking approach to developing a thesis; it helps the researcher break down all the layers (chapters) of learning. The researcher can visualise their progression, investigation, and justify the data in order to build upon the constructs, frameworks, models, and artefacts designed. Each chapter (layer) links to the next, and the next, and all link to the final conclusion.

Soft systems methodology was discovered post hoc in the research study, during the case study intervention phase. The researcher was able to observe the research journey from the introduction and literature review, through the case study exploration in order to develop the final conclusion. The 5E model analysis presented a broader view of the entire research process and enquiry. On the other hand, it would have been more dynamic if SSM learning cycles of action were discovered in the beginning of the research journey, as originally hypothesised by Checkland (1999). This would conceivably structure a larger debate which might have produced a very different outcome, development of model building, and improvement artefacts.

Future research in facilities management industry can embrace this three method research methodology of design science research with an action research approach and soft systems methodology model of learning cycles. It is suggested that soft systems methodology form part of the initial research investigation and used throughout the entire exploration. This will provide a better understanding of the patterns that develop and relationships that take shape throughout the research study.

7.4.2 Contribution to Practice

The research brings to light the idea of integrating lean principles, concepts and visual management technologies in facilities management practice. Visual management technologies have been explored in manufacturing, construction projects and service organisations yet lacks a logical framework in the FM industry, particularly in a UK university facilities management practice. This research is intended to make a contribution to the embodiment of industry knowledge by exploring lean visual management in facilities management systems. The intended outcome is a lean value based workforce that improves quality through the development of people, process, places and machines, resulting in a constant flow of activities and continued lean visual management technology integration.

During the action research reflective cycles, it was established that although implementing lean and visual management in FM systems will develop a value based FM workplace linking the FM department to the organization holistically, it really comes down to organisational change management and employee behaviour conflicts. Any time an organisation or facilities management department goes through a transformation, or starts to develop new patterns of working, employee attitudes can change and resistance can start to appear. Many employees sabotage the transformation efforts through poor attitudes and intimidation tactics. It is acknowledged that change management does not form part of the International Facilities Management (IFMA) organisation 11 core competencies, and the Facility Management Accreditation Commission (FMAC), who accredits FM degree programs, knowledge areas. This thesis makes a contribution to the practice of facilities management by introducing the need to embrace components of change management such as organisational change theory, cultural issues and behaviour conflict resolution as a core competency and knowledge area in facilities management.

Furthermore, there is a lack of project management books and current real life case studies specifically for facilities management education. The researcher extracted material from this body of research and developed curriculum for Master of Science (MSc) facilities management students. The theory was to introduce MSc FM students to real life case studies that revealed how a university facilities management department transformed their operation adding value to their customers and the university holistically. The main constructs of the case studies and literature review were extracted and placed in to documents labelled learning tools. The main learning tool documents created were: lean and visual management; change management; and evidence of lean and visual management in facilities management systems.

Case study one in Chapter Four was edited in to a smaller version and aided in teaching FM students about lean outsourced 3rd party FM service providers. Part of case study two, Chapter Five, was condensed in to a project management assignment that introduced the transformation of a facilities management department and their lean journey. The researcher modified the case studies and learning tool constructs in order to develop project management curriculum that introduces real life facilities management systems in to FM academic practice. At the end of each document the list of references used was provided to further teach the students how to cite, and develop a list of references while writing a research report. This will get the students ready for understanding what a research report looks like as they do research and write up their master's thesis. Additionally, a soft systems methodology model for the final exam was used. The students were to develop their own SSM model using an A3 sheet of paper to formulate their understanding of the entire semester curriculum. The development of FM pedagogy contributes to the practice of facilities management in higher education.

7.4.3 Contribution to Policy

Although this thesis does not contribute specifically to government policy, it is capable of contributing to an organisations strategic transformation plan. The visual workplace management building system introduced in Chapter Two (section 2.7, Figure 6), could be implemented as part of a restructuring program or lean visual management efficiency plan. The university facilities management department studied in case study two, Chapter Five, was directed by university executive leadership to cut their budget by £1 million and reengineer facilities operations. This research can form part of a facility management

strategic plan to aid in development of new standards of practice, which can eventually become university policy and guidelines in delivering facilities management services.

7.5 Limitation of the Research

The research is limited to one UK university estates and property services facilities management department and their third party outsourced facilities management service provider. A research philosophy of design science research combined with an action research approach was constructed and implemented in facilities management research. The researcher's case exploration strictly adhered to the phases and cycles of the design science research, action research approach framework specifically designed for this investigation. A soft systems methodology cycle of learning for action was created to illustrate the association of the different emerging themes during the research intervention process.

7.7 Final Statement

The main fundamentals of FM are linked to a social system composed of people, places, processes, and technology, governed by work standards, key performance indicators and in some cases service level agreements. This should all be tracked and openly communicated through the integration of lean and visual management technologies. If facility managers aspire to get noticed from executive leadership and the C-suite they must establish themselves as an efficient, lean visual technical industry. In the future workplace, facility managers will play a larger role where value for money is not just about the cost of providing services; real estate acquisitions; relocation and move management; event planning; and asset management functions such as real estate, IT, and furniture, fixtures, and equipment (FF&E) oversight; it's about the value of exposing human capital, an educated workforce, and creating a learning environment through the use of lean principles and visual communications. In a visual facilities management workplace employees are given the necessary tools to work together, share information, co-create value with the end user and enterprise holistically through lean visual management technology integration.

Value in the workplace will continue to evolve and the FM department will be at the forefront of change, but this change comes with a price. It was observed that for many facilities management staff transformation programmes and lean journeys could be

frustrating and present radically different job roles and responsibility. Staff at all levels need support from leadership as they experience new approaches in decision-making, and process and procedure redesign. More education and training in lean process improvements, visual workplace management technologies and change management should be on every facility managers to do list. This should form part of the facilities management departments' strategic plan.

This thesis advocates that every facilities manager be perceptive to change management concepts especially behavioural and cultural challenges. When change initiatives occur in the FM workplace, a facilities management change agent should be allocated from within, to track, manage and execute the transformation. And foremost, make sure that the FM workforce is comfortable, educated, and knowledgeable about the future, past and present, and have all the tools necessary to be successful. Resulting in well informed and confident human capital, workplace transparency, visual creativity, and efficient workflow practices that promotes added value to the triple bottom line of the organisation holistically.

APPENDICES

Appendix A: Case Study Initial Questionnaire

Lean Visual Facilities Management
Exploratory Case Study Report

Questionnaire Guide: A Face to Face Interview

Date:
Name:
Position:
Company:
Contact Information:

Interviewed By: Audrey Schultz **Recorded:**
Location of Interview:

---

1. What does "value" mean to you?
2. How do you perceive "value"?
3. What are your main priorities?
4. What are you measured against?
    a. Performance Measures
5. What are the biggest hurdles you face as an operations manager?
6. What are the "problems" you face as a facility management professional?
7. What are the "solutions"?
    a. Please elaborate
8. Are you familiar with lean philosophy?
    a. What is your understanding of Lean?
9. Can you perceive Lean techniques being implemented in your current organization? Where?
10. Where do you identify Lean techniques being implemented in facilities management organizations in general?
11. Name 3 areas in your organisation that needs to be tackled?
12. How would you describe the attitude in your organisation toward improving operational initiatives in general?

Appendix A: Case Study Initial Questionnaire

Additional Remarks or Observations:

Help Desk/Work Order Process:

Map out (in rough form) the current help desk/work order process:

What are the challenges of the work order task?

Do you perceive any issues that can be resolved with the current work order activities?

In general, not just based on the University's new facility, as a facility management professional what are challenges that you see with the overall task of help desk and work order activities?

Appendix B: Lean Visual Management Workshop Design Artefact Agenda

AGENDA

Date: Wednesday 16 May 2012

Theme: Lean Transformation and Visual Management Workplace

Venue: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

9:15 am: Coffee, Tea & Biscuits: Come early to get a seat and have a brew

9:30 am: Welcome, Introductions

9:45 am: Lean Transformation and Introduction
Audrey Schultz, XXXXXXXXXXXXXXXXXX

10:15 am: Introduction to the Value in Real Estate/FM
Tuuli Jylha, Aalto University, Espoo, Finland

10:45 am: Value Stream Mapping, Assessment and Analysis
Audrey Schultz, XXXXXXXXXXXXXXXXXX

11:00 am: First Breakout Activity: Visual Analysis – An A3 Reporting Exercise

12:15 pm: Working Lunch

1:00 pm: Discussion First Breakout Activity: Visual Analysis – An A3 Exercise

1:45 pm: Second Breakout Activity and Discussion: Defining Your Customer. What is meant by "Added Value"?

2:30 pm: Coffee, Tea & Biscuits

2:45 pm: Third Breakout Activity and Discussion: In your opinion: What are the Workplace Barriers? How do we mitigate them?

3:30 pm: Exploring the Visual Workplace, Introduction to Visual Technologies
The next phase of the research is introduced.

*Follow-up of Lean Visual Workplace Implementation is scheduled for June 2012 – Visual Workplace Analysis; October 2012; January 2013; May 2013.

4:00 pm: Close

Appendix C: Lean Visual Management Workshop Blitz Design Artefact

<table>
<tr><th colspan="2">Lean Visual Management Workshop Blitz Artefact</th></tr>
<tr><td>Action One.
A1.1: Define workshop objective.
A1.2: Objective:
→ Introduce lean principles, lean transformation concepts, and visual management to Estates and Property Services Facilities Management staff.</td><td>Action Two.
A2.1: Define the audience.
A2.2: Estates and Property Services staff.
→ All levels of employees.
→ Administration management.
→ Building managers.
→ Director's level.
→ Facility managers.
→ Multi skilled tradespersons.
A2.3: Number of Attendees.</td></tr>
<tr><td>Action Three.
A3.1 Workshop Logistics.
A3.2 Length of Time
→ One-day workshop.
→ No more than a typical day of work.
→ Approximately 7-8 hours, to include lunch.
→ Most employees arrive at work between 7:00 am – 7:30 am.
→ The event to end no later than 4:00 pm.
A3.3 Budget
→ Researchers department would provide lunch, beverages, and afternoon snack.
A3.4 Location
→ A conference room was reserved on main university campus.
→ Easy access for all E&PS employees.</td><td>Action Four.
A4.1: Create agenda of events.
A4.2: Schedule events for the workshop.
A4.3: Design power point presentations based on research case and Action One, A1.1 and A1.2.
→ Introduction Research Case Study.
→ Introduce Lean Transformation Concepts.
→ Explore Visual Management Workplace and Introduce Visual Management Technologies.
A4.4: Decide on additional hand outs to encourage continual learning on the subject of visual management.
→ Rationale to provide additional industry information on visual management to take with them and reinforce subject.
A4.5: Design interactive activities to embrace learn by during philosophy.
→ Supplies for activities.
→ Each activity was designed to have three items.
→ A purpose, an approach and an assignment.
→ Activity #1: Visual Analysis Creating an A3 Report.
→ Supplies: A3 paper, coloured pens and pencils.
→ Activity #2: Added 'Value' to the End User/Customer.
→ Supplies: Use M3 sticky notes and portable easel and easel paper.
→ Activity #3: What are some of the Workplace 'Barriers' and How to Mitigate them?
→ Supplies: Questionnaire to fill out for discussion and pass in for record.</td></tr>
<tr><td colspan="2">Action Five:
A5.1: Develop a designed Workshop artefact feedback document, for participants to fill out and pass back in.
A5.2: Follow-up plan.
→ Researcher will track outcomes of designed workshop artefact periodically for one year.</td></tr>
</table>

Appendix D: Activities for Lean Visual Management Workshop

Appendix D.1: Activity #1 – Visual Analysis, Creating an A3 Report

Purpose:

The purpose of this exercise is to participate in a lean visual problem solving activity in an open and creative learning environment. Based on the problem statement your group will devise an A3 report and present a plan for future consideration. The problem-solving A3 activity sets the stage for analysing an

Your team will be provided with the tools necessary to create a problem solving A3 document, such as coloured markers, pens and A3 sheets of paper. Take the first 15-20 minutes to discuss the background and current state. Describe the existing state clearly and visually. You will have 2 hours to complete the exercise.

