Cranfield University

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An Investigation into the application of Lean Methodology in the UK Hospital Sector

School of Health
MSc Organisational Knowledge

MSc THESIS

Academic Year 2008-2009
Supervisor: Dr C Wainwright
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This Thesis is submitted in partial fulfilment of the requirements for the Degree of Master of Science.

Abstract

Lean principles have been used in manufacturing organisations globally for many years. Lean principles are increasingly being successfully applied with respect to the delivery of healthcare services on a global scale.

Lean begins with eliminating waste, ensuring all work adds value, whilst serving the customer's / purchaser's needs. Determining the 'value added' and 'non value' added steps in every process, is the key tenet of Lean Thinking.

For lean principles to be effective, an organisation's culture that is receptive to its concepts and methodologies is vital. Demonstrated commitment to lean must begin at the very apex of an organisation, and key personnel should be involved in helping to redesign and reshape key processes, with a view to improving flow, whilst at the same time reducing waste.

Whilst healthcare differs in many ways from manufacturing, a number of similarities do exist: staff members are dependent on multiple and often complex processes in order to complete their duties, whilst at the same time provide value to the customer or patient.

Examples within this Thesis, illustrate Lean principles when applied to a healthcare setting, can have a dramatic effect on cost, productivity, financial performance, and most importantly the timely delivery of services to patients.

Acknowledgements

Contents

Chapter 4: <u>Findings: Benefits of Lean Implementation/ Empirical Evidence</u>

Chapter 5: <u>Case Study: Empirical Evidence from the Royal Bolton Hospital</u>

Chapter 6: <u>Discussion and Recommendations</u>

References   60

Chapter 1: Introduction

1.1 Background

Governments on a global basis aspire to be in a position to deliver better healthcare to its population, however the need to 'get value for money' from government expenditure has never been greater. Bhatia & Drew (2007) indicate crucially for the public sector, that lean thinking contradicts with the long held view that tradeoffs between the quality of public services and the cost of providing them are inevitable. Lean provides for newer and enhanced services at limited cost, whilst not disregarding the interests of key stakeholders such as the workers themselves.

The ever- increasing costs of funding public sector healthcare in the UK forms the rationale for conducting this research. Faced with the demands from an ageing population, ever increasing patient expectations, advances in medical technology, capped funding from Central Government (3% annual rise from April 2009) and the increasingly competitive arena in which UK hospitals operate, has meant a greater need for hospitals to be more efficient and self accountable.

Lipley (2009) mentions the current economic downturn will accentuate the pressures caused by an aging population and the increase in life style diseases, whilst improvements in medical technology means that the health service is in a position to treat a greater variety of diseases than in the past. He also indicates ''the NHS providers will need to ensure their organisations are more agile and able to flex capacity more readily''.

O'Dowd (2009) claims the NHS could be hit by a £15bn budget shortfall in a few years because of reduced government investment, rising cost and the current recession. Services may have to be cut, staff numbers trimmed, limits imposed on new drugs, and possible new efficiency savings set in areas such as prescribing in primary care to cope with the anticipated shortfall. The NHS will not survive the impending spending squeeze unchanged.

It is argued greater efficiency and the redesign of key services should result in quality improvements, which would result in budget savings essential to overcome this. The NHS will probably have to operate under much harsher financial conditions for a number of years to come, yet at the same time more elderly people, more technology, and higher expectations will create more demand for healthcare. A 2004, cross-government review headed by Sir Peter Gershon concluded that the public sector could save £20 billion each year as a result of working more efficiently. The resultant scarce resources could then be employed elsewhere to enhance services.

White (2009) mentions the need to work closely with staff, looking at productivity and areas to make savings and indicates many savings could be made by integrating care pathways. If as a result of Lean Implementation staff are redeployed to manage better what the NHS needs, and with better

workforce planning, there could be a massive benefit and no need for huge job losses.

Whilst most UK hospitals perform to a consistently high standard, and regularly meet government targets, this is not always achieved in the most productive manner or on a minimal cost basis.

As a result of new government initiatives, UK hospitals operate in a more competitive arena, and great emphasis is now placed upon reducing patient waiting times and providing a quality service. Whilst most UK hospitals perform to a consistently high standard, and regularly meet government targets (most UK hospitals successfully meet the eighteen week rule for waiting times), this is not always achieved in the most productive manner or on a minimal cost basis.

There is an increased emphasis on performance based funding, with performance targets playing an ever increasing role. This has formed the rationale for Foundation Trust status being granted, whereby increased independence is offered subject to self accountability and satisfactory financial performance.

There is huge potential in identifying and eliminating waste in internal systems, which can thereby free up potential resources (time and money) for alternative uses. Many researchers have indicated that the greatest source of 'internal competitive advantage' available to UK hospitals is the elimination of waste from their outdated systems.
A significant amount of wastage stems from duplication of processes- in particular paperwork, unnecessary rework, batching, idle time, waiting times, and unnecessary 'handoffs' between hospital procedures.

1.2 <u>Justification for Investigation</u>

With the ever increasing cost of healthcare, the NHS is put under ever increasing pressure to minimise costs, whilst at the same time improving patient care and safety. The intention is to ensure errors and the resulting risks of litigation are minimised.

The aim is to help UK hospitals identify and eliminate 'wastage' inherent in their often outdated internal processes and procedures, to help cut costs and expenditures, and equally important significantly reduce 'wasted time 'of highly paid professionals. These scarce resources can be better employed elsewhere within the hospitals to a greater effect. The intention is to encourage hospitals to learn to do more with 'existing resources' ie better utilisation of existing resources.

Enhanced forward planning and cutting out duplication of processes and rework is to be encouraged. Improving the 'flow of patients' and providing a 'better quality of service' to patients remains a priority.
The intention is to help hospitals improve or maintain a surplus of income over expenditure. Improved operational performance based on shorter waiting lists/

better quality of patient service, should result in a greater quantity of new patients choosing one hospital over another. The resulting enhanced income, should lead to enhanced facilities and hence further enhanced reputation. So a favourable situation for the successful hospitals arises, but also an opportunity for the poorer hospitals to benchmark themselves against the best, to improve their own processes/procedures.

Overall, the objective is to help UK hospitals improve their performances, by increasing awareness of the potential benefits of applying Lean Methodology, whilst outlining existing empirical evidence of what can be achieved as result of successful implementation ie Royal Bolton, Hereford hospitals, etc.

1.3 Research Question

The key research question that is being addressed relates to whether Lean Thinking as currently applied in the manufacturing sector can be transferred and be applied in the hospital sector, in preference to the generally held view that hospitals and the healthcare sector in general is unique, and such methodologies and tools are not applicable. Hospital operational performance pre and post Lean Implementation in terms of 'time taken to perform particular standard tasks and procedures' will be taken as a 'metric' to indicate the impact of successful lean implementation. Detailed empirical evidence will be provided. 'Financial cost savings' at a departmental level will also be another 'metric' indicating the success of lean implementation. Results based analysis will be offered to confirm the potential benefits of Lean, and hence validating the rationale for implementation.

Most UK hospitals have recognised a growing need to better understand both their practices and internal processes, in order to reduce wastage and deliver a better service to its patients. Off particular interest to most hospitals is a desire to develop a superior understanding of variations in patient demand, to enable it to offer a suitable yet flexible system, in order to have the capacity to meet such demands and in a cost effective manner.

It can be argued, many existing processes and inherent systems in UK hospitals, are unsustainable for the future, and need to be redesigned. This thesis seeks to analyse the relevance and applicability of Lean Thinking in UK hospitals, as a method for eliminating wastage, reducing costs and at the same time improving operational performance.

Overall aim is to produce a Thesis; outlining the 'core' benefits that can potentially flow as a result of applying Lean to the hospital sector, as already exists in the manufacturing sector and certain other service sectors such as financial services and the insurance industry.

1.4 Overview of Lean Methodology

Lean Thinking was developed by Toyota, and its key principle is the idea that work is a process which can be streamlined, as a result of the removal of waste and with close observation at each stage, resulting in maximum

efficiency. Lean is a management philosophy utilising a set of tools that can be implemented across all divisions and functions of an organisation. It is a practical system, which aims to maximise value through its two main principles:
1. The continual pursuit of waste elimination
2. Having and holding respect for individuals and society in general

According to Sanderson & Ramakrishnan (2007) Lean principles include:

1. "Restructuring key value streams to reduce waste and variability"- whereby it is crucial to understand what customers really value, which involves taking an 'end to end view of processes' in order to eliminate activities that do not 'add value', whilst it is vital to synchronise demand pattern with capacity to deliver the required product or services.
2. "Provide the enablers- in order to improve flexibility"-whereby it is vital to delegate decisions right to those workers directly involved, and to reorganise and multi-skill the workforce.
3. "Mobilising the people to sustain the gains"-whereby it is essential to install a performance management system with its associated incentive scheme, implement visual controls throughout the organisation and ensure periodic reviews are carried out. It is also vital to motivate and educate the entire workforce towards the goal of continuous improvement, and ensuring lean capabilities are built into all layers within an organisation.

1.5 Theoretical Overview of Lean Healthcare

Lean is an approach that seeks to improve flow in the patient journey whilst at the same time seeks to eliminate all associated wastes. It is the process of identifying the least wasteful way to provide value to customers. Lean is seen as a possible solution to the three key challenges the NHS currently faces, that is, the issue of quality, productivity and low morale.

Ward (2006) mentions NHS chief executives have indicated they could release greater resources if they could get 'better value for money' from 'clinical processes and staffing areas' where lean could have the greatest potential impact. Examples include entering patient data only once, reorganising key hospital equipment and furniture ensuring that staff does not have to make unnecessary trips up and down their wards/ departments, and minimising the costs of mistakes/errors by rectifying them as and when they occur.

According to Jones & Filochowski (2006) Lean thinking can be applied and serves a useful purpose in healthcare because:

1. "Healthcare is full of long, linear (end to end) processes, patient processes, diagnosis and treatment processes and support processes, like radiology and pathology". However, it is noticeable that none of these processes flow. In the UK the flow is continually disrupted by queues that have become a very noticeable feature of the healthcare system.

Lean demonstrates that these dreadful waits need not be there, and analyses 'inactive periods' also. It teaches us how to remove these 'inactive periods', and also focuses heavily on processes that do greater harm than good, for example, the multiple recording of 'patient data'.

2. "It does not go for simplistic answers". Lean is aware that the process flow (perhaps a patient) is often complex, and will be dependent on several key decisions. Flow is also dependent on all different types of information flows, which Lean maps and records.

Jones & Filochowski (2006) indicate "so much of the caring process depends on key decisions", which may take only minutes. However the absence of which, or the "scheduling of work to suit staff work patterns" can cause prolonged delays of hours or even days sometimes.

According to Buchanan (2007) with respect to information flows, given a scenario where a patient's test results have not arrived back, "the care process in effect stops". Taking the case, where a patient's notes have not arrived at an outpatients department, then an appointment may have to be cancelled and hence rescheduled, since the information contained in the documents is vital for a correct assessment and diagnosis.

Royal Bolton has become the first hospital in UK to introduce 'lean thinking'. Paperwork has fallen dramatically at the hospital and patients are now discharged at an ever faster rate.

Fillingham (2008) argues the aim of a Lean approach is to improve quality from the patients' perspective. The emphasis is on front line staff improving the process about which they have in depth knowledge. This means eliminating what does not add value (waste), so that they can spend their time on work that enhances the 'patient experience' and hence is value adding.

Typically, there are 8 waste types in healthcare:
Injuries- damage to people and staff (e.g. stress)
Defects- medical equipment that is not right and needs repairing
Inventory- patients that are kept on a waiting list (often a long list)
Overproduction- unnecessary tests and X-rays are carried out
Waiting-clinicians waiting for supplies to arrive/ patients waiting for a ward round
Motion-having to walk up and down the ward to obtain appropriate supplies
Transportation-moving patients from ward to ward
Processing Waste-things that doesn't add value, e.g. continuing to care for patients in hospitals when they could be discharged

1.6 Layout of Thesis

In chapter two, an extensive literature review of Lean Production and Lean Thinking is given for comparative reasons. An advanced theoretical analysis of lean methodology is offered, key concepts and tools from manufacturing

are highlighted, and their relevance and applicability to the hospital sector are discussed. The 'conditions-enabling' factors that are essential for successful lean implementation in the UK hospital sector are given and discussed from both a theoretical and practical perspective.

