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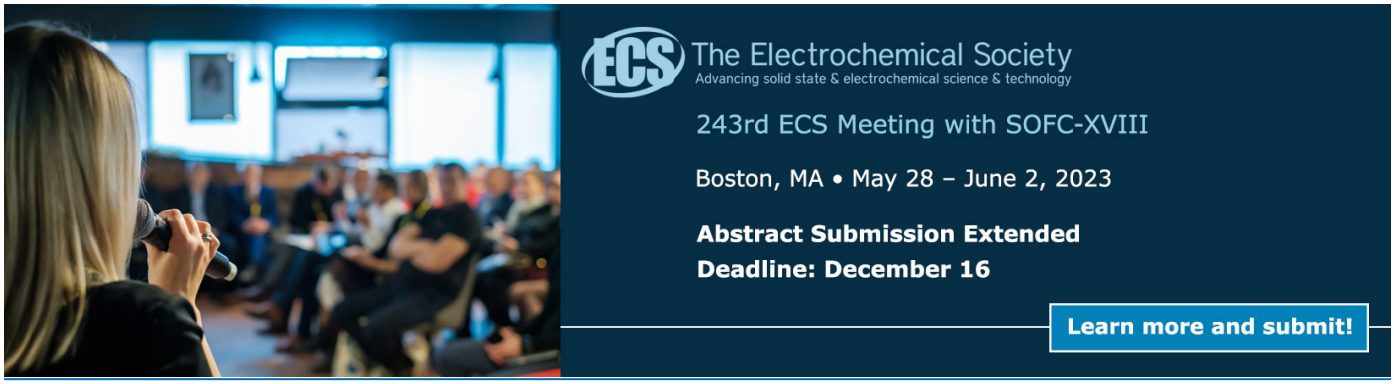

Lean and visual managements contribution to sustainable facilities management

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Abstract. Sustainable management practices such as lean and visual management can be directly linked successfully to facilities management practices. This was acknowledged during an exploratory case study that assessed the leanness of a university's transformation, evaluating their lean and value-added approach to enhancing workflow efficiencies. The research study was limited to one UK university estates and property services lean journey. Design science research methodology with an action research approach was applied. In conjunction with qualitative methods such as interviews, questionnaires, and participatory observations in action that included a workshop. The literature review surmised that there is a lack of data demonstrating the correlation between lean visual management and sustainable management practices especially in facilities management services. Additionally, combining sustainable management and change management methods is also not widely researched. When sustainable management practices that include lean and visual management are implemented in facilities practices customer expectations are improved, waste eliminated, color coding and labelling implemented, and known sustainable practices such as recycling of furniture, fixtures and equipment occur adding value and reallocating financial resources. It is recommended that change management be introduced to better understand workplace culture when executing transformation directives. Subsequently, management will become better equipped at contending with employee's attitudes, work ethics, and behaviours. The originality of this research exploration illustrates that facilities management departments should embrace sustainable management practices that include lean visual management methods combined with change management. Consequently, improving employee experience, return on investment and acknowledgment from customers, senior leadership, and the C-suite.

1. Introduction

The growing cost of aging buildings, leasing space, and managing real estate portfolios plus the escalating cost of work inefficiencies have a huge influence on the organizations bottom line. Capital expenditures, operations and maintenance of facilities, and employee salaries are continually at the forefront of strategic initiatives [18]. The public sector and government agencies are always seeking value added strategies, designing leaner efficient work structures, updating policies, and modifying funding support. This is all linked to the sustainability efforts of the organization and becomes a key

component when making changes to the work environment [18]. It is essential that facility managers integrate operations with the entire organization's strategic plan and assess what services are essential in meeting administrative requirements. The facilities department has a vast opportunity to integrate sustainable management practices that blend well with the organizations core business mission, vision, and culture.

There is a lack of literature evidence and published research indicating that lean visual management practices are implemented in facilities management (FM) services adding value to the facilities department, customers, and the organization. According to Schultz [17] the literature suggests that lean management practices are limited in scope to aerospace, construction, healthcare, manufacturing, operations and maintenance practices, retail maintenance, and transportation sectors. This makes a strong case for further investigation and research into the value that lean and visual management add to sustainable facilities management services.