Assignment:

Break out in to groups of 4 or 5 people. Your teams can utilize the following spaces throughout the 7th Floor ThinkLab area: the small conference room to the right as you walk outside of the ThinkLab; the break area directly outside of the Think Lab; and the large conference Room 714b. Make sure to write all of your names on the back of the A3 report to be handed in after Activity 1 discussion.

Problem Statement: Select one of the process improvement statements below.

A. How could we prevent the work orders from being put 'on hold' status?

B. Define what could be the handyperson's new set of responsibilities and job description.

C. Within in your group come up with one major issue and use the A3 exercise to define it.

Appendix D.2: Activity #2 – Added "Value" to the End User/Customer

Activity #2 – Added "Value" to the End User/Customer

Date: Wednesday 16 May 2012

Name: _____

Position:_____

Company:_____

Division:_____

Purpose:

The purpose of this Activity forms the basis for the Lean Visual Management research project relating to adding Value in the FM workplace. By interpreting the theories and topics that we have discussed in the workshop today, you will develop your own theory on "Adding Value" to your customer.

Approach:

According to James Womack and Daniel Jones book, 'Lean Thinking, Banish Waste and Create Wealth in Your Corporation', (1996), Simon & Schuster Inc., New York, NY. The first step in collecting project data is to understand "how value" is perceived from the customer's perspective, because the needs of the customer determines how we produce goods and services in relations to our customer.

Assignment:

After filling in the above requested information i.e. name, position, etc., answer the following questions. To be handed in after the discussion.

First Question: Who is your customer?
Second Question: In your opinion, how do you perceive "Added Value" from your customers' point of view?
Third Question: In your opinion, how do you perceive "Added Value" as an internal customer (an employee) of the organization?

_____

_____

_____

_____

Appendix D.3: Activity #3 – What are the Workplace "Barriers"? How to Mitigate them?

Activity #3 – What are the "Barriers" and How to Mitigate them?

Date: Wednesday 16 May 2012

Name: _____

Position:_____

Company:_____

Division:_____

Purpose:

The purpose of this Activity forms the basis for the researcher in understanding how the employee determine who the customers are and what barriers stand in their way that stop them from performing their job. Employees' know best how their position ought to operate.

Approach:

According to Durward Sobek and Art Smalley's Book, Understanding A3 Thinking, 2008, CRC Press, Taylor & Francis Group. Leaders want to surface problems so that people working in the process will solve those problems at the root cause, thereby making the process that much more stronger.

Assignment:

After filling in the above requested information i.e. name, position, etc., answer the following questions. To be handed in after the discussion.

First Question: In your opinion, what are the barriers that prevent you from doing your job to the fullest and adding value to your customer(s)?

Second Question: How can we mitigate the barriers? What is the answer?

Make sure you state who your customer is.

_____

_____

_____

_____

Appendix E: Lean Visual Management Workshop Presentations

Appendix E

Aim of the Workshop

The next phase:

- The Visual Workplace

The next steps that formulate the PhD Research will be continued literature review on the above topic and follow-up data collection:

- Visual Analysis June 2012
- October 2012; January 2013; May 2013

What has been put in place?
What works and what doesn't' work?

Estate and Property Services Balfour Beatty Workplace Case Material

- Workshop Material
  - Handouts
    - Guide to Making an A3
    - 3 Ways to Make Lean More Visual
    - Visual Workplace Handbook
    - 5S/Visual Workplace Handbook
- Material after the Workshop
  - Documentation of the Workshop
  - Project Report
  - Role out of Visual Workplace Tools
  - Follow-Up Research/Continued Data Collection

The Next Steps

- **This research will follow the Lean Transformation:**
  - How has Lean been implemented?
  - What Tools have been used and put in to place?
  - What aspects of the Lean Transformation were successful?
  - What aspect of the Lean Transformation were unsuccessful?
- **Implementation of a Lean Visual Workplace in complex Facility Management Systems**
  - How successful were we in implementing a Visual Workplace in complex FM systems?

Appendix E

What is meant by Lean?

- To maximize **customer value** while minimizing waste. Lean creates more value for customers with fewer resources.
- A lean organization understands customer value and focuses its key processes to continuously improve.
- The **ultimate goal** is to **provide perfect value** to the customer through a **perfect value creation process** that has **zero waste**.
- Lean thinking changes the focus of management from optimizing separate technologies, assets, and vertical departments to optimizing the flow of products and services through the entire value stream that flows horizontally across technologies, assets, and departments to our customers.

The Lean Enterprise: http://www.lean.org/WhatsLean/

What is meant by Lean?

- **Lean Services**
  A popular misconception is that lean is suited only for manufacturing. Not true. Lean applies in every business and every process. **Lean is not a tactic or a cost reduction program, but a way of thinking and acting for an entire organization.**

Lean Thinking

- Businesses in all industries and services, including healthcare and governments, are using lean principles as the way they think and do.
- Many organizations choose not to use the word lean, but to label what they do as their own system, such as the Toyota Production System (TPS) or the Danaher Business System.
- Why? To drive home the point that **lean is not a program or short term cost reduction program,** but **the way the company operates**. The word **transformation or lean transformation** is often used to characterize a company **moving from an old way of thinking to lean thinking**. It requires a complete transformation on how a company conducts business. This takes a **long-term perspective and perseverance**.

Appendix E

RIEs Vs. Full Implementation

What is meant by Lean?

- **Lean Time-Line**
- The term "lean" was coined to describe Toyota's business during the late 1980s by a research team headed by Jim Womack, Ph.D., at MIT's International Motor Vehicle Program.
- The characteristics of a lean organization and supply chain are described in **Lean Thinking**, by Womack and Dan Jones, founders of the Lean Enterprise Institute and the Lean Enterprise Academy (UK), respectively. While there are many good books about lean techniques, **Lean Thinking** remains one of the best resources for understanding **"what is lean"** because it describes the **thought process**, the overarching **key principles** that must guide your actions when applying lean techniques and tools.

Lean = The Three P's

People, Process, Purpose

- **People:** How can the organization insure that every important process has someone responsible for continually evaluating that value stream in terms of business purpose and lean process?
- **Process:** How will the organization assess each major value stream to make sure each step is **valuable, capable, available, adequate, flexible**, and that all the steps are linked by **flow, pull,** and **leveling?**
- **Purpose:** What customer problems will the enterprise solve to achieve its own purpose of prospering?

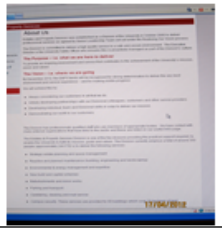
How can everyone touching the value stream be actively engaged in operating it correctly and continually improving?

Appendix E

Lean = The Four P's

People, Process, Procedures & Purpose

- **People:** Create a Transparent Learning Environment.
- **Process:** Asses every value stream. Does it make sense?
- **Procedures:** Develop a step-by-step instruction to achieve desired actions and processes.
- **Purpose:** What is our purpose in creating value for our customer?



"Just as a carpenter needs a vision of what to build in order to get the full benefit of a hammer, Lean Thinkers need a vision before picking up our lean tools," said Jim Womack. "Thinking deeply about purpose, process, people is the key to doing this."

The Lean Enterprise: http://www.lean.org/WhatsLean

Lean Transformation

How do we get started?

Getting Started

- **Find a change agent** = Lean Leaders
- **Create lean knowledge**
- Find a lever by **seizing a crisis** or by **creating one** to begin the transformation
- **Forget grand strategy**
- **Map the value streams – Process Mapping**
- **Begin as soon as possible**
- **Demand immediate results**
- **As soon as you've got momentum, expand your scope**

The Lean Enterprise: http://www.lean.org/WhatsLean

Appendix E

Lean Transformation

Creating an Organization to Channel Your Value Streams

- Reorganize your organization by product/service and value stream
- Create a lean promotion function
- Deal with excess people at the outset, and then promise that no one will lose their job in the future due to the introduction of lean techniques

Lean Transformation

Completing the Transformation

- **We are just getting started!!**
- Develop your lean strategy
- Convince your suppliers and customers to take the steps toward lean transformation with you
- Convert from top-down leadership to leadership based on questioning, coaching, and teaching and rooted in the scientific method of **Plan-Do-Check-Act = PDCA**

Lean Transformation

Install Business Systems to Encourage Lean Thinking

- Utilize policy deployment
- Create a lean accounting system
- Pay your people in relation to their performance
- Make performance measures transparent
  - SLA's
  - Performance Indicators/Reports
- Teach lean thinking and skills to everyone
  - LeanREB/ARVO Workshop
  - Books/Journal Papers/Educational Team Meetings
- Right-size your tools in the warehouse, equipment storage, repair shop, mail and supply room and information systems

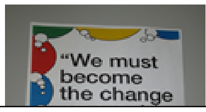
Appendix E

Lean Transformation

Creating an Organization to Channel Your Value Streams

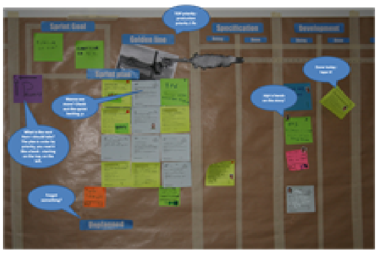
- Devise a growth strategy
- Remove the anchor-draggers
- Once you've fixed something, fix it again – PDCA & CI

"Two steps forward and one step backward is O.K.; no steps forward is not O.K."



What are the most common mistakes in implementing lean?

- Lean beginners should limit scope of their initial project.
- The hardest challenges is that you will uncover new problems and greater challenges. Be aware of how difficult this will be.