In chapter three, the research methodology utilised for the purposes of compiling the thesis is given which included primarily taking a deductive approach, along with an inductive approach in terms of a case study of best practice of Lean Implementation in the UK hospital sector ie Royal Bolton Hospital. Justification for the use of research methodologies is presented for completeness.

In chapter four the findings in terms of potential benefits that can flow from Lean Implementation in the UK hospital sector are mentioned and discussed extensively. Vast potential benefits and cost savings can arise from alternative uses of scarce resources as a result of Lean Implementation. Empirical evidence is provided.

In chapter five a case study discussion of 'best practice' hospital, i.e. The Royal Bolton Hospital, is presented for comparative purposes. Detailed analysis of the Trauma Stabilisation Unit and the Pathology department in particular is offered.

The final chapter offers a comprehensive discussion of findings and analysis, along with some recommendations, based on advanced theoretical underpinnings and benchmarking, with a view to offering a set of suitable solutions to the constraints any UK hospital is currently facing, in order for performance improvement to take place.

Chapter 2: Literature Review: Advanced Theoretical Overview of Lean Methodology

2.1 Introductory Overview of Lean Manufacturing and Lean Thinking

It is appropriate to begin with a definition of Lean Thinking:

"Lean is a concept, a process of relentless improvement and a set of tools, techniques and methodologies that leave behind them a trial of successes in bringing about effective resource allocation".

Atkinson (2004).

Whilst the goal of Lean Manufacturing is suggested as:

"Streamline the flow of production while continually seeking to eliminate waste and thus reduce the resources used to improve a given set of items"

Womack et al (1990).

Lean involves a transfer from traditional 'batch and store' mass (volume) production techniques to the concept of 'one-piece flow' pull production. Traditional 'batch' mass production involves the production of large volumes of products, in advance of potential demand which are then stored. Whereas a 'one piece flow' configuration organises production in such a way that different 'processing steps' are performed directly next to each other, whilst the 'flow' of production is continuous, little storage occurs, and production is to order.

Hines & Taylor (2000) indicate: "this shift calls for highly controlled processes operated in a well maintained, ordered, and clean environment that incorporates principles of employee-involved, system wide, continual improvement", whereas De Treveille & Antonakis (2006) mention: "rather than setting a goal for specific level of leanness, the focus of lean production is to continuously improve a process".

Drew et al (2004) point out lean techniques can be very effective, and organisations that do not develop a lean working environment, will become uncompetitive, and will not survive. However, they indicate implementing lean is not an easy process, but requires commitment, discipline, money and time. Recall, it took Toyota in excess of 20 years to develop and perfect its world renowned lean production system.

Corbett (2007) mentions lean techniques were initially developed in order to "eliminate waste and inefficiency" from manufacturing production systems, with the intention of improving product quality, enhancing reliability, whilst cutting production times. As a result, unwarranted 'activities' were removed and all other forms of waste gradually eliminated. According to Caulkin (2002), "in the majority of industrial processes", activities that do not add value can account for "in excess of 90 % of a factory's total activity."

Modern day commentators state the primary rationale for organisations to introduce lean production techniques is to enhance their profitability, reliability and competitive position. The aim is to lower production costs, enhance product quality, whilst being more responsive to market (customer) needs.

Figure 1

Lean Operations & JIT

Supply

The Operation

Operation Resources

Delivery of products and services only when needed

Required time, quantity and quality of products and services

Demand

The Market

Customer Requirements
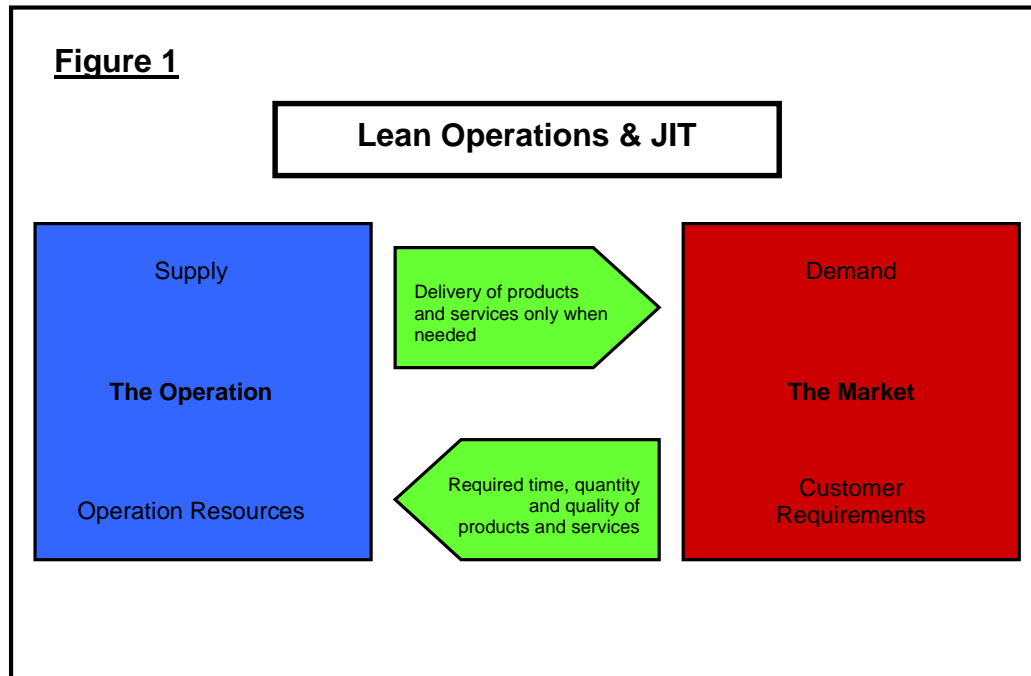
[Adapted from: Slack et al (2004)]

Womack et al (1991) in their global benchmarking study found that between Western and Japanese car firms there was a two to one gap in productivity, quality and time in both product development and car assembly. The benchmarking data illustrated a more effective way of organising and managing customer relationships, production sites, the supply chain, product quality. This new concept, termed "lean production", had been first pioneered by Toyota in 1940's Japan.

2.11 The Essence of Lean Thinking

Atkinson (2004) states, Lean thinking "is about achieving more with less", which implies analysing existing assets, and utilising them up to an optimum level, in order to obtain maximum possible out of them, likewise Parry (2005) indicates the purpose of lean is to deliver "customer value-using the least resource", whilst Thilmany (2005) states it "is about the practice of breaking down a business process to its most valuable parts and paring wasted time, energy and product". In general it does mean what it implies, which is performing tasks better, at greater speed, at minimal cost, whilst minimising production waste in terms of time, materials and rework (Holweg (2007) provides detailed analysis).

Drew et al (2004) argue the aim is to eliminate non value adding procedures. They argue that post lean implementation the majority of jobs will become

simplified and hence easier, which will help ensure staff are more motivated and hence their productivity/ output will rise.

Womack & Jones (2003) refer to lean thinking conceptually as the ''antidote'' to ''muda'' (Japanese word for waste).They argue elimination of waste along the entire supply chain is vital, and go to specify eight types of waste, the first seven based on the work of the late Toyota executive Taiichi Ohno, and claiming the eighth as their own:

1. ''Defects''-errors made that thereafter require rework
2. ''Over-production''- of items not required
3. ''Inventories''- either items requiring further work or final items
4. ''Unnecessary processing''- steps which are not required nor add value
5. ''Movement'' – of staff needlessly from one location to another
6. ''Transport''- of items from one place to another unnecessarily
7. ''Waiting''- staff waiting for a process to finish or for semi finished Items to arrive from a preceding stage
8. ''Not to specification''- items which do not satisfy consumer needs

The authors argue lean thinking can help to re-determine value, place value adding activities in the most optimal sequence, that requested activities can be carried out free of any interruption as required, whilst all activity is performed more and more effectively.

2.12 The Five Steps Involved in Lean Thinking

Step 1: Specifying Value

Most commentators argue ''specifying value'' correctly is the primary and most crucial step in lean thinking. According to Womack & Jones (2003): ''value can only be defined by the ultimate consumer and is only meaningful when expressed in terms of a specific product with specific capabilities which meets the customer's needs at a specific price at a specific time''. They argue each company has a ''core value'', which they define as ''the product that best suits consumer needs''. The key issue is whilst value is defined by the consumer, it is producers (that is the managers who work in these organisations) that attempt to create it, and often there is a significant mismatch between the two.

Step 2: Identification of the Value Stream

According to Womack & Jones (2003) it is ''all the specific actions required to bring a specific product through the three critical management tasks of any business''. These tasks they define as:

- the ''problem-solving'' task, which involves the conceptual, through to the design, then engineering, to ultimately the launch stage
- the ''information management '' task, which involves order processing, scheduling, and to ultimate delivery
- the ''physical transformation'' task, which involves raw materials being transformed into finished product and ultimately sold to customers

Their key argument is that utilising the ''concept of a value stream'' requires lean thinking to look beyond an individual organisation, but instead analyse its

entire "value chain" from raw material extraction to final delivery of the product to consumers, which when identified has revealed, "enormous, indeed staggering, amounts of muda".

Step 3: Creating Flow
The following is the creation of "flow", which traces the product across departments. Womack & Jones (2003) credit Taiichi Ohno at Toyota with overcoming the challenge of creating continuous flow in small lot production. This was achieved in most cases without assembly lines by creating "cross-functional product teams" and the development of techniques for faster machine tool changeovers, whilst at the same time using more compact flexible machines. This enabled different processing steps to take place next door to each other in separate product-specific "cells" with the product being kept in continuous flow throughout. Its adoption avoids waiting, downtime and large piles of work in progress at each step in the process. Throughput time in physical production collapses from months or weeks to days or minutes. It has the additional benefit of lowering both staff and physical space requirements.

Step 4: The Concept of Pull
It is pull which activates flow. It is the "pull of the customer's needs". Womack & Jones (2003) mention "Pull in simplest terms means that no one upstream should produce a good or service until the customer downstream asks for it". Production is on the basis of "small lot size", sometimes even single one-off items, the organisation is very responsive and agile, hence the plant only produces "what is ordered when it is ordered". Effectively, customer orders pull forward newly produced items through a production plant. The resultant is there is no stock of work in progress items, no complex product tracking system and no build up of unwanted finished items neither.

Figure 2 **(A) Traditional and (B) JIT flow between stages**

(A) Traditional Approach – buffers separate stages

Stage A → Buffer Inventory → Stage B → Buffer Inventory → Stage C

(B) JIT approach- deliveries are made on request

Stage A ← Orders / Deliveries → Stage B ← Orders / Deliveries → Stage C

[Adapted from: Slack et al (2004)]

10
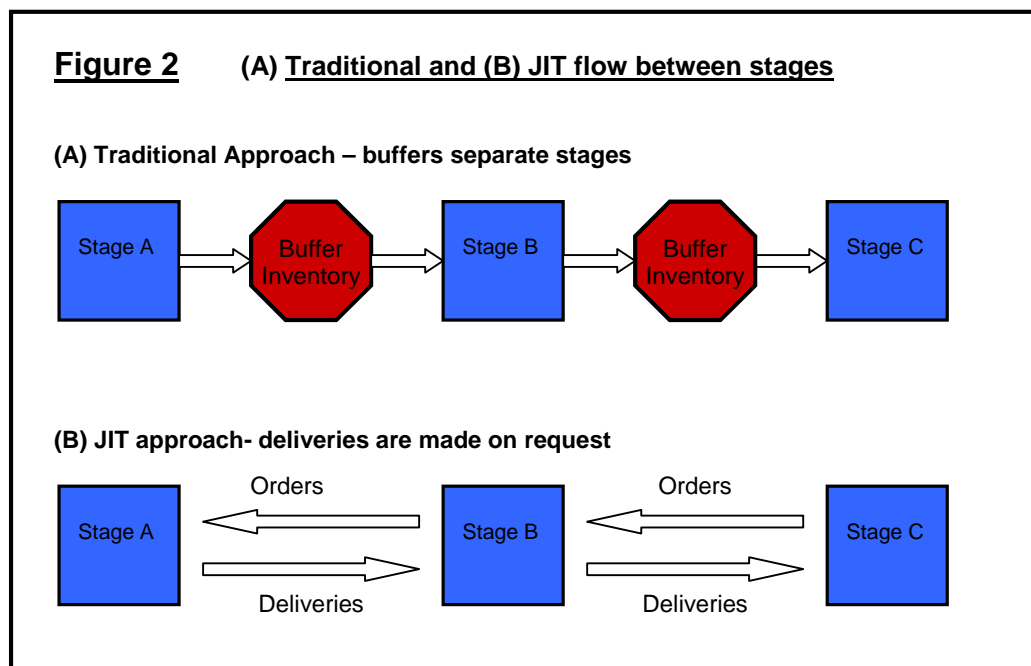
<u>Step 5: The Hunt for Perfection</u>
This final step in lean thinking, the continual hunt for perfection appears to be a natural outcome of the first four steps. Because they create a 'virtuous circle' these first steps lead to the discovery of new sources of value, new areas where waste can be eliminated, and new obstacles to "flow" or "pull" are identified. Each lean implementation round can be followed up by successive ones in the pursuit of perfection.