In recent years, sustainable facilities management has developed into what Nielsen, Sarasoja, and Galamba [12] consider an 'emerging theme'. Sustainable facilities management, also known as SFM, is defined "as integration of people, place and business of an organisation that optimizes economic, environmental, and social benefits of sustainability" [12]. SFM connects the department and organization too what Jaber [8] considers are sustainable environmental social governance, economic, and corporate social responsibility initiatives [8]. For this research the author sides with Hodges [6] theory of sustainable facilities management in that facility managers have a "unique position to view the entire process" of their organisation and how they offer facilities services. They are often put in the position of becoming the "leader of the only group that has influence over the entire life cycle of a facility. Therefore, the facility manager often becomes the proponent of sustainable and green practices". This provides the opportunity to "arm themselves with the proper financial and strategic planning tools", that "create long-lasting value to the organisation by developing, implementing, and maintaining sustainable facility practices" [6]. The authors envision that lean and visual management methods enhance facilities management services connection to the organization's environmental social governance, economic and sustainable management practices.

2. Research Methodology

The exploratory case study research analysis considered the leanness of a northwest England's estates and property services (E&PS) department. The department's internal lean transformation directive was examined. Research data was gathered using qualitative methods to include interviews, questionnaires, and participatory observations in action. The research methodology was design science research (DSR) with an action research (AR) approach. Design science research can be categorized into three or five research phases [9] [17]. A three-phrase design science research approach was chosen to identify an existing problem within E&PS's business structure. The main construct behind DSR phase one is conducting a literature review combined with an exploratory case study examining internal business practices and discovering the real-life problem. In phase two the researcher creates an artefact to resolve the real-life problem. This is followed by phase three, where the artefact is implemented, evaluated, and tested. According to Schultz the designed artefact must be "evaluated through testing with organization participants through observation and action" [17].

Burns states that "action research is not a methodology, it's an approach to inquiry that supports many methods" [1]. Schultz's [17] philosophy is that action research blends research of business, education, human services, and social systems. It identifies changes in the system and various points of view [1]. On the other hand, Bell considers that "researching in action is a systematic progression of enquiry, reflections and action conducted by researchers regarding their own workplace or organisation" [17]. The research inquiry 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" [17]. While conducting the exploratory case study the researcher was hired as an employee of estates and property services. Therefore, throughout the research exploration participating with various levels of E&PS employees' side by side developing artefacts and implementing change.

Together, design science research combined with action research strengthens the case study methodology and approach. Recapping the three phased design science research process is as follows; Phase one consists of a literature review and exploratory case study to determine the real-life problem; Phase two is the creation of an artefact as the solution; and Phase three evaluates the designed artefact in partnership with the researcher and case study participants, through action research. The action research cycles designed during field observations were plan, reflect, observe, and act. This interlaces the rigor of continuous improvement and clarifies the designed solution and its relevance to the organization's success [17].

3. Case Study Assessment

The first exploratory case study assessed the leanness of estates and property services transformation using Womack and Jones [20] five lean principals connecting their theory to facilities management practices, as follows:

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 actions required to bring a product or service through problem solving, information management, and physically transforming into a new process. Here, the value stream refers to the nature of actions that converts a facilities management service into reality.
3) *Make the Value Flow:* By reducing cycle times and batch sizes to the absolute minimum, ensuring each operation is highly visible and transparent, defined, and its status eliminates waste that might interrupt the process. In facilities management services, the value flow can be relayed to the cycle time of the work order process, repairs, and work activities.
4) *Let the Customer Pull:* Processes, products and services are produced and delivered on-demand of the customers' expectations.
5) *Pursue Perfection:* Even if the other four lean principles are followed, if the mind set for pursuing perfection has not been established throughout the system, any improvement will only deliver a one-off benefit [17] [20].

For this research study, the fifth lean principal is considered continuous improvement. This term is favoured over the use of pursing perfection, which is limited in nature. Other lean methods implemented were *one point of contact*, *multi skilled workers*, *just in time*, *Kaizen events*, *creating a learning environment*, *Gemba* walks and *Genryou*.

The concept of lean originates from industrial engineer Shigeo Shingo's total quality management (TQM) system of just in time batch systems and waste elimination. Taiichi Ohno in the 1950's advanced Shingo's TQM system and developed the Toyota production system (TPS). However, it was Krafcik's TPS research that defined the theory of *lean production systems*. Krafcik in 1988, concluded that TPS is a lean production system since it uses less energy and less resources [17]. Lean production theory includes many concepts, the research focused on visual management, creating a learning environment and continuous improvement. Other key lean concepts integrated were *Genryou,* which is a term that Taiichi Ohno [14] used to explain the theory of reducing production in a company. When a company streamlines their workflows, they become leaner, by "reducing the weight" of the operations through reducing *Genryou* [14].