The Lean Enterprise: [illegible]
Highways Agency, Derek Drysdale, Lean Improvement in the Highway's Agency's Supply Chain

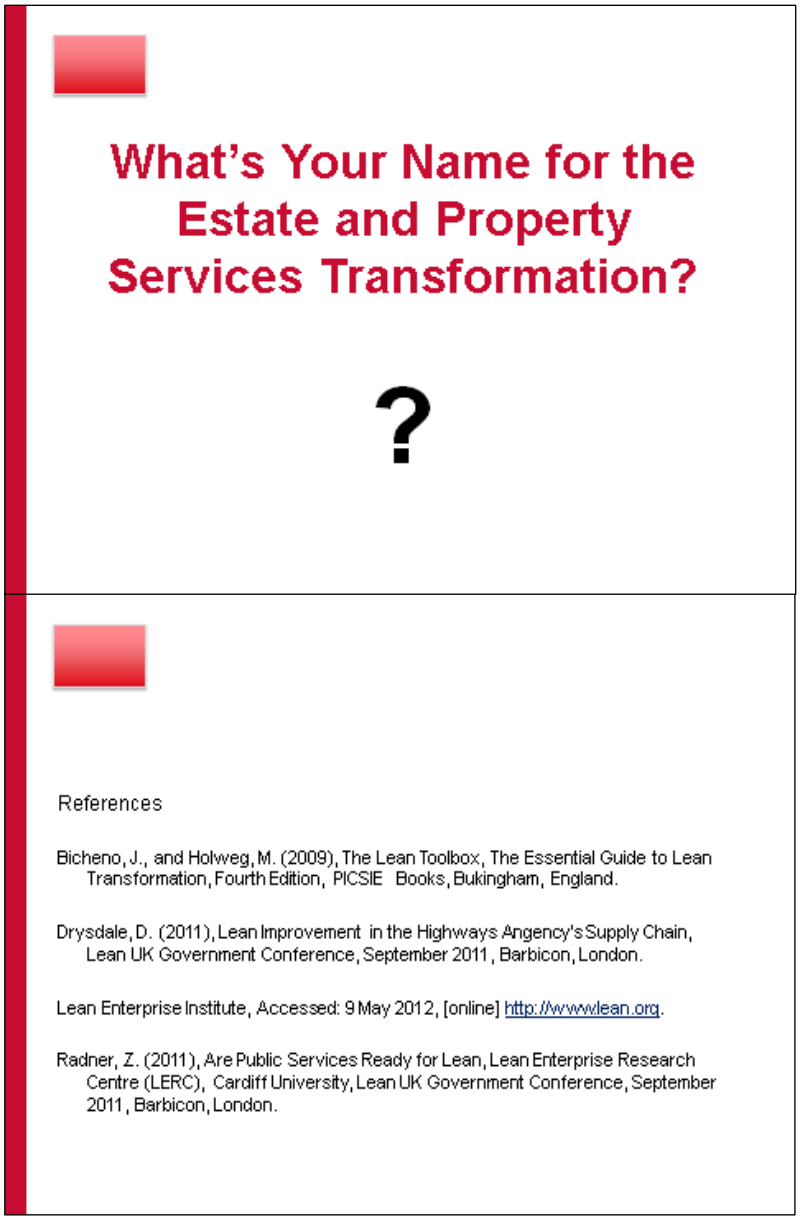
What are the most common mistakes in implementing lean?

- Lean must never be seen as a tool for headcount reduction or mindless cost-cutting. This fundamentally misses the purpose of **lean**, which **is to create value through eliminating waste**. As companies improve their processes they should be able to **reallocate** their **productive resources** to **new value-creating work**.
- Another important attitude to avoid from the beginning is the impulse to implement individual lean tools without seeking to understand the system holistically. This is hard to avoid, since many lean tools deliver immediate payoffs.

But ultimately all lean workers must understand the "why" behind the tools, or their value will be lost

The Lean Enterprise: [illegible]

Appendix E



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Bicheno, J., and Holweg, M. (2009), The Lean Toolbox, The Essential Guide to Lean Transformation, Fourth Edition, PICSIE Books, Bukingham, England.

Drysdale, D. (2011), Lean Improvement in the Highways Angency's Supply Chain, Lean UK Government Conference, September 2011, Barbicon, London.

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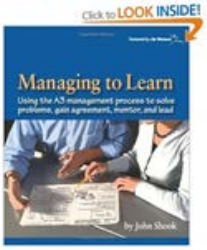
Radner, Z. (2011), Are Public Services Ready for Lean, Lean Enterprise Research Centre (LERC), Cardiff University, Lean UK Government Conference, September 2011, Barbicon, London.

Appendix E

Assessment and Analysis
Why an A3?



Lean Visual Management Workshop 16 May 2012

LEAN TOOLS

- 5S
- Process Cells
- TPM
- Setup Reduction
- Problem Solving
- Error Proofing
- Kanbans
- VSM
- Kaizen
- Visual Management
- Spaghetti Diagrams
- 3P
- DFM & A

A3

LEAN CONCEPTS

Lean is the elimination of waste to improve the flow of information and material

8 Types of Waste:

1. Scrap/Rework
2. Transportation
3. Associate Motion
4. Wait Time
5. Inventory
6. Over Production
7. Over Processing
8. Under Utilization of People

WHY LEAN ?

SAFETY & to make money

LEAN CULTURE

Bringing it all together:

- Leadership
- Communication
- Empowerment
- Teamwork

LEAN PLANNING

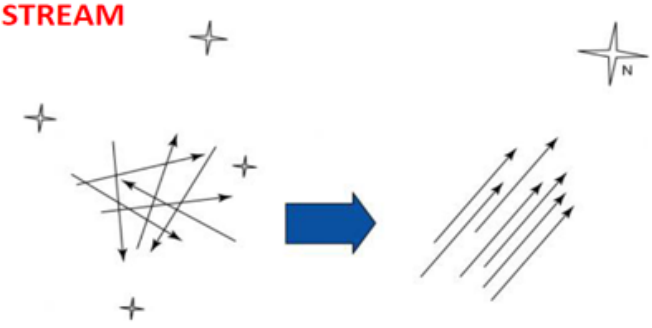
Create Value
- Profits
- Cash Flow
- Revenue

Leading Change
1. Sense of Urgency
2. Guiding Coalition
3. Vision & Strategy
4. Communication
5. Empowerment

Organization's Goals

What is a Lean Business?
Larry Rubrich

Understanding the process and developing **FLOW** and **PULL** through the system FOCUSING ON **CUSTOMER VALUE** & **VALUE STREAM**



Appendix E

The objective is to look for better methods

What do I need to achieve?

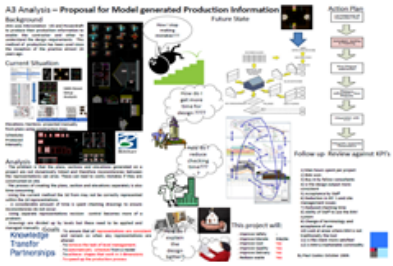
How do I want to achieve this?

How else might I achieve this?

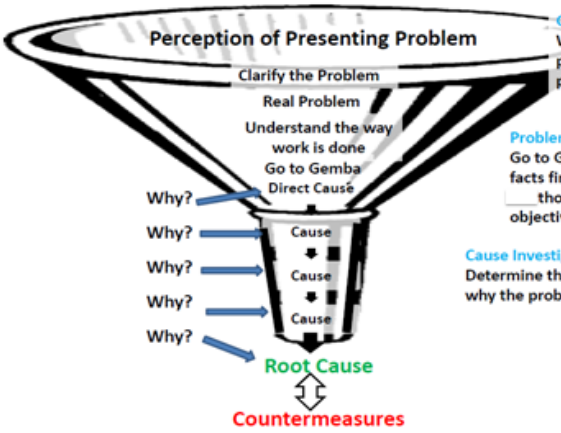
Also companies need to develop thinking problem solvers

What do we use A3 Exercises for?

- A3 for Company Strategy/Vision
- **A3 for Problem Solving**
- A3 for Proposals
- A3 Status Reviews



Understanding the problem

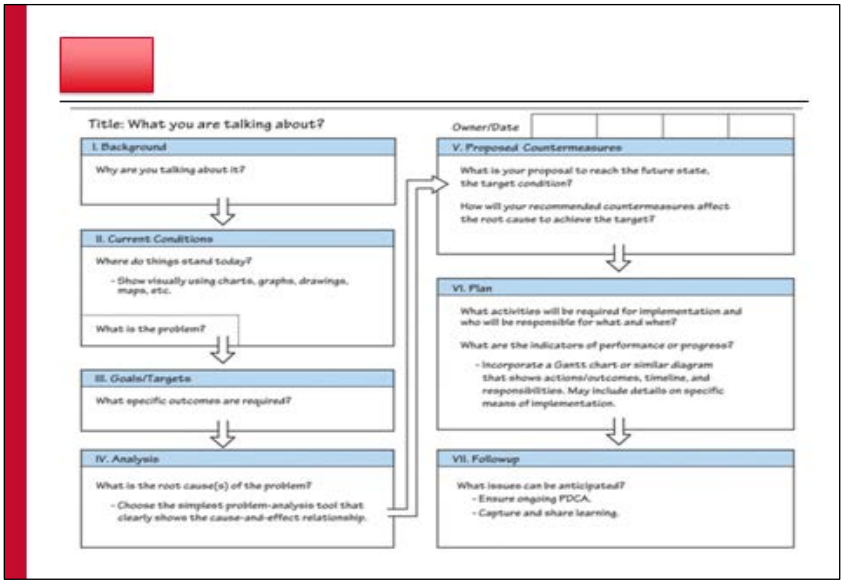


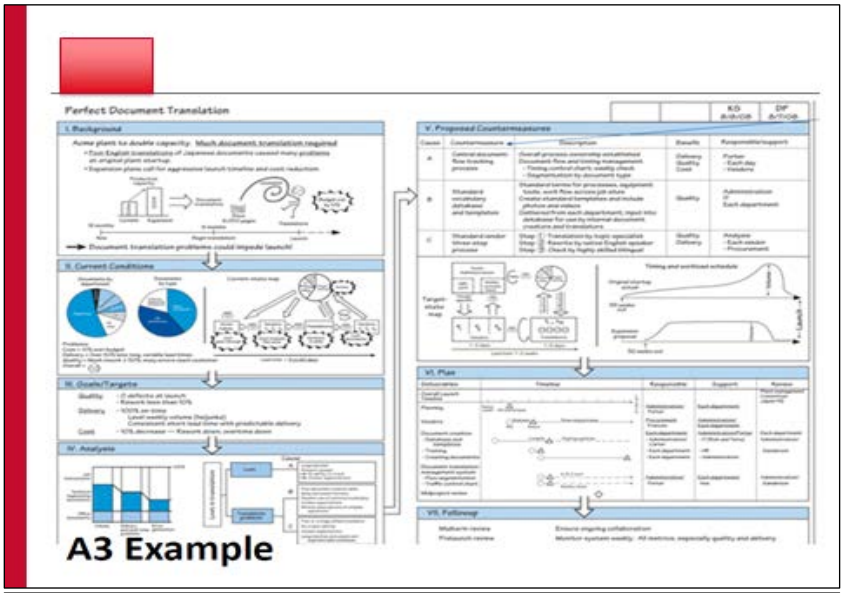
Grasp the situation
What is the actual problem in performance?