Atkinson (2004) argues "instead of reviewing their existing process, organisations should focus on designing the perfect process, cutting out any unnecessary stages, questioning time delays and over-inspection, and replacing unnecessary control with trust".

2.13 <u>Culture and the Lean Philosophy</u>

The success of implementing Lean Thinking is very much dependent on a receptive organisational culture that embraces active participation, and a clear vision and purpose of what needs to be accomplished. Hines & Taylor (2000) indicate the development of an organisational culture of continuous improvement is vital. Where everyone is involved, and essentially engaged in 'leading' the movement towards change, they 'own' the changes, feel accountable for them, and thus embrace the transformation. This empowerment and commitment ultimately benefits the organisation, since a satisfied and engaged staff membership continues to work towards the change process.

Parks (2002) highlights the key issue of "corporate culture and change management "as the basis of many examples of lean failures. There is a high necessity for changing the corporate culture, in order to allow a new way of conducting business to take place, post lean implementation. Mann (2005) indicates if done correctly, a lean implementation will result in a disciplined and organised workplace that seeks continuous improvement and hence stays competitive in the marketplace.

Atkinson (2004) indicates Lean thinking will only be successful when and if an organisation can develop a "thinking and listening culture" where " process design is created by those who deliver the product or service, not by a designer in an office far removed from where the product is created".

Overall the importance of a receptive and adaptive corporate culture and genuine senior management commitment which is visibly demonstrated and effectively communicated are key ingredients that are necessary to support a successful lean implementation exercise.

2.2 Characteristics of Lean Systems and Lean Tools

Spear & Bowen (1999) have devoted considerable time analysing the Toyota Production System and the unique reasons behind its tremendous success. They identified four rules which underpin Toyota's success:

- Rule 1: "Standardisation". The nature, sequence, timing and ultimately the outcome of all work (processes) are highly specified.
- Rule 2: "Direct Relationships". The organisation deals directly with its suppliers and customers. Additionally, there is a specific yes or no way to both send and receive responses from each other.
- Rule 3: There is a simple and direct channel (pathway) for each product or service.
- Rule 4: Improvements are carried out following scientific methods, under the supervision of a mentor, but at the lowest levels within the organisation.

The above rules provide useful insights into how corporate culture can impact upon the success or otherwise of lean implementation. Considering Rule 1, "set up" methods are prime candidates for standardisation and improvement. According to Parks (2002), set up "reductions of some 50% to 85% are common". In respect of Rule 3 manufacturing "cells" lie at the centre of Toyota's lean system, and play a crucial role in maximising the full potential benefits of lean production. Rule 4 recognises that within the Toyota Production System, improvements are made on a continuous basis as problems arise. The system is such that it can detect production and quality problems immediately, and not reliant upon an inspection stage later in the productive process.

The following are some of the important features of modern day lean systems:

Pull System of Work Flow
Lean systems incorporate the pull method of work flow, whereby it is actual customer demand which initiates production of the product or service. Firms using the pull method must be able to fulfil the customer's demands within an acceptable amount of time. Russell & Taylor (2009) state traditionally stocks of finished goods have been held and used, to minimise differences between production and sales volumes. These inventories tended to be large in volume.
Krajewski et al (2007) indicate that with this "pull system" workers go back to preceding workstations and take only those items or materials which are immediately required and can be processed immediately. At the same time, when their output has been taken away, workers at the previous workstation realise they need to start producing again, and they produce exactly the same quantity that the subsequent workstation has just taken. If their output has not been taken away, workers at the previous workstation stop production, which ensures no excess (waste) is produced. Production is coordinated and the required quantities are produced.

Figure 3   **The different views of capacity utilization in (a) traditional and (b) JIT approaches to operations**
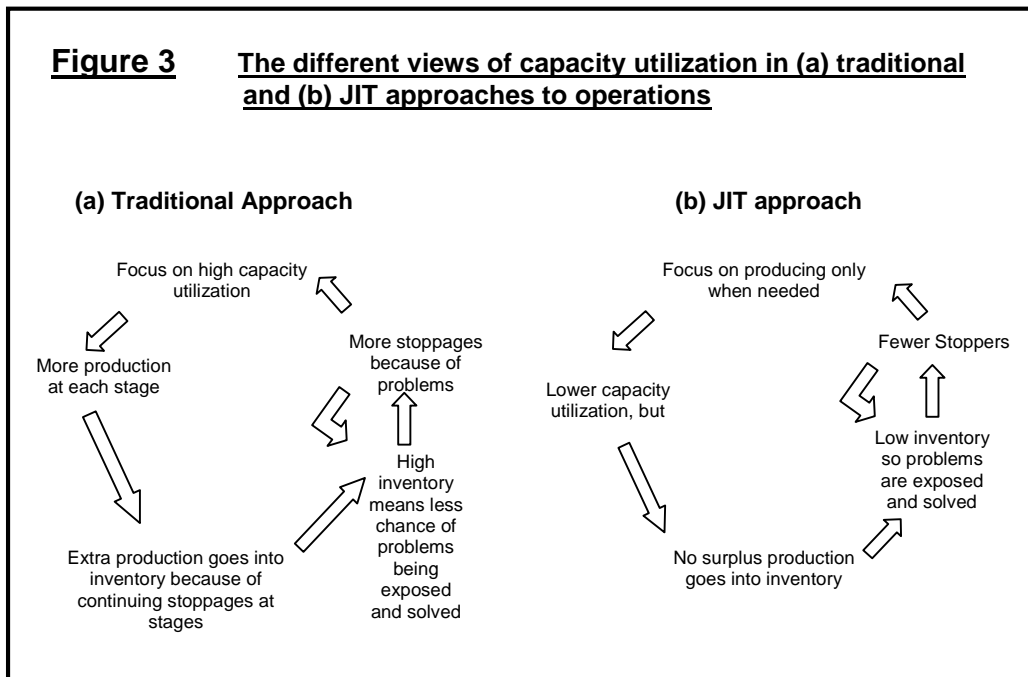
[Adapted from: Slack et al (2004)]

Shah & Ward (2007) indicate for "this pull process to work smoothly, lean production demands high levels of quality at each stage of the process, strong vendor relations, and a fairly predictable demand for the end product".

Quality at Source
It is an organisation wide pursuit in order to enhance the quality of its products, which ensures that workers build quality into the system, by acting as their own quality inspectors. The intention is for workers to never forward on defective items to the next stage in the production process. Krajewski et al (2007) indicate the Japanese refer to this practice as "jidoka", which allows workers to signal for help and even stop the production line as required.

Vonderembse & White (2004) mention "for lean systems to work well, quality has to be extremely high". Recall, spare inventory does not exist to cater for defective items. The production of defective items, which then have to be reworked, or discarded, is a waste that has to be avoided. Russell & Taylor (2009) argue "producing in small lots encourages better quality and that employees can detect quality problems more easily". If problems do arise, they can then be traced to their source and put right, without having the need to rework large volumes of defective items. It can be noted in effect virtually 100% inspection can be achieved, with a worker inspecting the first and then the last item when the batch is small.

Small Lot Sizes
Lean systems use as small as possible production "lot" sizes. Schroeder (2008) mentions "small lots have the advantage of reducing the average level of inventory relative to large lots". In addition, small lots can pass through the productive system considerably faster than large 'lots' can. In the event of defective items occurring, larger 'lots' cause greater delays since the whole lot has to be examined in order to locate the ones that need rework.

Russell & Taylor (2009) point out "small lot production requires less space and capital investment than systems that incur large inventories". This implies, by producing small quantities at a time, processes can be located closer to each other, and hence transportation between work stations can be both simplified and minimised.

Slack et al (2006) argue, the lower inventory levels held in small 'lot' production means "processes are more dependent on each other ", which they argue can be beneficial since it allows errors and potential bottlenecks to be identified quicker, whilst giving the workers to opportunity to correct them.

Quick Setups

For many organisations, prolonged 'setup times' forms the largest bottleneck, which implies any reduction of such, as part of lean implementation, can be greatly beneficial to improving productive efficiency. Schroeder (2008) points out teamwork, correct coordination of activities, and practice are all involved in 'setup' time. The reduction of which is best left to a group of workers and production engineers whom have close working knowledge of the processes.

Uniform Workstation Loads

It is argued lean systems work most effectively when the daily load on individual workstations is largely uniform. By 'smoothing' the production requirements of the final assembly line, lean production attempts to sustain 'uniform production levels'. Shah & Ward (2007) mention "smoothing the production flow is vital to dampen the reaction waves that normally occur in response to any schedule variations at the final assembly stage".

In the healthcare arena, hospitals can and do schedule surgeries in advance, which helps to ensure that essential facilities (for example consulting rooms, medical equipment, etc) are readily available when needed. The 'load' on the surgery rooms and clinicians / surgeons can hence is evened out to make the best use of the scarce resources. Efficiencies can be realised when the load on an organisation's resources can be managed.

Standardised Components and Work Methods

Stevenson (2005) indicates in manufacturing the standardisation of components, increases repeatability (whereby each individual worker carries out a 'standardised task' more often each day). Research shows that productivity increases, since as a result of increased repetition, workers learn to perform their tasks more efficiently.

Shah & Ward (2007) state "visual controls are used to reinforce standardised procedures and to display the status of an activity", which then allows every employee to be aware of the current situation and take necessary action as required.

Close Supplier Relationships

It has been noted lean systems operate with low levels of inventory, and little capacity slack, which implies organisations that use them, are heavily dependent on their suppliers and hence need to form a close working relationship with them. Schroeder (2008) indicates suppliers have to be very reliable, and their production capabilities have to be co-ordinated with the requirements of the customer they are serving. Supplies have to be

transported frequently, the lead time between deliveries has to be short, and it must arrive on time, whilst being of the correct quality (grade). Suppliers may be required to deliver several times a day.

Krajewski et al (2007) state a co-operative relationship with suppliers is vital, if efficiency is to improve, and inventories along the supply chain are to be reduced. Additionally, better communication of component requirements, enables more efficient inventory planning and delivery scheduling by suppliers, thereby improving supplier profit margins. Customers can then negotiate lower component prices.

Jacobs et al (2009) indicate confidence in the supplier or vendor's delivery commitment allows reductions of buffer inventories, however maintaining stock at a lean level requires frequent deliveries during the day. The authors argue some high quality suppliers willing deliver direct onto a production line, hence inbound receiving inspections of their products is no longer necessary.

Flexible Resources

Russell & Taylor (2009) indicate ''multifunctional workers'' and ''general-purpose machines'' form the basis of flexible resources available to an organisation. They argue employees in a flexible workforce can be taught to perform several tasks, and be equally competent in them all. It gives management the flexibility to transfer workers between workstations in order to eliminate bottlenecks when they arise, without the necessity for holding buffer stocks (a key tenet of lean thinking).