Lean management systems consider *Kaizen events* that bring together all employees to work collectively on continuous improvement initiatives. It creates "a culture where all employees are actively engaged in making change and improving the company" [23]. Kaizen events are developed to "teach employees to think differently about their work. In other words, a consistent application of a Kaizen action plan creates tremendous long-term value by developing the culture that is needed for truly effective continuous improvement" [23]. *Gemba* is another lean discipline introduced and widely used after the lean Kaizen workshop. Gemba is the Japanese word meaning to go see, get out of your office, and go see the real place where value is integrated [19]. It's essential that lean thinkers and leaders are conducting their Gemba walks in the field, not just seated behind their desks all day.

Starting a library of lean books and resources creates a *learning environment* which is key to employees understanding the concepts of lean, added value and visual management. Therefore, a *lean library* concept was presented, and suitable lean visual management books authored by Dr. Gwendolyn Galsworth were provided for the library. Galsworth's books introduce the concept of *visual management* (VM) and illustrate how visuality techniques can be designed and implemented in the workplace by employees at all levels. In a visual workplace environment, the information needed to do assignments are illustrated using visuality. This is achieved through value-added contributions to the organisation by communicating critical data in visual formats. Galsworth [4] contends that a visual workplace creates a language, a vocabulary of visuality that eliminates barriers, and envelops sustainable improvement initiatives forming visual order, which is the foundation of lean visual organisations. In a lean visual sustainable facilities management workplace, employees are provided with the necessary tools and techniques that increases communication, transparency, the sharing of information, and co-creating value with the end user across the organisation [17].

3.1 Assessing the Leanness of a University's Transformation

The researcher was made aware that the university's estates and property services (E&PS) department were instructed to reduce their operating budget by £1 million due to lack of government funding. Estates and property services reorganisation supported the functions of the university's strategic plan and transformation program. E&PS was charged with reviewing all facilities services using a value for money criteria. At the same time a new director of estates and property services was hired. The director initiated a transformation directive that introduced a lean and value added approach to facilities practices.

Phase one exploratory case study assessed the leanness of estates and property services lean value added transformation. The directives that were put into action would reshape the workplace and services provided. The main emphasis was to enhance the overall campus experience, support improvements and the environment for students, staff, and visitors; deliver quality facilities maintenance services; develop a competitive transparent pricing structure for inhouse and outsourced facilities services; establish benchmarking perimeters; provide one point of contact; develop a lean approach to delivery of services; value stream map all process and procedures to remove wasted activities; promote sustainable practices such as recycling and composting, this included recycling of furniture, fixtures and equipment (FF&E); engage with university led initiatives aimed at improving the diversity and impact of the campus master plan. Additionally, the inhouse security department was restructured and the construction department was dissolved slowly overtime.

3.1.1 E&PS specify their value

An internal university customer focus group was established. Prior to the reorganization E&PS had never asked customers what their expectations were for facilities management services. They also reached out to industry professionals, various organizations, and universities to find out how they managed facilities services. Customer focus groups recommended customer satisfaction surveys and a customer survey team was formed. This is associated with the lean principle of pull, the customer sets expectations and pulls the services through the value stream. As a result, lean facilities management was established using lean pull systems. The customers were part of the process that set service standards and value expectations. Estates and property services evaluated the British Services Institute BS EN 15221-3 which provides direction for benchmarking services establishing quality and value-added facilities management practices. Previously, E&PS had never benchmarked services, thought about customer satisfaction, or considered service level agreements (SLA's) and establishing key performance indicators (KPI's). New monthly reports and performance criteria were considered adding value to their operations. This links back to the director's transformation charges that variations in operations must be lean and have a value added approach.

3.1.2 E&PS Identifies their Value Streams

E&PS organized standardized operations into hard and soft services. Hard FM services were long term maintenance, building maintenance and grounds (landscaping) maintenance. Soft FM services were split

into the following categories: reception/helpdesk, cleaning services, mail delivery, sorting, furniture re-use, tenant services, pest control, recycling and waste removal, utilities management, parking management, porterage and university moves, and security services. They updated their CAFM (computer aided facilities management) system and established monthly reports based on key performance indicators incorporating a revised PPM (planned preventive maintenance) schedule. Monthly audits of operations were benchmarked, and new service level agreements were developed for each workflow. Maintenance schedules started to be measured and audited monthly and results integrated into performance reports. Additional monthly reports were developed for security, health and safety, furniture collection and recycling, student accommodations, maintenance, and energy management.