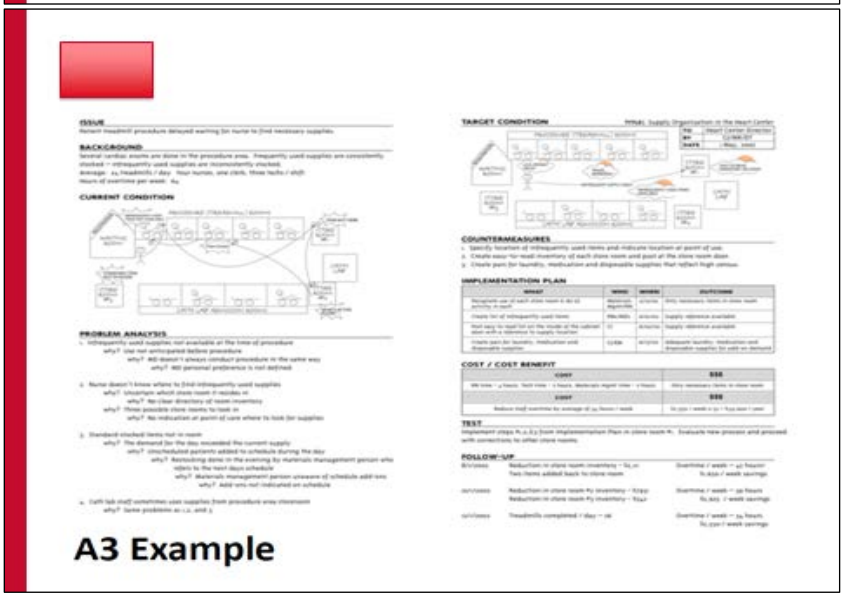
Problem Breakdown
Go to Gemba get the facts first hand, analyze thoughly and objectively

Cause Investigation
Determine the Root cause, why the problem is occurring

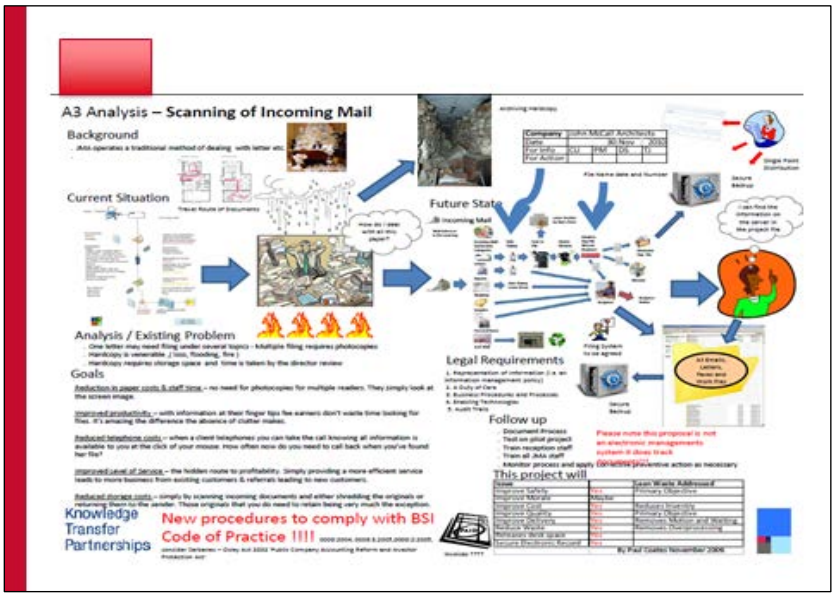
Appendix E

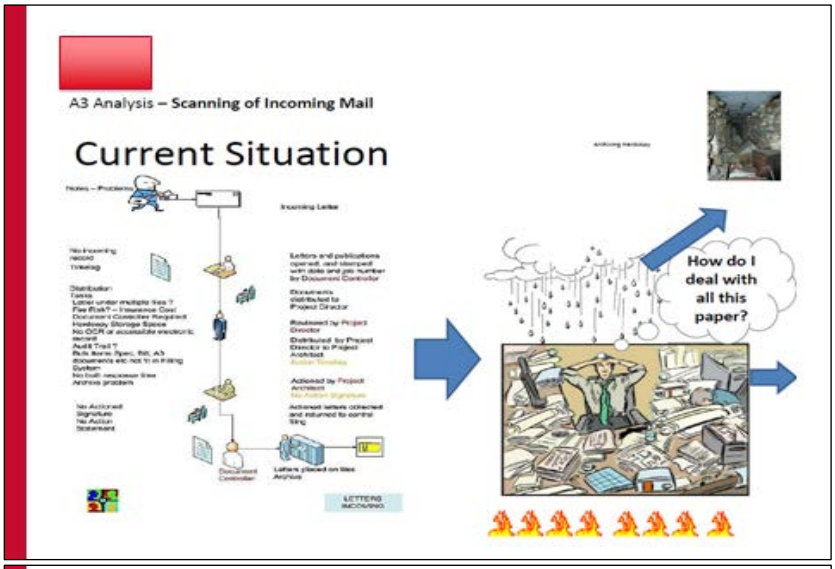

Title: What you are talking about?
Owner/Date
I. Background
Why are you talking about it?
II. Current Conditions
Where do things stand today?
- Show visually using charts, graphs, drawings, maps, etc.
What is the problem?
III. Goals/Targets
What specific outcomes are required?
IV. Analysis
What is the root cause(s) of the problem?
- Choose the simplest problem-analysis tool that clearly shows the cause-and-effect relationship.
V. Proposed Countermeasures
What is your proposal to reach the future state, the target condition?
How will your recommended countermeasures affect the root cause to achieve the target?
VI. Plan
What activities will be required for implementation and who will be responsible for what and when?
What are the indicators of performance or progress?
- Incorporate a Gantt chart or similar diagram that shows actions/outcomes, timeline, and responsibilities. May include details on specific means of implementation.
VII. Followup
What issues can be anticipated?
- Ensure ongoing PDCA.
- Capture and share learning.

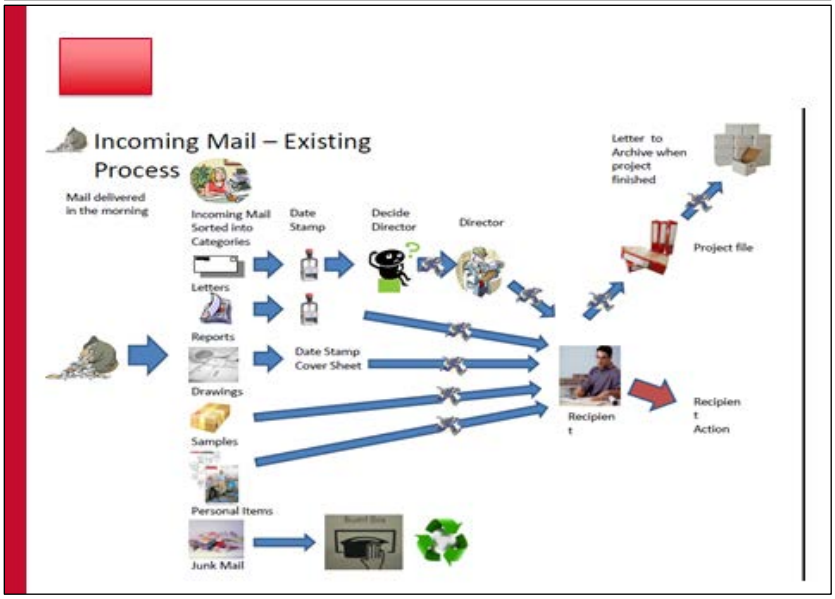

Perfect Document Translation
A3 Example


A3 Example

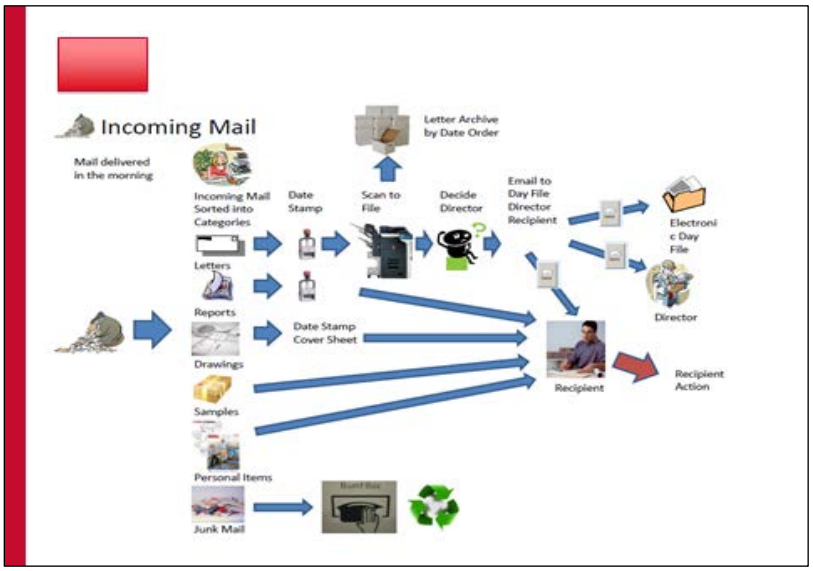
Appendix E

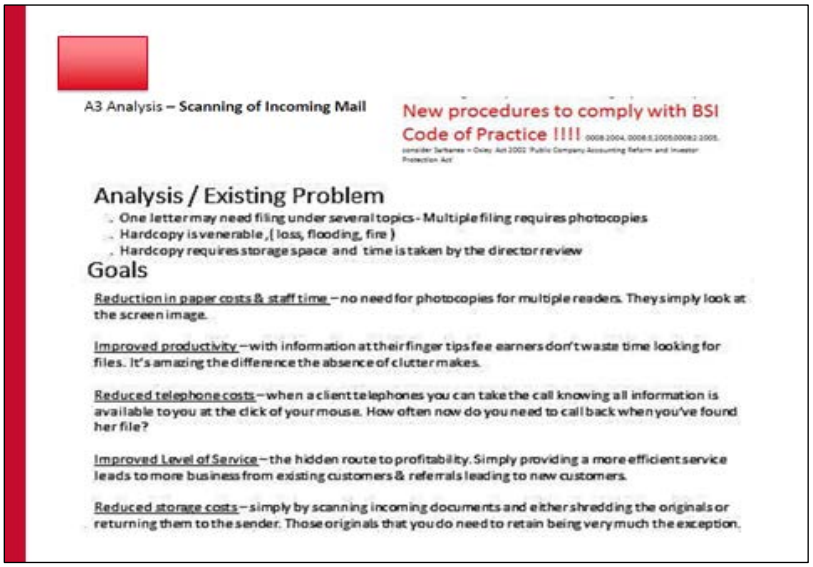

A3 Analysis – Scanning of Incoming Mail
Background
Current Situation
Future State
Analysis / Existing Problem
Goals
Legal Requirements
Follow up
This project will
Knowledge Transfer Partnerships
New procedures to comply with BSI Code of Practice !!!!

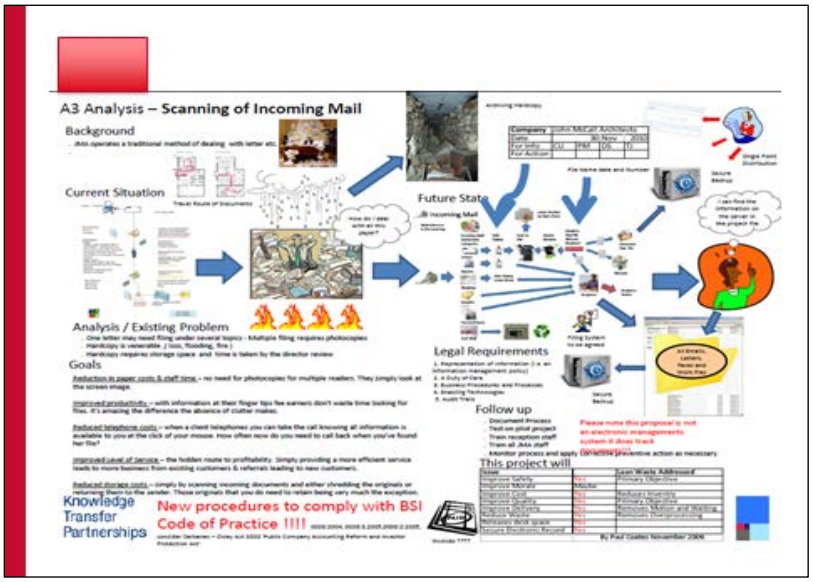

A3 Analysis – Scanning of Incoming Mail
Current Situation
How do I deal with all this paper?