Additionally employees can cover for those on holiday or those who are off sick, whilst Krajewski et al (2007) argue some job rotation tends to relieve boredom and refreshes employees. It is argued the more customised the product or service is, the greater the firms need for a multi-skilled workforce.

Group Technology (Cell Manufacturing)

Slack et al (2004) state it is ''an approach where manufacturing work centres (cells) have the total capabilities to produce an item or group of similar items''. 'Cells' refers to a set of different machines placed together, which then process a 'family of parts' (those which have similar shapes or processing needs) and the layout of the machines is usually U-shaped.

Russell & Taylor (2009) indicate work progresses through the cell in a single direction and few delays (waiting) occur. Krajewski et al (2007) point out, as a result of cells producing similar items, ''setup time requirements are low and lot sizes can be reduced''. Overall, cell production eliminates unnecessary movement and prevents queues (waiting) from forming between productive operations, it lower inventory, whilst also lower staffing requirements.

Automation

Vonderembse & White (2004) state it is a key aspect of lean production and is vital in ensuring production costs are lowered. Monies available, due to inventories being reduced or due to other efficiency gains achieved, can be reinvested in further automation to further reduce costs. This should lead to greater market share (since prices can be lowered as costs fall), profits enhanced or both. Automation does play a large and vital role when it comes to providing lean services.

Five S (5S)

It is a Japanese method developed for organising, cleaning and thereafter maintaining a safe and productive work environment. These five tasks of sorting, straightening, shining, standardising, and sustaining are done systematically to achieve lean systems. It is claimed, implementation of 5S as a routine, can lead to lower costs, improved on-time delivery and productivity, higher product quality and a safe working environment. Esain et al (2008) maintain 5S is useful for understanding of processes and sets the foundation for change within any Lean initiative.

Preventive Maintenance

Schroeder (2008) argues effective ''preventive maintenance'' will lower the potential frequency and length of any potential machine downtime. In addition to their regular maintenance activities, maintenance engineers can test other parts of a machine that may need to be replaced in the near future. Krajewski et al (2007) mention renewing parts during ''scheduled maintenance periods'' is a lot easier, far quicker and far more cost effective that having to deal with machines breaking down during production periods.

According to Stevenson (2005) another idea is to ensure workers are made responsible for maintaining their own equipment on a regular basis, whilst developing pride in ensuring their machines are always kept in an excellent working condition.

The following are some relevant lean tools:

Kaizen (Continuous Improvement)

Kaizen requires the active participation of all employees at all levels within an organisation. Russell & Taylor (2009) mention the key to lean success is the willingness of employees to detect quality problems, stop productive operations as necessary, nominate ideas for improvement, analyse and re-evaluate their own work processes, perform a variety of functions, and adjust their working habits.

Jacobs et al (2009) indicate the key to 'kaizen' is the concept that ''excess capacity or inventory hides underlying problems with the processes '' which a product undergoes. Lean systems help to reveal such problems, by the gradual reduction of productive capacities or inventories, until such underlying problems are exposed. The coordination that is required for lean pull systems to operate ensures that problems are identified in time, to allow corrective measures to take place.

Value Stream Mapping

A device that records the current state and future states of both information and material flows within an organisations 'value stream', from supplier to final customer. It is a widely used qualitative lean tool aimed at eliminating waste since it helps managers identify the source of wasteful non-value-added activities. Hence, it helps identify targets for future process improvement activities. Krajewski et al (2007) state waste in many processes can be as high as 60%.
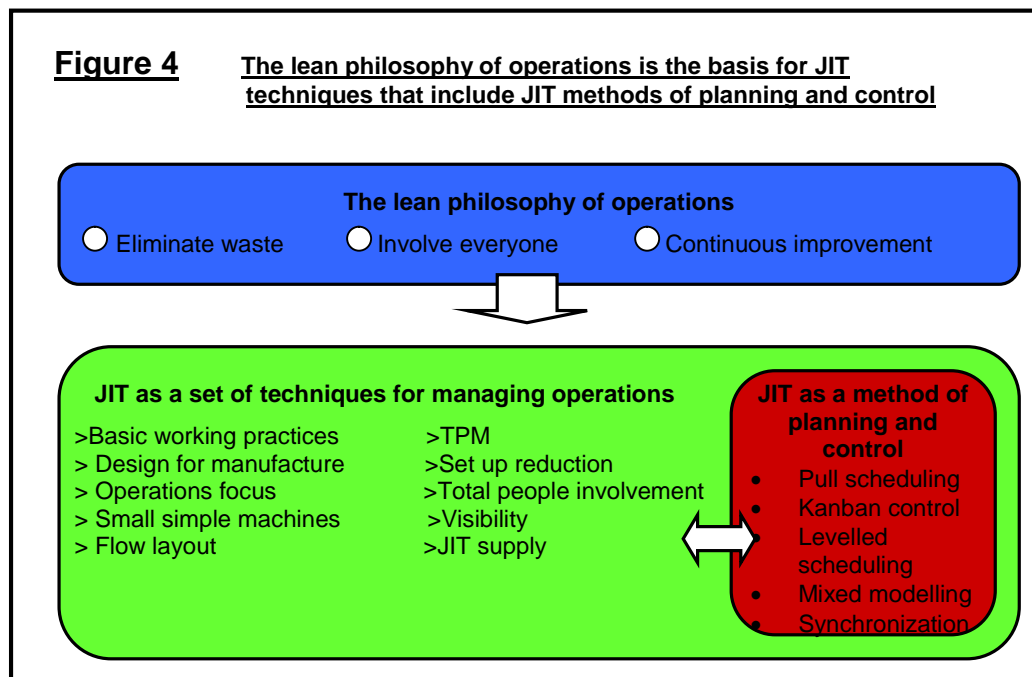
The aim is to bring the production rate of the entire process closer to the customer's desired demand rate. The benefits of this tool to the waste

removal process include reduced lead times and work in process inventories, reduced rework and scrap rates, and lower indirect labour costs.

Just in Time (JIT) / Kanban

Slack et al (2004) indicate the ''just in time philosophy is simple yet powerful-it eliminates waste by cutting excess capacity or inventory and removing non-value added activities''. The intention is to create products or services only as and when needed, whilst continuing to improve the 'value added' aspects of productive operations.

Jacobs et al (2009) mention it is ''a scheduling system that calls for any item needed at a production operation (be it raw materials, finished products, etc), to be produced and be available precisely when needed.''

Figure 4   **The lean philosophy of operations is the basis for JIT techniques that include JIT methods of planning and control**

The lean philosophy of operations
◯ Eliminate waste   ◯ Involve everyone   ◯ Continuous improvement

JIT as a set of techniques for managing operations
>Basic working practices   >TPM
> Design for manufacture   >Set up reduction
> Operations focus   >Total people involvement
> Small simple machines   >Visibility
> Flow layout   >JIT supply

JIT as a method of planning and control
• Pull scheduling
• Kanban control
• Levelled scheduling
• Mixed modelling
• Synchronization

[Adapted from: Slack et al (2004)]

Kanban (signals/ cards) are used to regulate levels of stock and work in process (W.I.P). Schroeder (2008) points out the drive to implement JIT highlights many quality problems that are buried by carrying 'buffer stocks', by encouraging the even flow of only 'value adding' steps, these problems become apparent and have to be dealt with explicitly.

According to Kolberg et al (2007), within the healthcare arena, JIT seeks to balance the demand for medical services with the available capacity, with a view to eliminating wastes such as overcapacity. They imply for JIT to be useful, demand must be predictable and planned for. But, emergency or outpatients departments often experience difficulties in predicting demand over a longer period of time. In these departments it is conceivable difficulties may become apparent in trying to smooth up the flow of patients. It is often the case that patients are 'piled up' in emergency departments without prediction, thus the departments need to be continuously prepared for the unpredicted patients that do turn up requesting emergency treatment.

Theory of Constraints

Young et al (2004) state this concept focuses on "bottlenecks or constraints" it is easy to acknowledge that queues are associated with bottlenecks, whilst accepting that the removal of one bottleneck could create another bottleneck in the system. Note the identification of healthcare bottlenecks is not an easy task nor are they obvious. The National Audit Office (2000) report implied that hospitals themselves can act as bottlenecks, for example the ineffective discharge of patients due to poor working practices, and states there will always be one or more bottleneck in the system.

Smith (2001) advocates designing such a system, with the bottleneck(s) strategically located, where they can best be monitored or reacted to, as necessary. Another line of argument follows the logic that anything that "increases throughput at the bottleneck", whilst it may increase costs, as long as it 'adds value' to the system and is safe, is worth pursuing. From the healthcare setting, if we analyse the scenario where a ward is associated with a particular operating theatre and the operating theatre indeed is the bottleneck. Here the theory of constraints would advocate lowering ward occupancy such that it was a match for the theatre's throughput, whilst accepting that a certain proportion of fixed and variable cost already incurred (lighting and heating, and fixed staff costs, etc) would be wasted as a result.

Six- Sigma

It is a method which involves the use of 'statistical tools' which aim to reduce variation and hence improve organisational processes. Jacobs et al (2009) mention it "is the practice of building quality into the process rather relying on inspection", whilst Young et al (2004) describe it as "a universal system to assess quality, produce quantifiable results, and establish quality goals". Six sigma is often given as an accepted rate of "3.4 defects per million". The methodology is dependent on timely and accurate data, clearly specified outcomes, and overall an agreement on what constitutes a defect. This represents a major challenge in a healthcare setting. According to Young et al (2004) the crucial issue is not the actual number of errors, but more important is having a "systematic process in place to identify the sources of errors, which then drives them down". It is argued, high throughput procedures in a healthcare setting, taking prescriptions and knee replacements as examples, may benefit from greater use of this approach.

Taylor (2006) indicates lean thinking offers an opportunity to get hospital processes right, whilst Six-Sigma will then assist in eliminating the variation out of the processes. In a healthcare setting, the intention is to reduce the number of processes, which will enhance the service offered to patients, making it safer, whilst at the same time reducing variations in existing systems. The author mentions "these techniques are critical to the long term future of health service organisations. We have to take out the waste to improve productivity, which, at the same time, will lower costs and provide a safer service to patients". Overall, it is the focus on improving quality, whilst getting more from the workers (improving their productivity) which is what is critical for improving patient care in the long run.

Van den Heuval et al (2006) in their analysis of Dutch hospitals point out ''waiting times and waste strongly affect the quality perception of patients and Lean and Six-Sigma helps solve these problems''. They argue six-sigma helps reduce defects, which can only have a positive effect on 'perceived quality' as far as patients are concerned. We are aware defects in a healthcare setting are known as 'complications', which are potentially harmful to patients, whilst they can cost hospitals huge sums of monies in rectification work and litigation costs.

Esain et al (2006) in their analysis of Welsh hospitals conclude the key is to adopt and apply all aspects of Lean Thinking, Six Sigma or Theory of Constraints, as required, while understanding their underlying assumptions. The authors state these industrial techniques require time to bring about the transformation of performance required.

Black (2009) concludes Lean Six-Sigma is excellent for driving process change but it has limitations in the complex social environment of hospitals unless it is combined with Realistic Evaluation (identifies the behavioural and social variables that are causing processes to function the way they do in a specific context) to focus on making context specific change.

Rogers (2004) indicates the methodologies of lean thinking, the theory of constraints, and six-sigma have been successfully adapted to NHS healthcare in the UK. He indicates there has been considerable success from utilising these tools, particularly in improving emergency flow and reducing journey times in cancer care. He states at Nottingham City Trust ''elective admissions rates have increased by 8%'', whilst cancelled admissions for surgery have been reduced by half, as a direct result of improving the emergency pathway, using the above three tools.

Overall, critically in the context of healthcare, it is not practical to expect the introduction of new systems that work perfectly instead we should aim to design in gradual improvements into existing systems. This improvement should take place in consultation with all interested parties and in particular with patients themselves.

Proudlove et al (2008) in their UK analysis found identification of 'customers' and 'processes' in the complexity of the NHS particularly difficult, especially because organisations were not structured around key processes, and state the 'silo' nature of NHS organisations and structures is not naturally conducive to identifying processes.