Major work levelling initiatives took place by combining the reception and helpdesk activities and expanding the role of the handyperson and porterage services. The reception/helpdesk associates new responsibility was to become *one point of contact* for all customer requests and assigning work orders (WO's) to the appropriate *multi skilled tradespersons*. This was insured by purchasing a new phone system that was installed and linked to 5 reception desks in various buildings across campus. The new reception/help desk position and phone system ensured that the flow of information to and from the customer was constant and acceptable. They began monitoring all outstanding work orders benchmarked them against SLA's and KPI's. 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 was entered into the CAFM system by the reception/helpdesk associate it was distributed via e-mail to the necessary multi skilled tradesperson. If the WO was an emergency repair, the tradesperson on emergency duty was contacted immediately. The reception/helpdesk became the key point of contact for managing the lifecycle of workorders and repairs. This might resemble standard facilities management operations to some readers. Though for E&PS this was all new sustainable management practices.

Another big change was merging the building porterage employees and handypersons into the lean concept of *multi skilled workers*. In the facilities management and real estate industry employees are tasked with everything and anything to manage real estate assets. One day they are setting up for an event, the next day hanging wall mounted file sorters, repairing systems, moving furniture, fixtures, and equipment, or performing lite construction activities. E&PS estimated a savings of £136,000 equalling a 20% savings by transferring activities performed by multi skilled tradespersons to the new handypersons/porterage staff. One multi skilled tradespersons would be made redundant, resulting in an additional £30,000 savings.

The new handypersons/porterage staff provided light repairs, including fixing light fixtures, heaters and door and window hardware, helping with FF&E issues, fixing ceiling tiles and painting. E&PS identified cross training opportunities for both building handypersons and multi skilled tradespersons. The handypersons/porterage staff were not interested in attending training sessions and upgrading their skillset. All multi skilled technicians were more than happy to increase their skillset, services, and responsibilities. Most of them were working toward certificates in their field, such as becoming a master electrician or joiner. Animosity between the handypersons and technicians took place. Selected work orders were assigned to handypersons/porterage personnel; they would attempt or not, to repair items that eventually had to be reassigned to a multi skilled tradesperson. Resulting in a variety of WO's being left open beyond their life cycle, causing red flag issues and a change in monthly reporting metrics. E&PS updated the work order structure, highlighting WO's close to their due date as yellow, and red when the tickets weren't closed out on time. The receptionist/helpdesk staff became responsible for managing the work order life cycle and tracking yellow and red flagged tickets. When the WO ticket was closed out, a customer survey was forwarded to the individual who called in the repair ticket, unless it was a facilities staff person. The survey answers were compiled into a monthly report benchmarked per customer service KPI's. Streamlining work order tickets, the new handypersons/porterage and reception/helpdesk responsibilities, and *just in time* processes eliminated waste and provided cost-effective sustainable operations for the university.

The exploratory lean assessment case study determined that estates and property services department was amid a lean journey that was adding value to facilities services. E&PS value streamed mapped all facilities process and procedures and developed standard level of agreements and benchmarked performance indicators per service. The key themes were value added, levelling out process and

procedures, creating a new FF&E recycling program and becoming cost conscious. *Genryou* and *one point of contact* was introduced by reorganizing the reception/helpdesk, *multi skilled tradespersons* and the handyperson/porterage activities. They also assigned a multi skilled tradesperson to be on emergency duty each day. CAFM systems were upgraded and aligned with planned preventive maintenance schedules. Alleviating reactive work and building operations cost therefore becoming more sustainable.

It was clear that senior leadership understood what lean principles were and how to imbed them into facilities operations. The term value added, and lean approach was posted all over their department documents. Nonetheless, most of the facilities staff had never been trained in lean principles and had no comprehension of what lean, and value added meant within the context of their operation. A negative attitude surfaced amongst employees and many viewed lean as the enemy. They saw the transformation as reducing costs by making people redundant and adding more responsibilities to people that didn't want to take on additional workloads. Even the multi skilled technicians voiced their opinion that this transformation effort is not going to succeed. This ended the exploratory case study and design science research phase one. The real-life organizational problem was determined as follows: E&PS was a major contributor of university services keeping the campus safe, healthy, and running properly. Merely most E&PS employees did not understand their departments lean transformation directive and value added approach. They were not educated in lean practices and never had a conversation about what added value meant regarding facilities management services.