Incoming Mail – Existing Process
Mail delivered in the morning
Incoming Mail Sorted into Categories
Date Stamp
Decide Director
Director
Letter to Archive when project finished
Project file
Letters
Reports
Date Stamp Cover Sheet
Drawings
Samples
Personal Items
Junk Mail
Recipien t
Recipien t Action

Appendix E

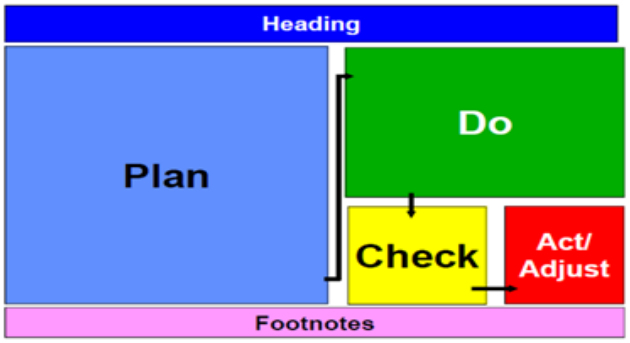

Incoming Mail
Letter Archive by Date Order
Mail delivered in the morning
Incoming Mail Sorted into Categories
Date Stamp
Scan to File
Decide Director
Email to Day File Director Recipient
Electronic Day File
Letters
Reports
Director
Date Stamp Cover Sheet
Drawings
Recipient
Recipient Action
Samples
Personal Items
Junk Mail


A3 Analysis – Scanning of Incoming Mail
New procedures to comply with BSI Code of Practice !!!!
Analysis / Existing Problem
. One letter may need filing under several topics - Multiple filing requires photocopies
. Hardcopy is venerable ,(loss, flooding, fire)
. Hardcopy requires storage space and time is taken by the director review
Goals
Reduction in paper costs & staff time – no need for photocopies for multiple readers. They simply look at the screen image.
Improved productivity – with information at their finger tips fee earners don't waste time looking for files. It's amazing the difference the absence of clutter makes.
Reduced telephone costs – when a client telephones you can take the call knowing all information is available to you at the click of your mouse. How often now do you need to call back when you've found her file?
Improved Level of Service – the hidden route to profitability. Simply providing a more efficient service leads to more business from existing customers & referrals leading to new customers.
Reduced storage costs – simply by scanning incoming documents and either shredding the originals or returning them to the sender. Those originals that you do need to retain being very much the exception.

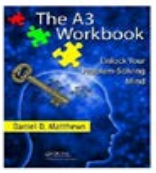

A3 Analysis – Scanning of Incoming Mail
Background
Current Situation
Future State
Analysis / Existing Problem
Goals
Legal Requirements
Follow up
This project will
Knowledge Transfer Partnerships
New procedures to comply with BSI Code of Practice !!!!

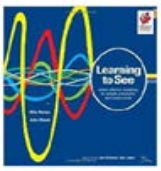
Appendix E

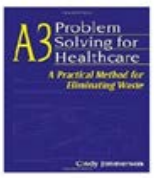
Typical Story Board Layout

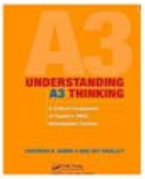


Dave LaHote, The A3 as a PDCA Storyboard









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Shook, J. (2008), Managing to Learn, Using A3 management process to solve problems, gain agreement, mentor, and lead, The Lean Enterprise Institute, Inc., Cambridge, MA, USA

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Appendix E

The Visual Workplace

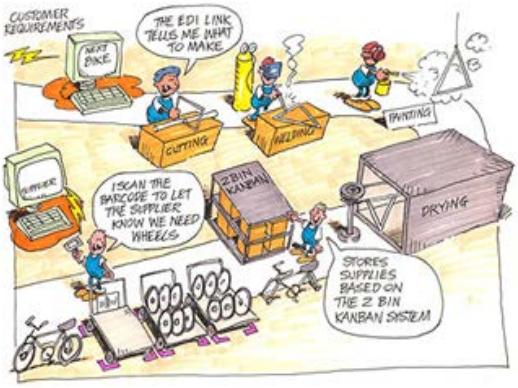
Lean Visual Management Workshop 16 May 2012

Lean Workflow

Before

Lean Workflow

After:



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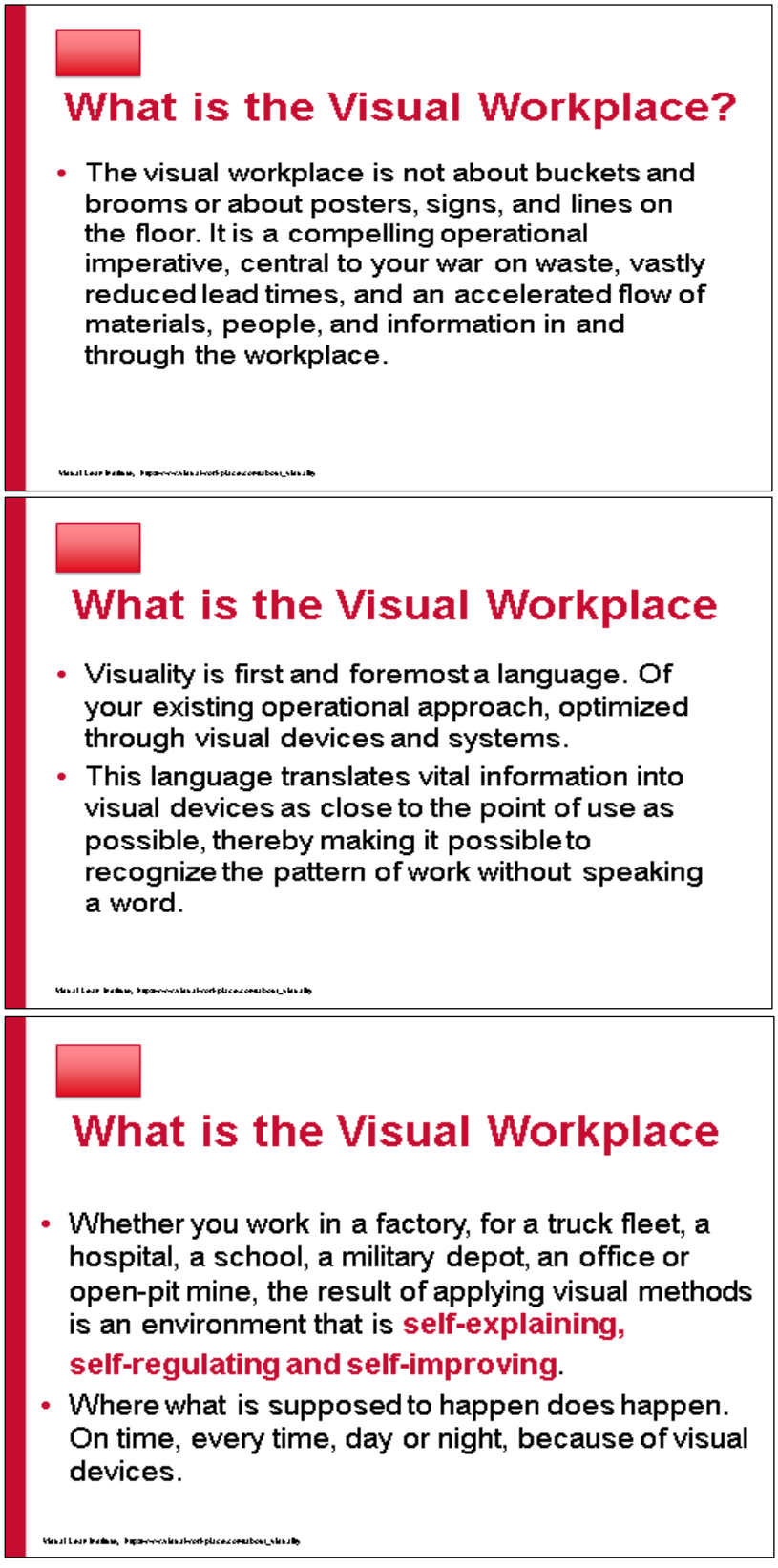

What is the Visual Workplace?
• The visual workplace is not about buckets and brooms or about posters, signs, and lines on the floor. It is a compelling operational imperative, central to your war on waste, vastly reduced lead times, and an accelerated flow of materials, people, and information in and through the workplace.
What is the Visual Workplace
• Visuality is first and foremost a language. Of your existing operational approach, optimized through visual devices and systems.
• This language translates vital information into visual devices as close to the point of use as possible, thereby making it possible to recognize the pattern of work without speaking a word.
What is the Visual Workplace
• Whether you work in a factory, for a truck fleet, a hospital, a school, a military depot, an office or open-pit mine, the result of applying visual methods is an environment that is self-explaining, self-regulating and self-improving.
• Where what is supposed to happen does happen. On time, every time, day or night, because of visual devices.

Appendix E

Visual Workplace

This concept involves combining generally accepted management principles along with fine arts principles to:

- Improve customer satisfaction by connecting employees to the mission
- Improve employee satisfaction by celebrating employees
- Improve cycle time/lead time performance by strategically sharing information
- Hold employees accountable in an honest and open way
- Shape the outside world's view of your organization by designing it in a manner that greatly impresses the stakeholder, with the overall goal being improved performance

Visual Workplace

The Visual Workplace House is a stacked set of **methods**, **tools**, and **visual outcomes** that, when systematically applied, **convert the physical work environment into a visual landscape of work**.

The Ten Levels

Many of these categories may look familiar, but **what is new** is to **think of them as a single line of logic.** An **integrated framework** that shares a common purpose:
Share vital information about the task at hand, without speaking a word.
In short, to let the workplace speak.

Appendix E

Visual Workplace

The Ten Doorways into a Visual Workplace, helps us define and understand the holistic view of a Visual Workplace.

From the Vice Chancellor to the facility managers, multi-skilled tradesperson, building managers, campus managers, team leaders and administrative services - **every level** of the organization **contributes to a fully-functioning visual enterprise.**

Ten Doorways

- This does not mean that one group is prohibited from imbedding certain levels of visuality. Rather, it means that specific groups take the lead in imbedding certain visual functions in the organization.
  - Supervisors and Managers take the lead in implementing visual displays/production control boards
  - Value-added associates (line employees) take the lead in installing visual order (amplified 5S)

Ten Doorways

- Using the Ten Doorways as a guide, the organization can ensure that everyone is part of the enterprise
- All members of the workforce are involved in asking and visually answering the following questions:
  - **Who Needs-to-Know?**
  - **Who Needs-to-Share ?**
- When these questions are answered from the viewpoint of the individual — as Dr. Gwendolyn Galsworth says:

"the viewpoint of the **"I"**—the enterprise speaks without saying a word and the operational system becomes transparent"

Appendix E

Visual Workplace

Once we recognize the importance of the
"I-driven"
approach to visuality, the next question becomes:
Which doorway do we open next?