2.3 <u>Lean in the Public Sector</u>

Lean has been advocated as a methodology which could result in vast cost savings and greatly enhanced quality of service on offer, within the public sector. To date the most numerous and extensive examples of the application of lean techniques in the public sector seem to origin from the healthcare sector. Radnor & Walley (2008) mention a study which assessed the applicability of lean techniques in both the UK and Swedish healthcare

market. The study by Kolberg et al (2007) came to the conclusion that Lean is applicable and can be successfully implemented within a healthcare setting.

Bagley & Lewis (2008) point out lean principles are applicable within the UK public sector. They mention the following benefits of lean implementation in the public sector:

- "Faster response times"
- "Exceeding targets"
- "Reductions in waste and unnecessary work"
- "Flexible approach to process management that more closely matches workforce resources to service demands"
- "Financial savings"
- "Staff released to improve service elsewhere"
- "Reduced headcount"
- "Increased customer satisfaction with feedback used to drive further improvements"
- "More effective working relationships with contractors and suppliers".

We are aware that the creation of an organisational culture that allows for active participation of everyone in an organisation is vital for successful lean implementation, and this applies equally to the public sector also. Research indicates lean implementation works best when driven forward by all the workers (usually working in teams) in an organisation, and not just a senior management initiative. Certain 'enabling factors' also need to be present, along with the required visible 'tools and techniques', to ensure lean implementation is both successful and sustainable.

Radnor & Walley (2008) state lean techniques can be adapted successfully to meet the needs of the public sector. The authors argue in healthcare organisations, the absence of a "process view" is almost "culturally embedded". They mention how individual workers: "before they only saw their part of… the whole patient journey", whereas post lean implementation "together they had a better feel for what the patient experiences". They go on to argue "a process view would allow hospital staff to map outflow for the first time" and hence try to conceptualise the ways in which "current local hospital optimisation" leads to unnecessary, complicated and inefficient patient journeys overall. The "case study sites" they report upon, all stated that lean implementation had been beneficial and had resulted in substantial improvements in productivity, the speed of delivery to patients, and the quality of service offered to patients.

Meanwhile Radnor & Boaden (2008) indicate it is not easy to determine what benefits can be achieved in the public sector, and what has been achieved is not always clear-cut. They argue measures such as a reduction in time taken, space used and the lowering of costs, do not allow for "intangible benefits". The authors mention these intangibles such as a better understanding of customer needs, the creation of "cross-team synergies" and an increase in staff morale are key to performance improvement in the public sector

Interestingly, Locock (2003) in analysing Lean states: ''the speed of implementation and the rapid proliferation of different variants…make a dispassionate assessment of its effectiveness hard to achieve''.

Overall, Radnor & Boaden (2008) argue there is ample evidence which suggests lean can facilitate the elimination of gross inefficiencies that still currently exist in public sector services, yet there is always the danger that managers in the public sector will try to implement lean techniques without understanding them first, nor having set in place the prerequisite conditions that are vital for success. The resultant is lean techniques are applied to public sector processes, which are totally not suited to it, which naturally leads to failure and suspicion, in addition to a waste of scarce financial resources. Critically, better public services at lower cost is a legitimate consumer expectation, and a more efficient public sector can stimulate wider economic growth as well as delivering direct benefits to society.

2.4 <u>Lean Thinking in Healthcare</u>

2.41 <u>Overview</u>

A definition of Lean Thinking in the context of healthcare is given as:

''Lean Thinking is a philosophy that requires the continuous elimination of waste or non value added elements from processes so that customers or patients are given ever greater value''.   Aherne (2007)

Lean healthcare is about the creation of better value for patients, with the elimination of all activities that are considered wasteful. Lean healthcare analyses value from a patient (client's) perspective and ask what represents 'value' to them? The overall aim is to improve flow amongst activities that are considered of essential (core) value to the hospital itself and those that are valued by patients along their healthcare journeys.

It is often argued, existing UK healthcare systems are structured in such an unplanned way, and that they do not allow for the 'process of care' to run smoothly, but rather are disjointed and rather fragmented. A typical hospital will be based around functional departments such as A&E, pathology and radiology, whereby patients progress from one site to find they have to have to queue up at another site, whereupon once their details have been 'processed', they are sent to another site and face further waits.

Whereas until 2006 Lean was primarily considered as a way to alleviate general problems in hospitals, lean nowadays is specifically aimed at eliminating problems that impact directly on the delivery of cost effective and efficient healthcare by the hospitals. Lean has been implemented in order to:
- Reduce very lengthy 'elective' waiting lists
- Overcome breaches in emergency department waiting times (target)
- Reduce the high levels of delayed patient discharges

Westwood (2005) implies NHS managers and staff have not understood in the past how patients and their associated information, flows through their hospitals and the various functional departments within them. Each functional manager or clinician tries to maximise his functional activity or minimise his costs, with total disregard for the impact it may have on existing bottlenecks within the system which dictate the speed at which patients and information flow through it. Additionally, Westwood (2005) reports using lean to enhance ward processes, had led to substantial savings in staff time in many cases, which allows for more time to be spent directly with patients.

Kolberg et al (2007) indicate lean as applied to healthcare has the primary objective of "minimising or eliminating delays, errors, repeated encounters, and inappropriate procedures". Alternatively, Young et al (2004) call for a need to "disentangle actual pathways and obtain a clear picture of journeys" both internally and across primary and secondary care.

Tsais and Bruce-Barrett (2008) argue, by considering the patient's viewpoint and thus focusing on the patient's experience as a starting point, one can step back and observe how processes embedded in the diagnosis, treatment and care of patients can be improved for the patient. This encourages hospitals towards initiating minor changes as the need arises.

Lean in healthcare can lead to fewer medical errors, better allocation of resources, fewer steps in the care process, improved information flow (enables quicker response times in emergency services) and reduced overall wait times. Black & Miller (2008) mention, lean advocates "bringing the process of care to the patient", as opposed to the traditional method of transferring the patient through a myriad of departments and the associated paperwork that accompanies it.

Successes can be achieved with Lean thinking because well established systematic techniques are brought to bear to improve existing processes. Any and all constraints within processes are removed and then only the necessary constraints are built back in. Improvements can be achieved quickly because Lean focuses on bringing people together and promotes 'intense scrutiny of problems' to create clear and workable solutions.

In general it is vital that senior NHS leaders and practitioners at hospital level consider and judge how the implementation of lean techniques should be adapted and thereafter applied to suit local conditions, with a view to improving quality, safety, and efficiency so that the provision of local hospital services can be more reliable and timely.

2.42 Productivity- Impact of Variations in Demand and the Discharge Process

Moore (2006) indicates NHS productivity is at unacceptable levels and has to be improved, and goes on to state it could be rectified by "working equipment and facilities harder". The author argues "nothing happens in the NHS for two and a half days a week", and says we should not continue to spend on the NHS, but rather "squeeze" more out of the existing system, since it is idle a

third of the time. Moore (2006) implies it is vital to analyse "variations in activity" and thereafter try to monitor and control it, whilst at the same time ensure the workers are more productive.

Jones (2006) in reference to GP surgeries and patients visiting Accident & Emergency departments, states that demand is "actually quite stable and predictable". He argues the highest variation is in "elective work", which has been held up on long waiting lists and thereafter scheduled again and again. He further argues queues and the associated scheduling and paperwork that accompanies it, create substantial unnecessary costs throughout the healthcare network which need to be avoided. The author calls for a faster discharge of patients, functional departments cooperating with each other, standardisation of procedures, coordinated ward rounds, and much clearer and specific handoff procedures.

2.43 <u>Womack and Jones' (2003) Model- A Healthcare Perspective</u>

Kollberg et al (2007) and Westwood et al (2007) both analyse Womack and Jones' (2003) five 'principles' of Lean Thinking from a healthcare perspective:

1. <u>Specify Value</u> –according to Kolberg et al (2007) the crucial first step in lean healthcare is to identify who the customer is and what their specific needs are? They mention a number of "critical success factors" which help to specify value from a patient's perspective. These crucial variables may include medical quality (treatment), accessibility to medical services, comfort of surroundings, lower waiting times and fewer delays, respect for the patient, involvement in decision making, and better clinical outcomes. In addition, it has been shown treatment offered in the right place, at the right time, by the right staff member/clinician certainly adds value to the patient.

2. <u>Identify the Value Stream or patient journey</u> – according to Kolberg et al (2007) potential value adding activities begin from the very moment the patient make first contact until the required treatment is finally completed. They argue "value is primarily created when the patient meets the healthcare staff during diagnostic and/ or treatment activities".
Westwood et al (2007) advocate placing a "high value on patients' time", whilst at the same time "minimising the time required between each step in a hospital process", which will add value to the patients. The authors also state it is vital to have a person within the organisation, who is responsible for the entire patient journey from first contact to final treatment and discharge.

3. <u>Flow</u>- Kolberg et al (2007) claim flow can be achieved by focusing attention on the individual patient, and thereafter following the patient from the start to the end of their journeys, whilst ignoring traditional functional boundaries that exist, but instead an attempt is made to create a "continuous flow over these boundaries". Westwood et al (2007) indicate for a patient this would entail:
- "Avoiding queuing and batching"
- "Avoiding multiple referrals"
- "Removal of all obstacles which prevent the quickest safest practical flow of care"

Kollberg et al (2007) mention "JIT, level work scheduling and the creation of multi-skilled teams" as solutions that should help to improve 'flow' within healthcare. They state applying JIT in a healthcare setting requires balancing the existing capacity with the demand for care services. They argue the identification of periods of potential high demand, would help hospital departments make necessary adjustments, such as transferring staff from periods of low demand to periods of high demand. In addition to altering capacity to meet demand, variations can be 'smoothed out' by scheduling patients with non urgent treatment needs to periods of low demand.
The authors advocate the creation of "a multi-skilled team for specific groups", which would ensure patient journeys through healthcare would be shortened, and be dealt with by one team without the need to transfer patients across departments.

4. Pull- Westwood et (2007) indicate "it is vital to create pull in the patient journey". They imply that each and every step in a patient's journey has to pull staff, equipment, skills and information towards it, individually, as required. Each functional department has to respond to incoming demand, as opposed to transferring patients and passing them from one division to another. Delays would be reduced and productivity enhanced, which would save time and money, whilst crucially quicker processes would help to reduce the length of time a patient is hospitalised.
Kollberg et al (2007) indicate the importance of "synchronising the key parts of treatment with the patients' needs", which they imply will help ensure patients spend the least amount of time in the healthcare system. Additionally, they point out that the necessary resources, which ensure the required care is provided, should be provided only as and when required. They point out NHS hospitals need to first "identify their value streams" and secondly to create and implement new patient and information processes, which flow through them.

5. Perfection-the desire to seek perfection within the healthcare system is seen as vitally important. The implications of a failure to carry out tasks correctly the first time, or not seeking continuous enhancements in services provided, could result in dire consequences, including unnecessary patient deaths and the associated litigation thereafter. Decker & Stead (2008) describe perfection in a healthcare setting as "the patient receiving outstanding care in a timely fashion that results in the correct diagnosis and therapy". Alternatively, Westwood et al (2007) indicate perfection from the patient's point of view entails their treatment is completed:

- "On time"
- "With no mistakes"
- "Without delay"
- "With the best outcome"

In order to obtain this, it is essential to have consistent and reliable processes.

2.44 <u>Examples of Waste in healthcare systems that often occur:</u>

1. <u>Overproduction</u>- a good example is the production of medical reports unnecessarily or reprinting labels on the basis that they may be needed. Further examples may include preparing more 'surgical supplies' prior to treatment than is required by the consultant/clinician, unwarranted requests for tests from the blood sciences department, and consultants reserving 'investigation slots' as a cautionary measure ahead of actual demand. In essence, more is produced than is required, or alternatively earlier than needed by the subsequent process/step.

2. <u>Movement</u>- which involves the actual or potential movement of patients, medication, equipment or medical reports unnecessarily further away than need be the case. Essential patient paperwork is often kept some distance away-with staff often walking to the other end of a ward to pick up notes, whilst considerable walks are involved when locating other staff members in other parts of a hospital. This unnecessary non value adding motion should be eliminated.