4. The research intervention – "The change"

DSR case study phase two inquiry tracked the development of artefacts and intervention of change. Based on E&PS's real-life organizational problem determined in DSR phase one, a visual workplace management system artefact was created and organized into the following categories: visual displays, performance metrics and standards; visual order and visual foundation technologies; and visual controls, visual office, machines and guarantees. Lean principles combined with visual management become the pillars that glue the categories together. One could not introduce lean concepts without referring to visual management and vice, versa. The visual workplace management system creates a knowledge workforce and aids in developing a culture around lean, visuality and continuous improvement. The lean transformation approach was tracked using the visual workplace management system artefact.

4.1 Visual Management Introduction and Implementation

E&PS's shortcomings were that internal staff had no knowledge of what lean, and a value added approach meant. Estates and property services needed their employees to all be on the same page for the lean directive and transformation to be successful. Another designed artefact created in DSR phase two was a *lean visual management workshop blitz*. This is what is referred to as a lean *Kaizen* event.

The researcher created a PowerPoint slide deck introducing sustainable management systems emphasizing value and waste, an introduction to lean and its history, lean transformation methods and visual management techniques. An international researcher from Aalto University in Finland was invited to present their case study findings on value and waste in real estate (facilities) management. Three interactive activities were designed for the workshop, they are as follows: A-3 report, discussion on the concept of value in facilities management services using sticky notes, and a discussion on barriers in the workplace using a flip chart. There were 16 workshop attendees that included administrators, the assistant director, building and campus managers, a carpenter (joiner), electrician, operations manager, and team leaders. The workshop was scheduled for one day and lasted 8 hours.

After the workshop the researcher sent a copy of the presentations and activities to E&PS's director of administration. They recommended that E&PS start a lean library and provided them with two books by Dr. Gwendolyn Galsworth, Visual Workplace/Visual Thinking and Work that Makes Sense. Senior leadership started their *Gemba walks* as a weekly ritual. By instituting Gemba walks facilities managers start to see where the issues are and become more familiar with department and organization needs. This might include creating ways to eliminate waste throughout the system and turning internal problems into quality value added services.

Various levels of employees started to speak the language of lean and visual management. Tangible research data was developed, and visual management technologies were created and integrated into the workplace. The continued leanness of E&PS was observed, and visual management technologies were further designed and assimilated. The concept of *lean stand-up meetings* and using white boards as visual communications was introduced, but not sustained overtime. The researcher was tasked with programming the CAFM system to provide students the ability to enter and track student accommodation work orders. Students were also provided the ability to communicate with the student accommodation facility manager. Work order instructions were designed and posted in each student housing unit. This is a form of visual thinking and visual communication that transpired because of reading Dr. Galsworth visual management books.

4.2 Intervening event and the consequences for the E&PS case

During the research, E&PS's administrative offices were relocated in various areas across campus. The facilities services building that housed everyone, including the grounds and carpentry shop, mail room, warehouse and storage would be demolished and made way for new student accommodations complex. Some lean services and visual management practices already implemented were sustained. No new work structures were put in place during this phase of inquiry. Once estates and property services main administrative officers were relocated across campus, visual management techniques started to be exhibited, again. Sustainable visual management practices adapted after the workshop are as follows: Visual communications such as *speaking the language* of *lean* and *visual management*, creating a *learning environment* by *reading books* about the *visual workplace* and *visual thinking*. Visual Controls, visual office, machines, and guarantees were created in the form of *color coding* the data and phone cables. Therefore, the receptionist/helpdesk employees knew how to insert the cables into the correct electrical receptacle to start up the daily communication systems.

Visual order, establish a visual foundation related to the *Gemba* walks started. *Patterns of work* were implemented. The new main facilities administration reception cabinets were all white. Each cabinet and draw had a different lock and key. Therefore, a new *visual management color coded* system was designed using color coordinated key chains and colored dots. This helped ensure that the receptionist/helpdesk associate knew exactly what key opened each lock and cabinet door. It streamlined the work activities throughout the day, saving time, eliminating wasted efforts, and employees became more efficient. Visual safety solutions were identified across campus, as well. At the 5 reception/helpdesks, emergency panic buttons were installed and red *labels* with black letters were posted above the safety buttons. A security door release button was installed at two locations and were labelled using what Galsworth [4] states is the best *visual color combination*, (U.S.) school bus yellow background with black letters. Visual displays, performance metrics and standards started as E&PS's management staff began using *A3 reporting* in meetings. A white *visual display board* to communicate *work patterns* and assignments started being used. However, it was not organized and sustained; the team leaders wrote anything all over the white board including happy faces. In all student accommodation units, an instruction sheet developed by the researcher to inform students how to enter and track workorders was posted. Large capital project schedules and project data posters were pinned up on the walls for *lean stand up meetings*. This concluded design science research phase three evaluation inquiry results after the *lean visual management workshop blitz* artefact was introduced.