Building Blocks
Why a VWP?

- People have too many questions to ask. Some of the questions are asked, but most of them remain unasked.
- When people don't ask questions:
  - They live without the answer and do nothing
  - Or They make things up

The Need to Know

Value-Added Employee

- What am I supposed to do next?
- Where is the fixture for the next job?
- When is the claims report do?
- How many lights need to be changed today?
- I found the fixtures, now how do I do the changeover?

Manager/Supervisor

- Where is the material we have been waiting for?
- Who's on holiday today?
- How many work orders are showing red today? This week?
- When will the steel assemblies be fabricated?

Appendix E

The Need to Share

Value-Added Employee

- Where are the parts/materials I need to complete my task?
- What I am working on now.
- When is the claim report do?
- When do I need that report.
- When to turn in the daily completed task list.
- How many ballast are in stock for the change out of the 2x2 light fixtures?

Manager/Supervisor

- Where are the material/supplies we have been waiting for?
- Who's on holiday today?
- How many work orders are showing red today? This week?
- When will the steel assemblies be fabricated?
- What new jobs are coming down the pipeline?

Galsworth, G.D. (2005), Visual Workplace, Visual Thinking, Visual-Lean Enterprise Press, Portland, Oregon, p. 29.

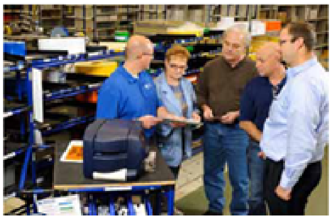
The Need to Share

- What do I know that others need to know in order to do their work – Or in order to do their work better?
- What information do I need to share?
- How may **I** help **You**?
- **Each of us has knowledge that could help others**

Galsworth, G.D. (2005), Visual Workplace, Visual Thinking, Visual-Lean Enterprise Press, Portland, Oregon, p. 29-30.

The Need to Share

As a result of applying the "I" – Need to know and attaining control over our corner of the woods, we gain confident and command, eventually turning to others and beginning to share what others need to know.



Galsworth, G.D. (2005), Visual Workplace, Visual Thinking, Visual-Lean Enterprise Press, Portland, Oregon, p. 30.

Appendix E

References

Galsworth, G.D. (2005), Visual Workplace, Visual Thinking, Visual-Lean Enterprise Press, Portland, Oregon.

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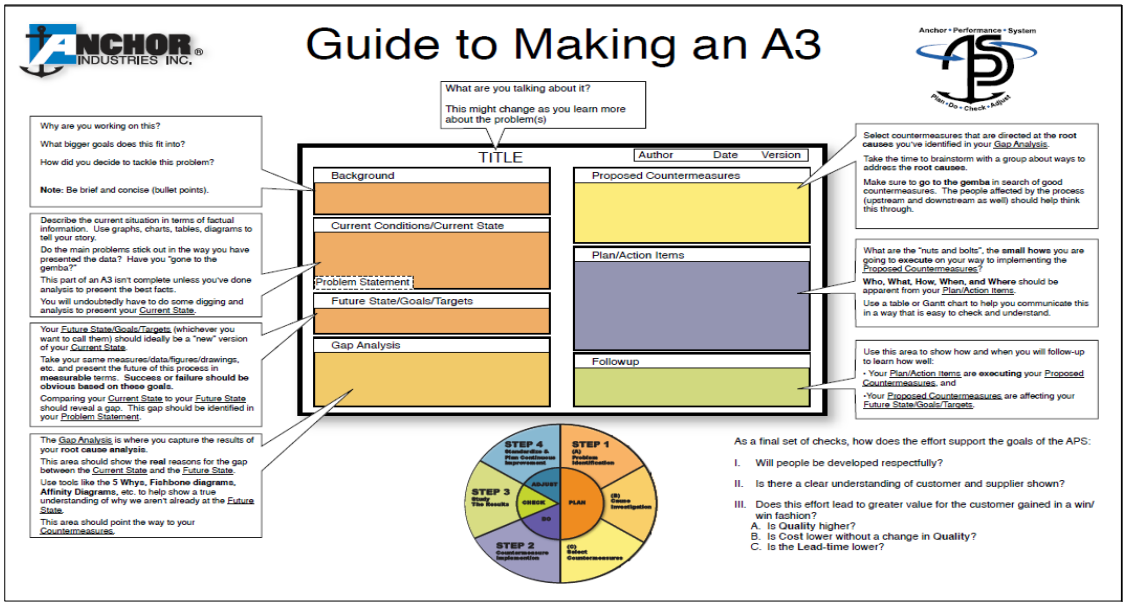
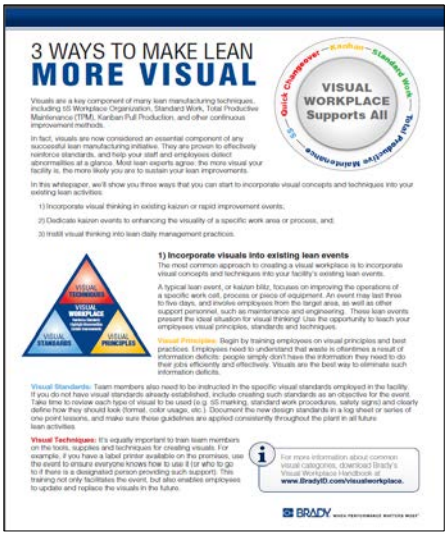
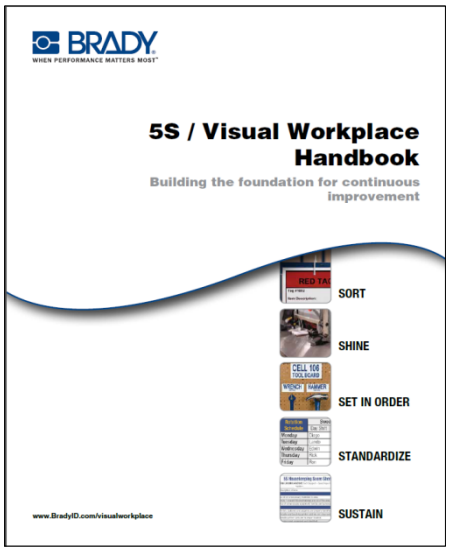
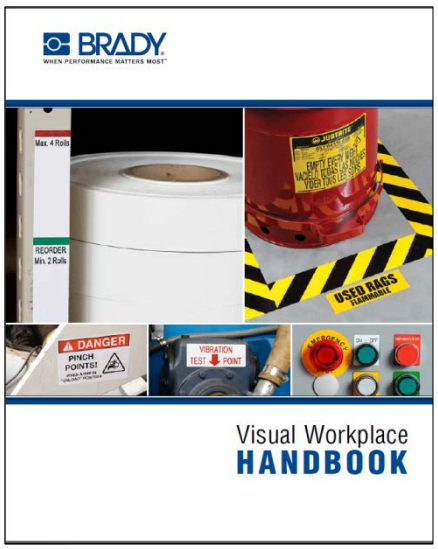
Visual Lean Institute, http://www.visualworkplace.com/about_visuality

Appendix F: Workshop Handouts









Appendix G: Lean Visual Management Workshop Feedback Form

1. **What went well today?**

2. **What could we have done better?**

3. **What activity or aspect did you like about the workshop?**

4. **What activity or aspect did you not like about the workshop?**

Appendix H: E&PS Lean Workshop Follow-up

One Year Later Questionnaire
ALS – PhD Lean Facilities Management

E&PS Lean Workshop Follow-up One Year Later
Estate and Property Services (E&PS)
Questionnaire

On Wednesday 16 May 2012, you attended a Lean Transformation and Visual Workplace Workshop at The University of Salford. It is one year later and we are following up to see how you are doing with your lean journey and visual workplace development.
Title of Case Study Project: The Lean Visual Workshop - One Year Later

Instructions:

Please fill out the questionnaire and answer the queries below to the best of your knowledge. There is space to add any additional information that you feel would assist in the development of the research case. All names and positions will not be used throughout the PhD thesis. Everyone will be referred to as an operative with a number given to each, i.e. operative one, operative fifteen, etc.

Part 1: Background Information

Name of Participant: _____

Position Held: _____ Date: _____

Part 2: Lean Visual Workshop Questions

1. Since the workshop last year, have you used any lean tools or visual techniques at work? YES ☐ NO ☐

2. If you answered 'Yes' to the questions above, please explain what lean tools or visual techniques you have used since the workshop?

3. If you answered No to question (1) above, would you give a reason why you are not using lean tools or visual techniques at work?

4. Have you implemented any new lean tools or visual management techniques at work this past year since the workshop? YES ☐ NO ☐

If you answered Yes to the above question, would you please explain and give examples.

Appendix I: Informed Consent

Informed Consent

Name of Researcher and Key Point of Contact: Ms. Audrey L. Schultz, Contact information, e-mail:

- The subject will have the right to withdraw consent once given at any stage, without prejudice, and where appropriate, to withdraw any data collected.

- The investigator will undertake to protect the confidentiality of the subject.

- In the event that the results are published, the investigator shall protect the identity of the subject, unless the subject consents to be named.

1. I confirm that I have read and understand the information sheet attached for the above research study.

2. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

3. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected.

4. I understand that relevant sections of any notes and data collected during this study may be looked at by responsible individuals from The University of Salford where it is relevant to my taking part in this research. I give permission for these individuals to have access to my information.

5. I agree to take part in the above research study.

I have read and understand the above and consent to participate in this research study. My signature below is not a waiver of any legal rights. Furthermore, I understand that I will be able to keep a copy of the informed consent form for my records.

By signing below you give consent and authorization as a participant in the said research project.

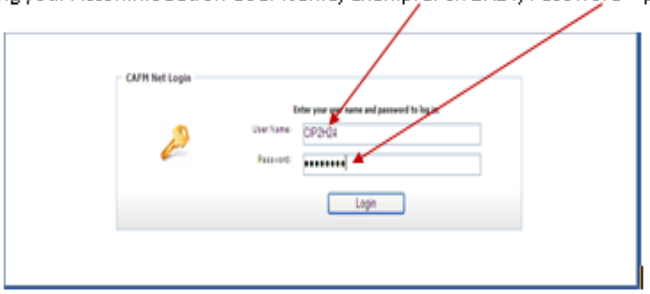
_____	_____	_____
Signature	Print Name	Date

Appendix J: Student CAFM Net Accommodation Instructional Sheet Artefact

Student CAFM Net Accommodation Instructional Sheet

To Log an Accommodation Job go to: https://cafm.salford.ac.uk/CAFMNet_Accommodation

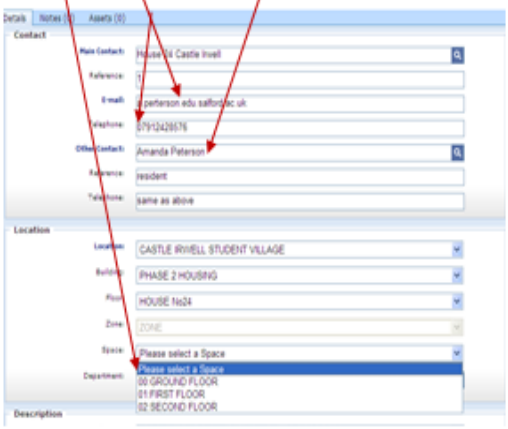
Log on using your Accommodation User Name, example: CIP2H24, Password = password



CAFM Net 2012 Webpage will come up - Go to Help Desk, Log a Help Desk Request

Insert Your E-Mail, Your Mobile Number, Your Name any other Contact information.