3. <u>Inventory</u>- whereby excessive stocks are held in stockrooms which are not being utilised and hence thereafter become obsolete, patients on lengthy waiting lists, whilst patients waiting to be processed in order to be discharged are other examples. Overall, it is uneconomical to hold excessive stock levels of any item.

4. <u>Overprocessing</u>- a good example being multiple recording of patient data, the recording of unnecessary data from patients upon arrival on admissions, manual recording by hand as opposed to onto a computer. Weinstock (2008) points out "removing inefficiencies and simplifying processes", such as this overprocessing will provide additional time for direct patient care, thus increasing overall patient satisfaction. Castle & Harvey (2009) indicate existing methods cannot easily identify the extent of duplication in information that exists, and go on to claim healthcare is extremely complex, a vast amount of data is gathered, yet despite doing this it remains a challenge to determine just how well a healthcare organisation is doing in respect of the quality and delivery of the services it provides and the associated costs involved.

5. <u>Waiting</u>- good examples being patients kept waiting far too long, the waiting involved for staff members/ clinicians to phone back with key information, and waiting for key equipment (or medication) to arrive from storage rooms or directly from suppliers.

   Westwood et al (2007) indicate waiting for: "patients, theatre staff, results, prescriptions and medicines, and doctors to discharge patients", which creates inefficiencies and increases hospital running costs.
   The overall intention is for patients to spend as small a time as possible in the waiting/ reception area of any hospital, instead the flow of patients through a hospital should be direct, planned and efficient.

<table>
<tr><td></td><td>Figure 5</td><td>Inventory and queues have similar characteristics</td></tr>
</table>

	Inventory (queues of material)	Queues (queues of people)
Cost	Ties up capital	Waste time
Space	Needs warehouse	Need waiting areas
Quality	Defects are hidden	Give negative impression
Decoupling	Makes stages independent	Promote division of labour and specialization
Utilization	Stages kept busy by work-in-progress	Servers kept busy by waiting Customers
Coordination	Avoids having to synchronize flow	Avoid having to match supply and demand

[Source: Slack et al (2004)]

6. <u>Errors</u>- are common and may be incidental such as the misplacing or misfiling of documents, to more serious ones which lead to formal complaints about service quality being made. Examples may include 'adverse drug reactions' which requires further treatment, repeating tests because the correct information was not obtained the first time, and patient readmission to hospital (classed as a failed discharge). A very common error in a healthcare environment that occurs is misplaced, inaccurate or incomplete information. This then prevents effective treatment being performed.

Wojtys et al (2009) indicate patients and referring clinicians value prompt access to appropriate medical providers, while medical providers value an efficient system that accurately triages patients to their clinics / hospitals. The authors, using the lean thinking process at the University of Michigan's Sports Clinic, were able to reduce waste and create an efficient, effective scheduling system that provides value to its patients, staff and providers alike.

As Bicheno & Holweg (2009) point out, the intention is to ''do more for the patient with fewer resources'', by the elimination of nonessential processes and procedures, which should result in improved patient quality and safety, enhanced efficiency and overall more satisfied patients.

2.5 Enablers- Conditions necessary for Successful Lean Implementation

It is claimed Lean thinking can be work since it involves all stakeholders in a healthcare setting and in particular the participation of doctors, nurses and other personnel involved in front line processes, which have a clear idea of what is value adding and what is not.

2.51 Critical Factors

Fillingham (2008) states cultural changes are critical. This involves managers getting out of their offices to go and see what is actually happening in the workplace. It requires a marked increase in the commitment made to training and development for improvement purposes. At Royal Bolton this cultural change is achieved via the week long 'rapid improvement event'.

Sanderson & Ramakrishnan (2007) indicate Lean "requires a profound cultural change within the organisation, driven by a sustained executive commitment". They argue it is essential that the "process changes" that do take place are sustained and improved upon, and not just a temporary measure of leadership enthusiasm.

Aherne (2007) indicates "top management and leadership support at both national and organisational level is critical to achieving successful and sustainable improvements of any kind", and he goes on to argue that senior nurses, whom are directly involved in "targeted or problem areas" are the best people to start and implement lean improvement measures. He states senior nurses should be empowered, and they should have adequate training and expertise to implement the required lean improvement measures.

Dixon (2009) emphasises the importance of the senior management team assuming a 'strong leadership' role in the lean implementation. By identifying and clearly communicating the reasons why change is necessary, leaders lay a vital foundation for the 'lean' road ahead. Westwood & Silvester (2007) additionally add, senior leaders should spend increasing amount of time on the wards (where the real work is done) in order to appreciate the issues, delays and problems which managers, staff and patients face daily.

Westwood and Silvester (2006) state that "a dedicated improvement expertise is essential" and that "internal capability needs to be developed in organisations", which can only help lean implementation and the creation of an organisational culture which facilitates continuous improvement.

Slack et al (2004) indicates the 'commitment of resources' is often the real test of management's belief in the improvement process. Support for the improvement programme will range from capital expenditures, to releasing workers for kaizen activity, to field trips, to outside resources of all kinds.

Dixon (2009) mentions "managing communication" is also vital, and managers have to exchange information within the organisation about the lean programme, both formally and informally, to engage staff participation

and commitment. By improving both internal and external communications, a hospital can begin to improve its quality, improve patient service quality, reduce running costs and hence improve its financial performance.

The application of new (information) technology, which can offer greater processing speed and cater for a larger volume of work, can help to improve the efficiency and effectiveness of communications between and information exchanges across functional hospital boundaries, is a key element of a set of measures that are implemented under a lean initiative.

Slack et al (2004) mention "project team support", whereby every improvement project is carefully planned and executed. It is essential that teams are populated with the right mix of talent and skill, and that necessary training is provided to supplement the knowledge of the group. Necessary outside resources need to be provided, progress has to be carefully monitored, and teams should be given the chance to report to senior management the results of their projects.

2.52 How to implement lean

Corbett (2007) argues, the important thing, is how well organisations implement lean techniques. He stresses the importance of intangible variables involved in lean implementation, for example the need to engage employees at all levels and improving their motivation levels, developing their ideas, encouraging their active participation in decision making and problem solving, whilst all the time ensuring they are receptive to change and remain flexible in their attitude.

Ward (2006) argues "fundamentally, people need to match resources to demand" and indicates hospitals need to develop an understanding of how many patients can be seen in a day, and likewise how many tests can be carried out in say a morning, and thereafter control and monitor its staff, equipment and other assets, around that demand.

Westwood et al (2007) state hospitals need to be organised "as a system with defined flows for patients and information rather than a collection of individual silos", which stresses the importance of co-ordination and co-operation between functional departments, which then facilitates improved flow whilst eliminating wastage from hospital systems.

Westwood & Silvester (2006) indicate "if we take a process perspective of our healthcare business and understand the demand (requests) for services, we can plan capacity to meet patient demand", and they go on to imply doing so will substantially reduce costs, since hospitals would not have to sacrifice scarce resources monitoring queues, nor would they have to redo things because the right care was not provided at the right time in the first place. They note that all patients are unique, but insist they can be "grouped by the processes they require", and imply patients who require the same clinical skills and medical technology can be grouped as a set, and thereafter treated quicker and more efficiently.

Jones & Filochowski (2006) argue "if we can see the flows right through these processes, we begin to see huge opportunities for streamlining them, eliminating many causes of errors and improving productivity", and go to imply patients can be treated a lot quicker, clinical staff can spend more time with patients (value adding), whilst theatre use and bed occupancy improves. This is hugely beneficial to all stakeholders associated with any one hospital.

2.6 Reflective Critical Review of Lean Literature

Overall, lean implementation is richly dependent on organisational culture and is a 'people first' initiative, hence most authors argue, the introduction of lean tools, new processes and new technology to an old functionally orientated culture within a hospital will not result in success. The majority of authors argue a radical change in the existing organisational culture is vital, in order to improve cross functional teamwork and improve communication across a hospital.

Many researchers indicate the introduction of lean techniques will require a change in 'existing mindsets' and established ways of doing things/carrying out processes. Where 'existing mindsets' are embedded this can prevent any analysis of alternative ways of performing tasks and procedures, at the expense of improved efficiency.

Jennings (2007) mentions workers may "also be inhibited by existing methods forcing them to comply with prescribed work schedules" and goes on to say hospital managers should hence "empower" their staff, which would then allow them to alter their work schedules such that they can minimise delays and hence maintain throughput (output over a given period). This would make sense, since those directly involved in the work usually know best, and how the system actually works.

Reviews of literature stress that Lean has to be seen as a long term change project (Bhasin & Burcher, 2006) and that "staff empowerment" is regarded as a major benefit (Bowen & Youngdahl, 1998) through the involvement of staff in Rapid Improvement Exercises. Alternatively, some authors are sceptical about the impact of Lean on individuals in the organisation (Parker, 2003). In general, lean has often been a more operational level, bottom-up approach to process improvement and involving staff from the lowest level upwards.

Jennings (2007) indicates "accountability is an issue that needs resolving early on" and implies hospital mangers and leaders have to held accountable for lean implementation and the associated results thereafter. Otherwise, it is a meaningless expensive exercise. Obtaining executive support is one sign of genuine commitment to a lean initiative and should help to sustain it over the long term.

Many hospital managers and leaders still hold very 'selective perceptions' about what lean really is, and falsely associate the elimination of waste with

pure cost cutting. Their respective organisations, under such misconceptions would fail to exploit lean's full potential to enhance performance. Jennings (2007) mentions it is advisable "to use pilot projects to showcase the benefits of lean", implying that any subsequent success would lead to implementation across wider parts of a hospital.

Bowers et al (2007) indicate "a more astute organisation will adopt a longer term outlook and realise that cost cutting and growth need not be mutually exclusive" and imply the removal of waste through lean improvements would release additional capacity which can be used for internal growth purposes, without the necessity for additional capital expenditure nor an increase in staff costs.

Most authors indicate "good preparation" is vital for the launch of a successful lean initiative. It is vital that hospitals do their research well in advance in order to gain rich potential rewards. Key questions raised and vital decisions taken during the initial stages of lean implementation will have a profound impact on eventual success or otherwise.

Most researchers indicate lean is no quick fix, arguing practitioners need to:
1. Focus on the whole big picture- whereby it is argued the full benefits of any lean initiative must include the impact it has on the hospital's entire value chain.
2. See it as a long term investment- whereby the intention is to obtain improvements in productivity on a successive yearly basis.
3. Focused efforts-maximum impact areas- whereby it is essential to pay attention to activities and processes that will directly reduce constraints in the system, and hence have a noticeable impact, rather than spend scarce resources on activities that are not the root cause of delays in the hospital system.
 4. Enhance value offered to patients- whereby this may be achieved by building upon a hospitals 'core competences' with the offer of additional facilities and services, which rival hospitals could not match locally. Early admissions, fast diagnosis, and early availability of treatment, along with lower fees (for fee paying private patients) are differentiating factors, which add value to a patient, and hospital management have to be acutely aware of such in the current competitive healthcare market.

Many authors infer, successfully implementing an organisation wide lean initiative has a number of layers. Piotrowski (2008) identifies three such layers as the: "Value Stream layer", "the Improvement layer", and a "Strategies and Tools layer". He argues organisations usually adopt one or perhaps two of these measures, thinking that they are operating as a lean organisation, yet these only result in selective and "isolated improvements" as opposed to the desired long term impact. He argues it is the collective sum of all the above three layers and the co-ordinated relationship amongst them that leads to a lean implementation exercise being effective. In addition, numerous authors indicate, the application of lean techniques to more than one functional department is vital if a hospital is to obtain maximum benefits and thereafter for it to be sustained.

Whilst we are aware lean helps to address problems in organisations that are facing difficulties, lean techniques can equally help successful companies and allow them to benefit from improved processes and productivity and ultimately greater profitability. It is also advisable to make known in advance, the level of expected improvements that are likely to take place, with the changes being monitored and quantified, so that in a hospital setting both managers and patients are made aware of the potential benefits it has to offer them.