5. Facilities Change Management

A design science research case study aimed at accessing the leanness of a university's transformation that included cost cutting directives, a lean approach, and value added initiatives was introduced. As illustrated, the continued effort of management to keep up with the transformation directives were not attainable due to the relocation of the department, lack of continuous improvement strategy, and cultural issues that sabotaged improvement strategies. While collecting the case study data, the researcher stumbled upon cultural clashes that abruptly stopped the research study. Any modification to facilities management services as illustrated herein, along with real estate acquisitions, redesigning the workplace, relocations, updating IoT technologies, data analytics and business intelligence platforms, even value stream mapping will disrupt employees comfort level. It was concluded that cultural constructs and

change had a direct influence on the research outcome and success of E&PS's lean journey. A variety of employees will always find fault with new systems making it difficult for management to follow through. Then the new lean directive turns out to be just another failed attempt at an organisational transformation program. According to Schultz [17] "it doesn't matter where you start implementing new systems; facility managers will need to follow an improvement plan and appoint change agents or lean champions to manage the implementation efforts and communicate with transparency to the employees, as well as senior leadership" [17].

Facility managers have a duty to fully comprehend change management processes and implement them alongside all new work directives. Scheduling change management (*Kaizen*) workshops dedicated to the organization and department transformation will help in being transparent and communicating new actions. Additionally, integrating lean *continuous improvement*, such as the Deming cycle of plan, do, check, and act will support the facilities department as they move forward. For example, a receptionist that had been with E&PS for over 10 years, value stream mapped the reception/helpdesk new process for answering the phone and inputting work orders. The value stream map visual was used to train all new reception/helpdesk associates. However, it was incorrect, and the researcher brought this up to administration. The lead administrator affirmed that the value stream mapping exercise had taken a lot of energy and time and therefore it stays in effect. A new (correct) value stream map will not be considered. This goes against leans continuous improvement principal, visual management and building an educated workforce and learning environment.

A year after the case study ended the researcher observed how the lean transformation was progressing. What they found is that all lean visual management practices had stopped. This is typical of an organization that didn't invest in lean managers, change agents and continuous improvement cycles. Action researcher and social psychologist Kurt Lewin's three-phase organisation change theory analogy combined with lean thinking will explain what happened. Lewin [2] describes a typical organisation as frozen in time, like an iceberg. In the first phase the frozen entity unfreezes itself and reviews the existing state of operations. This is also the first phase of value stream mapping, reviewing the existing state. The second phase is where the organization integrates value stream mapping into Lewins theory and maps their current processes, eliminating waste while redesigning new work structures. This becomes the new 'to be' state. In the third phase the new proposed or 'to be' state of operations is implemented then the organisation is refrozen in time [2]. The study determined that E&PS may never achieve the ability to refreeze their operations, since they haven't come to terms with developing a new culture, and better work habits nor using continuous improvement methods. Some new processes and procedures were working out well, with no value stream map connected to them. Other processes didn't match the value stream maps that were created. This ended the research inquiry follow-up.

6. Conclusion and Further Research

Sustainable facilities management should not merely be considered energy efficient strategies, changing out lighting to LED's and adding sensors or photovoltaic panels to the building. Sustainability starts with managing the process and procedures at the workplace level. Imbedding lean visual management and value added practices combined with change management to create an efficient, organized, and sustainable workplace. The success of any facilities management department also depends greatly on working closely with the customer in determining their expectations and satisfaction criteria, as well. Changing the practices and culture of an organization to a more human centric visual learning environment has its challenges. As an organisation starts to execute transformation initiatives behavior and cultural issues will arise. If facility managers aspire to be taken seriously and acknowledged by customers and the C-suite, then they must establish themselves as change leaders of the building life cycle by implementing sustainable management practices. It is hoped that facility managers will consider the value of embracing human capital and the importance of starting their own lean visual management journey. Contributing to the future advancement of sustainable facilities management practices.

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