Enter what Space has the issue.

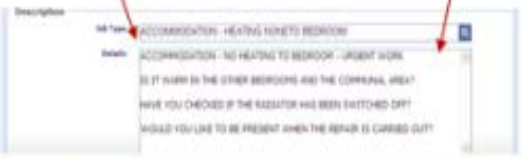


Search for the correct issue with your flat using the word **'Accommodation'.**

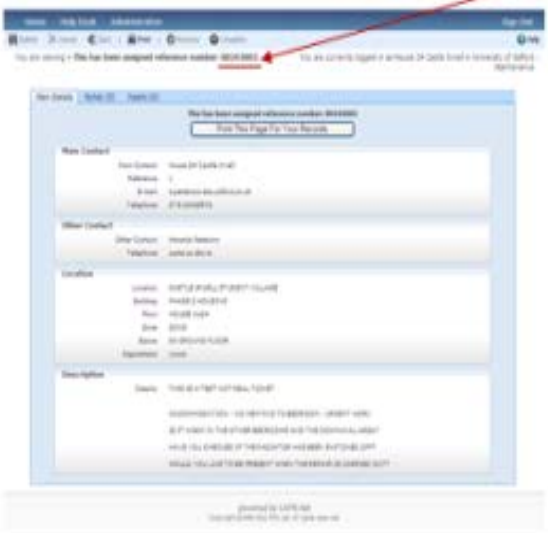
Appendix J

Select the description that best fits your issue. If there is not a description that best describes your issue use the description word **'ACCOMMODATION - OTHER'** and fill in details describing the problem.

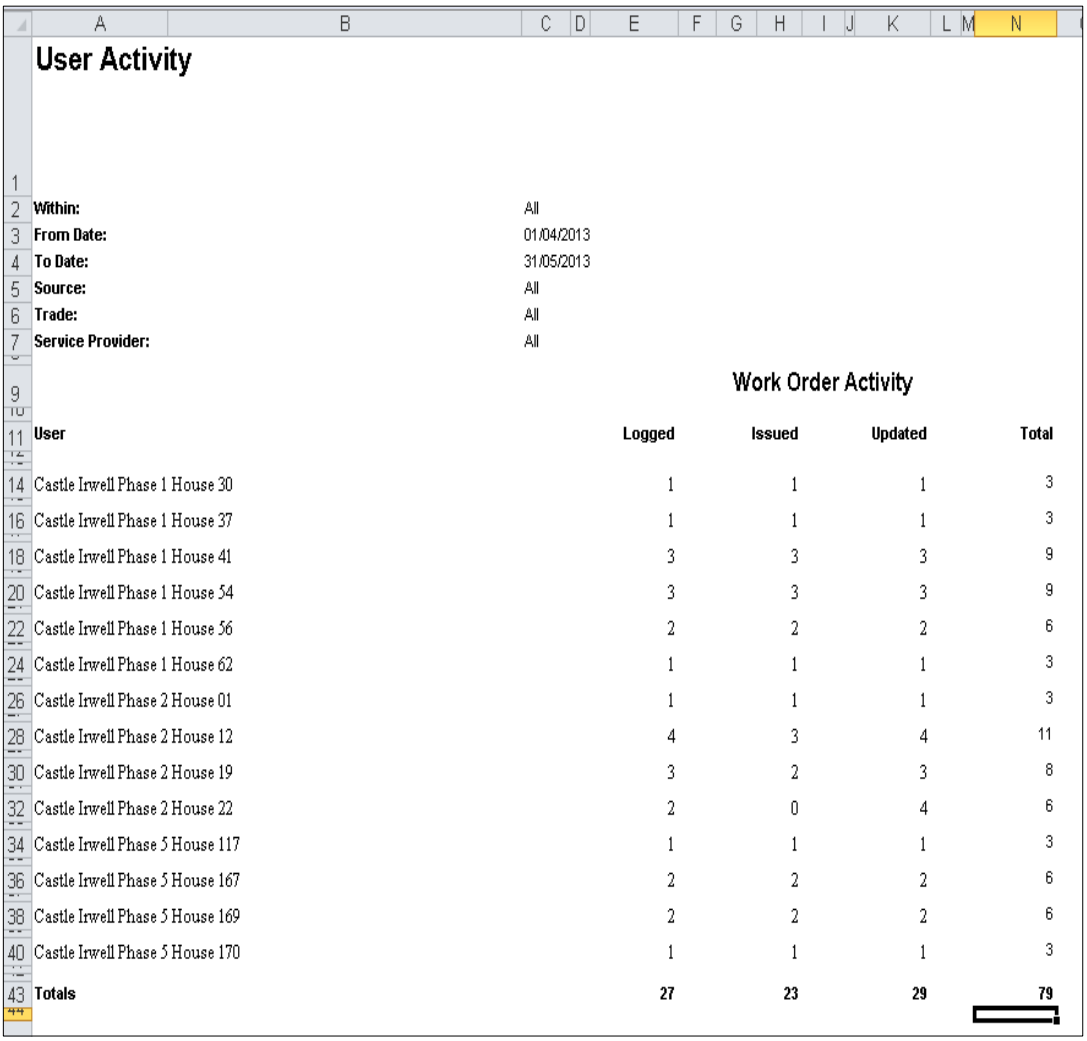
Selected accommodation issue



When finished entering your details and accommodation issue hit submit. A reference number will be assigned and the main details can be printed off.



Appendix K: Student CAFM Net User Activity 4/5/2013

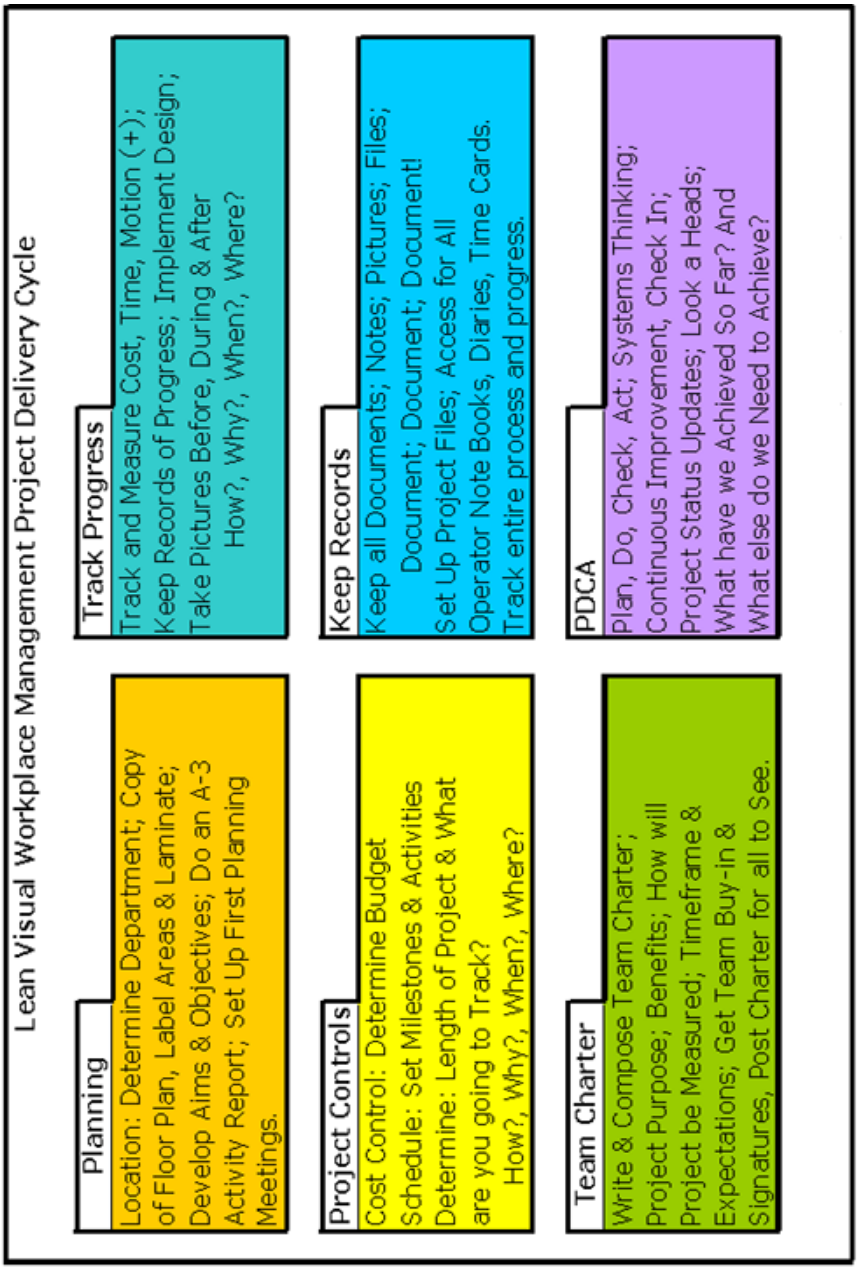


User Activity

Within:	All
From Date:	01/04/2013
To Date:	31/05/2013
Source:	All
Trade:	All
Service Provider:	All

	Work Order Activity			
User	**Logged**	**Issued**	**Updated**	**Total**
Castle Irwell Phase 1 House 30	1	1	1	3
Castle Irwell Phase 1 House 37	1	1	1	3
Castle Irwell Phase 1 House 41	3	3	3	9
Castle Irwell Phase 1 House 54	3	3	3	9
Castle Irwell Phase 1 House 56	2	2	2	6
Castle Irwell Phase 1 House 62	1	1	1	3
Castle Irwell Phase 2 House 01	1	1	1	3
Castle Irwell Phase 2 House 12	4	3	4	11
Castle Irwell Phase 2 House 19	3	2	3	8
Castle Irwell Phase 2 House 22	2	0	4	6
Castle Irwell Phase 5 House 117	1	1	1	3
Castle Irwell Phase 5 House 167	2	2	2	6
Castle Irwell Phase 5 House 169	2	2	2	6
Castle Irwell Phase 5 House 170	1	1	1	3
Totals	**27**	**23**	**29**	**79**

Appendix L: Lean Visual Workplace Management Project Delivery Cycle



Appendix M: Lean FM Exploring a Lean Visual Workplace Meeting Minutes

Lean FM – Exploring a Lean Visual Workplace

Meeting Minutes 1

Date: Wednesday, 3 October 2012

Time: 14:00 – 15:20

Theme: Phase One: First Planning Meeting - Lean Visual Workplace

Venue: Room 102, Myers Building

Attendees:

Assistant Operations Director
Quantity Surveyor
Team Leader Operational Support
Head of Administration Services
University Researcher

This forms the meeting minutes for the first Meeting 1 for Case Study: E&PS Mail Room Phase One: Planning Session.

An introduction took place and the researcher presented her construction, design and facility management professional work experience.