Lean is a long term project and operates under conditions of constant change and upheavals. Success is dependent on engaging the best people and ensuring their active participation, however it may not be easy to determine who the best people are. Additionally there is the issue of managers not nominating their most talented workers, in anticipation of their potential absence for a lengthy period of time.

2.7 Critical Review of Lean Literature: Challenges in implementing Lean in Healthcare

The application of unfamiliar management philosophies and operational tools from the manufacturing sector to the healthcare sector is often seen as both unacceptable and unworkable by those incumbent in the healthcare arena. Thus, it is argued both 'cultural and practical barriers' that do exist, need to be overcome before the widespread use of lean techniques can take place and be effective.

Considering cultural barriers, it is essential to overcome the most common and widely known arguments against the introduction of lean techniques to the healthcare sector, such as: "each patient is unique", "we are dealing with patients lives here" and "people are not automobiles" (Hines et al (2004)). Yet, there is evidence of significant success in applying lean techniques to other service industries such as insurance, retailing and banking, with very positive outcomes as reported by Swank (2003). In addition, early adopters of lean techniques into UK healthcare, such as Royal Bolton and Hereford Hospital have attributed their early gains and improvements directly to the introduction of such measures (see Chapter 4: Potential Benefits of Lean Implementation/ Empirical Evidence).

It can be argued there are significant organisational and professional cultural differences, which differentiates the healthcare sector from any other that has implemented lean into their working practices. Mann (2005) indicates healthcare professionals are "highly dedicated and motivated individuals" who seek primarily to provide "the best possible care" for their patients, whilst being used to constant change and experimentation and fresh demands for new data. Thus, he argues lean techniques should not be totally "alien" to professional operating in the healthcare sector.

Another issue that often arises is the claim that lean is merely a cost cutting and employment trimming exercise in disguise. When an organisation decides to implement lean measures, it is often alleged the aim is to cut operating

costs and at the same time make many employees redundant. But, in actual fact, a successful introduction of lean techniques would result in improved processes and operations, with associated changes in employee job descriptions and duties, but their employment is usually safeguarded.

In addition, lean should not be seen as a group of inflexible tools and techniques alone, but adequate consideration should be given to the softer human elements of employee motivation, staff empowerment, and respect for people, and the impact of these variables should never be underestimated. These human elements are essential for sustaining the lean initiative over the long term.

Young & McClean (2008) state surveys show that there is no single customer with a simple view of "value" that can drive lean thinking forward in healthcare, but that the field is full of "advanced views of value" that have yet to be interconnected in a systematic view. There is a trade-off between time, money, access to facilities and unspoken desirable values such safe, timely and quality treatment, which is both effective and yet efficient in delivery, whilst allowing for capacity constraints that may exist within the existing hospital system. The authors argue any hospital would need to satisfy this "minimum set of values" which patients hold, prior to lean implementation.

For Lean, however, the absence of a single customer with a compelling view of value is perhaps the most important feature of healthcare and consideration of value within the many "customer" communities reveals a complex and fragmented scene. Lean has to engage with these many value concepts in a rigorous and ideally, homogeneous way.

It is suggested process improvement in healthcare organisations must account for differences from the manufacturing environment where most structured process improvement techniques have been developed. Examples of key differences include the more varied and highly personal interactions between healthcare workers and patients, less certain demand patterns, and the differences in goals of for profit versus non-profit, government owned organisations in the healthcare sector.

It can be said, the multiple faceted nature of UK healthcare is usually split into geographically different sites, and with individual functions operating as autonomous 'silos'. The lean methodology insists the maximisation of performance by an individual operating unit is not the key nor is it sufficient, but of vital importance is the "entire process flow", which entails full cooperation between multiple operating units, within a healthcare setting. Cooperation has to be improved between functions and sites, so as to both achieve and thereafter sustain improvements in operational performance.

Research indicates healthcare supply chains are organised very differently from a typical manufactured product based supply chain. Organisations in a healthcare supply chain typically have no financial exchange as a patient moves from one organisation to another for services, instead they are both paid for their work by a third party. In addition, healthcare supply chain

partners who coordinate their work are unlikely to be contractually bound to meet a partner's time or quality standards. Partners may decide to meet regulatory requirements in performing their work but neglect their supply chain partners' requirements. In this case, downstream members (whom receive patients from upstream organisations) have little influence over upstream members, to dictate the process used to perform the work, the pace at which the work is performed, or the quality of their output (service quality). This has critical implications for the 'quality of service' received by patients.

Proudlove et al (2008) indicate that "in hospitals there is still a lot of undergrowth to clear" and that "a deeper appreciation of lean may be necessary" referring to the lack of more advanced lean implementations taking place in the UK hospital sector to date. One reason put forward for this is the excessive number of smaller and simpler actions that need to have taken place prior to a more complex and cross-functional initiative like lean implementation can take place.

In healthcare organisations in general, both providers and employees across functional departments all share the same desire of providing the best possible care to patients, allowing for existing resource constraints. Lean as a continuous improvement philosophy, with its powerful tools and techniques, and requirements for genuine accountability, helps a healthcare organisation achieve this goal. However as Liker (2004) insists, there has to be genuine commitment from senior executives and leaders from within the healthcare organisation, for lean implementation to be successful.

Chapter 3: Research Design

3.1 Research Setting

The main objective of the analysis is to determine the applicability of Lean principles into the UK hospital sector, allied with providing a justification for its introduction in terms of waste elimination and cost savings.

This Thesis was undertaken under 'operating parameters' which included a maximum time period of 15 weeks, financial budgetary constraints, whilst access to Northwest Hospitals was also limited.

Primary contact at the Royal Bolton hospital comprised the Bolton Improvement Cycle System Co-ordinator and the Service Improvement Manager. Following email correspondence, a couple of visits to the hospital were made for the purposes of validating academic theory in terms of case study evidence. All visits and interviews were conducted during 20th July 2009 and August 14th 2009.

3.2 Ethical Considerations

Whilst conducting primary research the researcher adhered to standard 'ethical principles' throughout the research investigation, as expressed by Bryman & Bell (2007):

- ''Respecting the dignity of research participants''

- ''Ensuring a fully informed consent of research participants''

- ''Protecting the privacy of research subjects''

- ''Ensuring the confidentiality of research data''

- ''Protecting the anonymity of individuals/ patients''

- ''Avoiding deception about the nature or aims of the research''

- ''Honesty and transparency in communicating about the research''

- ''Avoidance of any misleading, or false reporting of research findings''

3.3 Systematic Research Methodology

A systematic approach as outlined by White (2007) to conducting ''primary and secondary research'' was embarked upon. Specifically, a deductive (i.e. desk based) approach to the research enquiry was carried out, followed by an inductive (i.e. field based primary) approach to substantiate academic underpinnings with real life case study evidence. This way building upon the extensive and readily available information that already exists. Primarily it was a 'Qualitative' enquiry, using quantitative data only as necessary.

Ranking of Journal Papers was based on 'Relevance of Article' being as closest to the Research Question(s) as possible, 'Quality and Reputation' of

the journal itself, and the 'Reputation of the Author' as an expert in the field. This formed the basis of a 'systematic' approach to their selection, as indicated by Wallace & Wray (2007). Ranking was also based on the number of times an article had been 'cited' by other authors, and hence signifying its importance. Whether an article had been 'peer reviewed' was an additional criterion. Identifying key journals that are likely to be read by practicing commercial managers in the NHS was an additional consideration. Articles written prior to the year 1995 in general were excluded. Hence, this ranking, weighting and analysis of research articles on a systematic basis helps ensure the research question is being addressed as accurately as possible, with the latest available relevant literature.

Semi structured interviews were undertaken at a local hospital in the Northwest of England-for the purposes of obtaining enhanced qualitative information.

3.4 <u>Literature Review / Sources of Literature</u>

Whilst conducting the deductive research the framework advocated by Easterby-Smith &Thorpe (2008) was adopted in terms of exploring the volume of existing literature, with a view to addressing the following concerns:

- "What is already known about this area?"

- "What concepts and theories are relevant to this area?"

- "What research methods and research strategies have been employed

   in studying this area?"

- "Are there any significant controversies?"

- "Are there any inconsistencies in findings relating to this area?"

- "Are there any unanswered questions in this area?"

There was a reliance on an extensive literature search of over 150 leading academic journals in the fields of Healthcare, Human Resource Management, Operations Management, and Organizational Behaviour and Management, sourced from Databases available at Cranfield University, with Citations being 200+ approximately in number.

Journals such as: Harvard Business Review, McKinsey Quarterly, Sloan Management Review, British Medical Journal, Health Service Journal, International Journal of Productivity and Performance Management, Journal of Healthcare Quality, Journal of Hospital Medicine, Journal of Productivity and Management, Journal of Production and Operations Management, International Journal of Operations and Operations Management, Public Money and Management and Nursing Management were reviewed, amongst other leading publications.

This was supplemented by making extensive use of textbook chapters on relevant topics from the field of Operations Management, Human Resource Management and Organizational Behaviour and Healthcare Management as required.

Databases such as: ABI Inform, EBSCO, Emerald, Google Scholar, Medline, ProQuest, Science Direct, and Scopus (Biology and Medicine) were routinely searched, consulted and utilised.

3.5 <u>Qualitative Investigation</u>

Qualitative methods can indicate how people feel and what they think, but cannot tell you how many of them feels or think one way or another. The resulting discussion is to some extent 'unstructured' allowing participants to make any response as they so please, and they are not restricted to a list of given responses, which allows topics to be explored in more depth.
The principle of Reflexivity as advocated by Bryman & Bell (2007) was adhered to at all times. When collecting data, the researcher thought about his role and the impact it could have on the research enquiry. It was noted that qualitative research aims to ascertain ''subjective'' understandings from the experiences of participants, but at the risk of obtaining an ''objective'' assessment of reality.

3.6 <u>Primary Investigation: Royal Bolton Hospital: Selection and Characteristics of Participants</u>

At Royal Bolton hospital, a total of 7 key personnel were interviewed. The rationale being: for qualitative research to have maximum validity, the choice of who to interview, has to be made primarily on 'human judgement' and 'internal advise' as opposed to choosing at random. As Saunders et al (2007) point out ''sampling errors decrease as sample size increases'', and hence the aim was to interview a greater number of personnel, however this proved impractical, given the unavailability of key personnel during the time span of the research enquiry.

Consequently, the participant group comprised the service improvement director, the service improvement manager, two senior improvement facilitators, a ward matron, a theatre manager and the manager of the Pathology department. This sample was seen as most representative amongst the hospital staff, on the basis that they had the greatest knowledge/involvement in the lean processes within the hospital, the research enquiry was analysing.

At Royal Bolton hospital, personnel with relatively little power or authority, were interviewed first, in order for the interviewer to obtain a basic insight initially, and thereafter greater knowledge, prior to interviewing more senior participants, such as the Service Improvement Director. It was vital to take such an approach, ensuring that the limited semi structured interviews at the hospital, resulted in the required information being obtained, in order to address the research question in hand.

3.7 <u>Interview Structure: Semi Structured</u>

As Bryman & Bell (2007) indicate, here the interviewer puts forward a 'series of questions', which are in the form of an interview schedule, but has the flexibility to alter the sequence of questions. The questions tend to be more general than those often found in a structured interview. Additionally, the interviewer has the flexibility to ask any further questions, based upon significant replies.

Formal interviews were conducted with seven hospital personnel, whom were responsible for running lean initiatives and those that had been involved in implementing lean at the hospital. Qualitative data were compiled from interview notes, thereafter grouped under key themes, for the purposes of validating widely known achievements at the hospital.

The line of enquiry followed involved interviewing members of the service improvement team, the stroke ward matron, the theatre manager and the Pathology departmental manager, so as to elicit a ''cross-sectional representation'' of the impact that the introduction of Lean Methodology has had at Royal Bolton hospital.

A Questionnaire comprising twenty questions was used to collect data on key successes, major problems encountered and issues that need addressing at Executive Board level. The intention was to encourage participants to 'reflect' on lean implementation, with regard to the changes made, the benefits reaped, and the problem issues that remain.