Planning Phase

1) Location
    a. It was determined that the case study will consist of the Mail Room and Stores.
2) Floor Plans
    a. A copy of the existing mail room and stores will be furnished by E&PS.
    b. A copy of the proposed mail room and stores will be furnished by E&PS.
3) Aims, Objectives and Case Study Program
    a. Aims, Objectives and a Program of the case will be developed by the researcher.
4) Doing an A3 is not an activity that will be explored at this time.

Appendix M: Lean FM Exploring a Lean Visual Workplace Meeting Minutes

Project Control Phase

1) Determine Budget
    a. The budget will be looked at when a proposed design and visual tools are presented to the management team.
2) Set Milestones
    a. The researcher will devise a schedule of activities and proposed observance activities and present to E&PS management team.
3) Length of Case Study was approved by E&PS Management Team
    a. Phase One: October 2012 - December 2012
    b. Phase Two: January 2013 - March 2013

Team Charter

1) Develop a Team Charter, Management's perspective
    a. A meeting for the management team to develop a Team Charter will be set up week for Wednesday morning 10 October 2012, unless otherwise noted.
2) The Research Project will Measure the following aspects:
    a. Benefits
    b. Change
    c. Culture
    d. Cost
    e. Added Value
3) The workers in the mail room and stores will be called operatives in the research study.

Proposed Schedule: October

i. Planning Phase
ii. Take a look at the Existing State
iii. Team Charters will be developed
iv. The Book, "Work That Makes Sense" was distributed (2 copies, one on loan, one as gift in kind from researcher)

Action Items:

1) The researcher will send information on Team Charters.
2) The researcher will develop a program of times and dates for case study activities.
3) CT to send ALS quiet times and busy time details of the stores and mail room.
4) CT to put a list together of each employee with name and title.
5) E&PS to supply existing and prosed floor plans of mail room and stores to researcher.

a. E&PS to set up meeting Charter development meeting for Wednesday morning 10 October 2012.

This concludes the minutes to the said meeting if your view differs from what has been formulated; please contact the researcher at your earliest convenience.

Appendix N: Lean FM Exploring a Lean Visual Workplace Project Schedule

Appendix O: E&PS Stores Questionnaire

E&PS Stores Questionnaire

Estate and Property Services (E&PS)
Questionnaire for Developing a Lean Visual Store

Your company has been approached as an industry partner in collaboration with the said PhD case study research project.

Title of Case Study Project: The Lean Visual Stores

PhD Thesis: Exploring Lean Facilities Management in Complex FM Practice: Creating a LeanFM Visual Workplace

Case Study Objective

The principal objective is to understand the effectiveness of applying lean visual management techniques to the context of University Facility Management practice. The case study research will seek to embrace the theoretical philosophy of implementing lean tools and visual management techniques to develop a lean visual facility management organization. In this specific case study the concentration is on developing a lean visual stores.

Methodology

Interviews and questionnaires methodology will be presented to the University xxxxxxx, Estate and Property Services Stores to gather, introduce and synthesise project data. An initial meeting was established with key points of contact to introduce the research goals, objectives and discuss end-user participation; this document is a result of the discussion that took place. For clarification we are working with the internal customers of the stores which are defined from the researchers' perspective as the following:

Internal Stores Customers

1. Multi-skilled Trade Persons
    a. Electrical
    b. Mechanical
    c. Plumbing
    d. Joiners
2. Building Managers
3. Campus Managers
4. Handypersons
5. Administrative Personnel (?)

Collaborating, discussions, semi-structured interviews, questionnaires, observing on-site activities, will be research tools implied to gather the necessary data. This data will be synthesized and used in the researches PhD thesis. All research activities will be coordinated through key personnel within your organization. Prior to the collection of information, goals and objectives will be defined as to what work related information will be gathered. Some data may be recorded for personal use to allow transcription using a standard dictaphone. All data collected, including interviews, will be available for participants to review. No names or positions will be referred to in the PhD thesis, all participants will be referred to as an operative; each operative will be numbered.

Appendix O: E&PS Stores Questionnaire

Name of Participant: _____

Position Held: _____ How Long at current job?: _____

Full or Part Time: _____ How Many Hours per week: _____

How long have you been in the above position? _____ How Long have your worked for E&PS? _____

How many positions have you held while employed with E&PS? _____

Name the positions held? _____

_____

_____

_____

Part 2: Typical Questions Concerning the Research Topic

1. How often do you visit the Stores? _____
2. What is the main purpose of visiting the Stores? _____

_____

_____

3. Do you order supplies? YES ☐ NO ☐
4. Upon visiting the stores to retrieve a stock item, is the item usually in stock? YES ☐ NO ☐
5. How are you notified when the stock item ordered has come in? _____

_____

_____

Questions for Multi-skilled Trades Staff: State What Trade You Work In:_____

6. When you are at a site repairing an issue, do you have the necessary tools and supplies to do your job? YES ☐ NO ☐ Explain and Give Examples. Please use the box below to for your answer.

Appendix O: E&PS Stores Questionnaire

Questions for Building Managers

7. Do your building handypersons/porters and cleaners have the necessary tools and equipment on site to perform their task? YES ☐ NO ☐ Explain and Give Examples. Please use the box below to for your answer.

8. What stock items do you keep on site for repairs?

9. Do you stock light bulbs/fluorescent tubes on site? YES ☐ NO ☐

10. Do you stock ballast for light fixture repairs on site? YES ☐ NO ☐

11. If you answered 'NO' to question '10.' above, Why do you not keep ballast for your buildings light fixtures in stock at your building site? Please use the box below to for your answer.

12. Have you ever thought about keeping all necessary equipment on site at your building for typical building repairs? YES ☐ NO ☐

3

Appendix O: E&PS Stores Questionnaire

13. In the future it may become necessary for each building to keep more stock and supplies on site as the Stores relocates to a smaller more central location on Peel Park Campus, Maxwell Well area. Would you please do an exercise and think about a location(s) in your building where you can keep more supplies and equipment on hand. Take a look around your facility, or you may already have an idea of where to keep additional stock levels. There are two questions to this item:

a. What stock items would you keep on site?

b. How many rooms do you have available for equipment and cleaning supplies? _____

c. What size are these rooms?

14. Have you any suggestions of how the Estate and Property Services Stores can better serve you as a client?

Appendix O: E&PS Stores Questionnaire

Informed Consent

Name of Researcher and Key Point of Contact: Ms. Audrey L. Schultz, PhD Scholar and Research Assistant, [redacted] Contact information, e-mail: [redacted]

- The subject will have the right to withdraw consent once given at any stage, without prejudice, and where appropriate, to withdraw any data collected.
- The investigator will undertake to protect the confidentiality of the subject.
- In the event that the results are published, the investigator shall protect the identity of the subject, unless the subject consents to be named.

1. I confirm that I have read and understand the information sheet attached for the above research study.
2. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
3. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected.
4. I understand that relevant sections of any notes and data collected during this study may be looked at by responsible individuals from The University of Salford where it is relevant to my taking part in this research. I give permission for these individuals to have access to my information.
5. I agree to take part in the above research study.

I have read and understand the above and consent to participate in this research study. My signature below is not a waiver of any legal rights. Furthermore, I understand that I will be able to keep a copy of the informed consent form for my records.

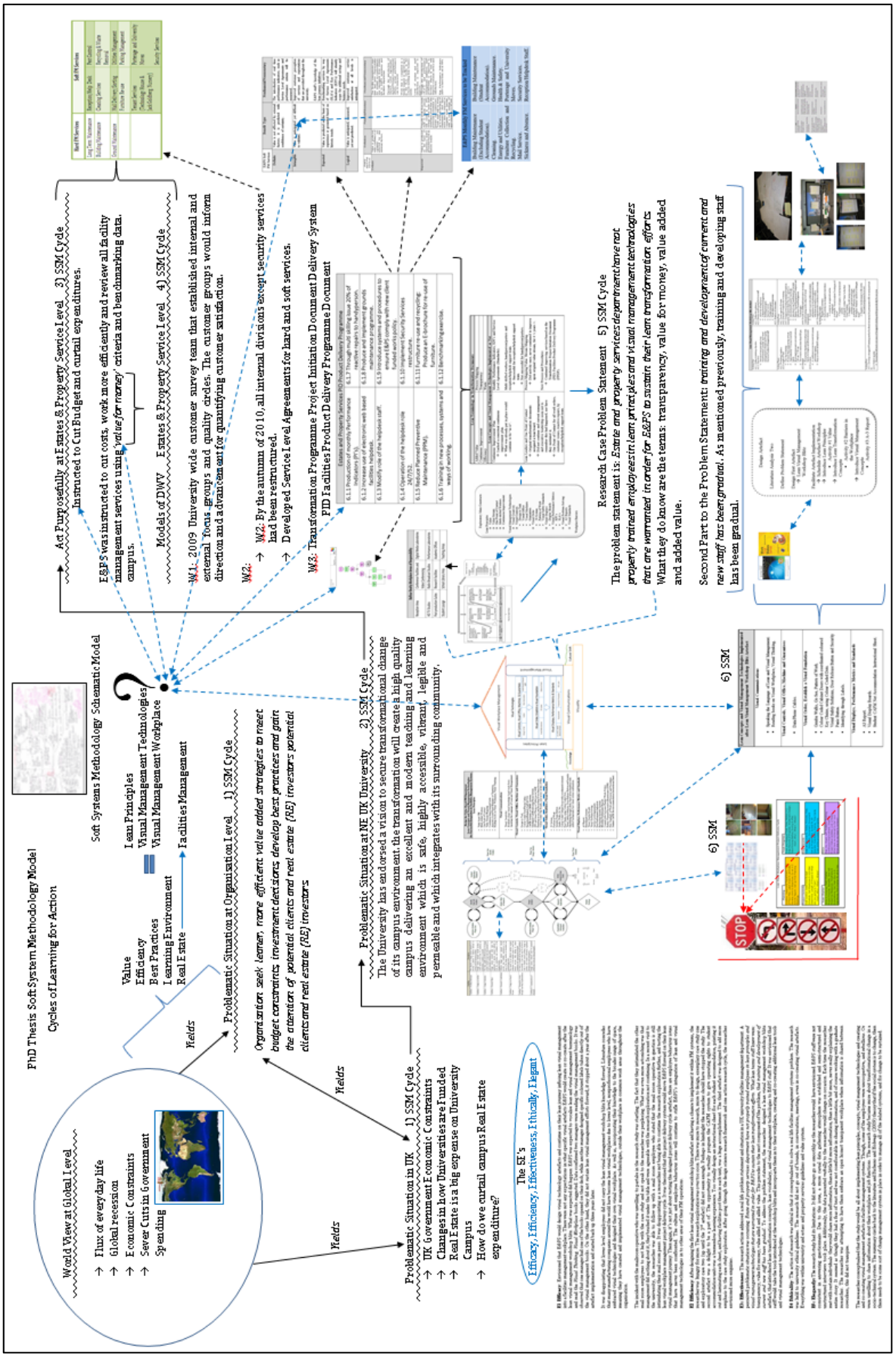
You have been chosen to partake in Lean Visual Stores research study and would like your opinion on the stock levels, merchandise kept, ordering procedures and how it all affects you as customer of the stores. All information provided will be strictly confidential. Any acknowledgement of your name and organization provided in this document will be subject to your agreement.

By signing below you give consent and authorization as a participant in the said research project.

Signature	Print Name	Date

5

Appendix P: Soft Systems Methodology Model Cycles of Learning for Action



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