As Easterby-Smith & Thorpe (2008) mention, semi-structured interviews were chosen on the basis of them offering minimal risk of ''misrepresentation and misinterpretation'' of the data collected, offering high reliability and validity, whilst offering maximum flexibility during the interview process.

As Gill & Johnson (2002) advocate, each interview conducted at the hospital began with a brief explanation of the purpose of the research, with the intention of increasing the awareness and enhancing the commitment of the interviewee. Each interview conducted took on average half an hour to one hour in length and was conducted within hospital grounds.

Every interview began with a Questionnaire, consisting of 20 general questions. This enabled the participants to talk openly, which allowed the researcher to determine the extent of their involvement with various processes within the hospital. As the interviews progressed, specific topics were addressed to a greater extent.

3.8 <u>Data Capture and Analysis: A Quantitative Approach</u>

The chosen method of quantitative collection was a mixture of interviews and the collection of case study material. This was performed to substantiate the findings of the qualitative investigation in order to provide the required level of robustness at practitioner level. Inferential Statistics examine the sample data

in order to support observations or hypotheses, and provide objective data for subjective review. By performing this type of analysis, it was then possible to corroborate any potential conclusions drawn from the qualitative investigation.

3.9 Limitations of the Research Investigation

The concept of "Ethnography", whereby the researcher is encouraged to 'immerse' himself / herself into a setting, and hence become part of the study group, in order to obtain a deeper appreciation of the subject matter under investigation, proved troublesome. Being new to the hospital, the researcher faced issues that were difficult to comprehend. The lack of medical knowledge on the part of the researcher meant that considerable time was spent on familiarisation with the subject matter instead.

As Easterby-Smith & Thorpe (2008) indicate the risk of both interviewer and interviewee bias was always evident. In an average interview there are numerous opportunities for errors to occur, as a result of interchange between the interviewer and the interviewee. As recommended by Gill & Johnson (2002), the interviewer requested "respondent validation" at every stage where possible in order to minimise the risk of these errors from occurring.

The aim of the 'primary research' at the hospital was to obtain information from a wide range of directly relevant stakeholders. Yet, this proved impractical at the best of times, with regard to the unavailability of key personnel both within the Service Improvement Team and the Royal Bolton hospital in general, due to pressing commitments elsewhere. Thus, statistical inferences drawn thereafter may not have the desired properties of validity and robustness, as would otherwise be the case.

There was lack of adequate and accurate data in certain areas (Accident & Emergency, Maternity departments, etc) to enable the researcher to draw any meaningful statistical inferences (see Easterby-Smith & Thorpe, 2008) about the overall impact Lean Methodology has had at Royal Bolton hospital.

Given monetary and time constraints attached to the Thesis, the number of interviews and visits to the Royal Bolton hospital were limited. This also meant there was less flexibility in terms of conducting visits in other associated parts of the hospital, and other competing hospitals for comparative benchmarking purposes.
The impact of the current pandemic flu meant a fewer number of visits were offered by the hospital than had originally been indicated, due to the increased pressures on all staff members, during a critical period. This was a limiting factor.

3.10 Concluding Remarks

Understanding performance drivers and constraints within a large complex and extremely busy district general hospital such as Royal Bolton was always going to be difficult. However, all relevant hospital staff members were very receptive to this research, very informative and extremely helpful at all times.

The tours of the Pathology department, the Stroke ward and the Theatre ward were particularly insightful.

Chapter 4: Findings: Benefits of Lean Implementation / Empirical Evidence

4.1 Overview

On the operational side, the organisational benefits to a hospital can include; increased surplus, increased capacity, improved employee morale and performance, waste elimination and lower inventory levels.

It has to be noted on the other hand, research does suggests that there is a great amount of unwarranted activities that occurs within hospitals, as a result of countless delays, repeat tests, and activities not occurring in the correct sequential order. It is argued lean really focuses on the one hand with the patient's journey, whilst on the other the medical process which ensures that the journey is made possible.

4.2 Findings: Healthcare Benefits

Aherne (2007) in relation to Lean healthcare mentions the following key benefits:
- ''more patient admissions and diagnoses''
- ''shorter patient waiting times''
- ''more timely and efficient delivery of care''
- ''faster bed turnarounds''
- ''improved workplace organisation''
- ''enhanced cleanliness and safety''
- ''better and more streamlined administration processes''
- ''less inventory used and better use of space''
- ''better supply and storage management''

Alternatively Fillingham (2008b) identifies the key benefits of lean implementation as:
- ''enhanced quality of service and patient outcomes''
- ''a greatly improved patient experience''
- ''better management of patient flow and demand''
- ''improved organisational and process efficiency''
- ''improving staff morale and performance''
- ''enhanced quality of service and patient outcomes''

whilst pointing out potential reductions in costs, errors (both in testing and treatment), patient waiting times (both 18 week rule and the 4 hour target), delays (in diagnosis, treatment and discharge) and in waste (in terms of time and resources).

Jones (2008) identifies key benefits from Healthcare Lean Implementation as follows:

1. Improved 'quality of outcomes' as mistakes and errors are minimised
2. A significant reduction in the 'time taken' through the healthcare process
3. The resultant being: the number of patients that can pass through the system increases i.e. throughput of the system increases.

Patel (2008) indicates benefits to patients include; reduced waiting times improve overall outcomes, resulting in greater satisfaction with NHS services. And by improving asset utilisation and eliminating waste, taxpayers get a better deal and money is released to invest where it's most needed.

4.3 <u>UK Empirical Evidence</u>

4.31 <u>General Findings</u>

Black & Miller (2008) indicate the application of lean principles routinely results in dramatic results. Reductions of 50% or more in patient waiting time, distance travelled by staff, laboratory turnaround time, and various other processes are typically reported within weeks or months.

University Hospitals of Morecambe Bay NHS Trust implemented lean techniques within 3 divisions at Lancaster Royal Infirmary. Lipley (2008) indicates prior to lean implementation there was:

- ''Duplication of effort''
- ''Overstuffed filing systems''
- ''Badly designed working areas''
- '' Wasted internal capacity''

However, post Lean implementation clinical records can be retrieved a lot quicker, fewer clinical documents/notes go astray, and a greater number of patients are now seen to and treated.

Lipley (2008) provides evidence that the Stockport NHS Foundation Trust, found post lean implementation, ''an improved throughput in the radiology department at Stepping Hill Hospital, by as much as up to 50 per cent''.

Lipley (2008) also indicates lean implementation at the Royal Devon and Exeter NHS Foundation Trust, has enhanced 'flow' within the dispensary, whereby the average time taken to 'make up prescriptions' has fallen from ''90 to 20 minutes'', whilst inventory holdings have been reduced by ''£150,000'', yet supply has been unaffected.

Within the South Devon NHS Trust, the Gastroenterology department implemented lean measures, whereby the pre-operative stage triggers plans and schedules for patients and staff so everyone knows which patients will be arriving, when they will be arriving and for what particular type of treatment. Readmissions and length of stays were reduced from 12.6 days to 6.0 days. Improvements meant they reduced the number of beds they needed and some staff could be redeployed.

Matheson (2006) discusses the Mayday Healthcare Trust in Croydon, and indicates from December 2004 to December 2005, it reduced the length of stay on average for elective surgery from "5.1 to 4.5 days", overall average length of stay from eight to seven days and was able to close 78 beds, without affecting the level of provision it offered, nor compromising service quality.

The Trust created a short-stay, mixed condition facility for patients staying less than 72 hours, and now accepts admissions on the actual day of surgery, and not the day before, as previously. In addition, clinical staff offer flexibility now, and they carry out ward rounds on a Monday, when a ward is busier with weekend admissions.

4.32 Hereford Hospitals Trust-Pathology Department

Westwood (2005) when analysing Hereford Hospital found turnaround times for tests in the pathology department fell "by 40% in seven days by improving the flow of the specimens through the department", whilst wasteful activities were eliminated. They found productivity has "improved by 252% at peak times", whilst staff now also finish processing the work 15 minutes earlier than was previously the case.

Westwood & Silvester (2007) mention a £365,000 saving each year, as a result of inpatients being discharged a lot quicker, the average length of stay being shortened, and the creation of new capacity within the hospital from more effective resource utilisation of existing assets.

As a result of the "specimen reception" now being manned, standard working practices and procedures being implemented, the average delays in "specimen reception" has fallen from around "13 minutes to less than one minute". It can also be noted that the "maximum variation" in time has fallen from "over 30 minutes to less than 4 minutes".

Overall, it has been demonstrated that the improved turnaround times in the pathology department has resulted in improved performance within the A&E department and hence the hospital's ability to meet the four hour waiting target within A&E. Now, a greater number of patients are "given their pathology results within 45 minutes". Resultant being, quicker decisions can be made within the A&E department.

4.33 Pennine Acute Hospitals (NHS) Trust- Radiology Department

Lodge & Bamford (2008) when analysing the "radiology service" found:

- "All management information and waiting lists were manually produced"
- "A wait of 26 weeks was considered normal in November 2005"

They indicate the implementation of ''lean techniques'' throughout the entire department, has resulted in faster diagnosis of patients, treatment is now started much earlier, and hence various departmental managers are in a better position to manage capacity in order to meet actual demand.

Lodge & Bamford (2008) point out post September 2006, as a result of Lean implementation, there has been a very noticeable decrease in waiting times across the different imaging services within the department (the longest waiting time has now fallen in excess of 30% across all areas within the department). It can also be noted waiting times across services are now less than 13 weeks (from 26 in November 2005) and now there is only ''a single waiting list across the four hospital sites''. The average inpatient wait for scanning services has decreased from five days to three days, freeing up 18,000 bed days per year.

4.34 <u>Peterborough Hospitals NHS Trust -Ophthalmology Department</u>

Locock (2003) states Peterborough Hospitals Trust has redesigned its cataract service. Detailed investigations suggested it would be more cost effective for the healthcare provider, and far more efficient for cataract patients, if they could be ''booked directly onto an operating list'', and hence avoiding the necessity to visit their GP nor have an outpatients appointment at the hospital prior to the operation.

The resultant being, a team of optometrists in the community were trained, in order to determine a patient's need for surgery. During a consultation the optometrist can ''book a day surgery slot'' at the local hospital directly, for a date and time acceptable to the patient.

The overall impact has been a reduction in the time taken from ''diagnosis to operation'' (from several months to just 6 weeks), clinic appointments do not exist now, fewer journeys are made by patients, there is no duplication of services, whilst costs have fallen significantly.

4.35 <u>Blackpool, Fylde and Wyre NHS Foundation Trust-Geriatrics Department</u>

Brandao de Souza & Archibald (2008) analysed the Geriatrics department at the Blackpool, Fylde and Wyre NHS Foundation Trust. They found, post lean implementation:

- '' A 50% reduction in 'length of stay' was achieved in two wards''

Whilst a new approach, which combined lean principles and ''computer simulation'', with a view to reducing 'waiting lists' within an audiology department, within the same Trust, was analysed by Brandao de Souza et al (2008). This resulted in a much more consistent and robust timetable for clinics, better equipped and more organised consultation rooms, whilst

storage space was better utilised. These minor, minimal expense changes, resulted in a 25% enhancement of capacity, which encouraged the finance department to fund further "short term capacity".

4.4 Worldwide Empirical Evidence

4.41 Virginia Mason Medical Centre (Seattle, U.S.A)

Lipley (2008) indicates the Virginia Mason Medical Centre (VMMC) has 5000 personnel, whom look after approximately 16,000 inpatients and around 900,000 clinician visits during any one year.

Wysocki (2004) indicates the VMMC has cut costs dramatically, whilst cutting "infection rates" to near zero. In addition, it has managed to free up in excess of "1,200 square metres of space", whilst the distance hospital staff need to walk has been cut noticeably.

Weber (2006) points out "lean has reduced staff walking distance by 38% (34 miles)", whilst stock levels have halved, and "the average waiting time has fallen by 53% (708 days)".

Spear (2005) mentions, changes implemented at VMMC using lean techniques have ensured a lower likelihood of "ventilator-associated pneumonia". It has fallen from "34 cases with 5 deaths in 2002 to 4 cases with 1 death in 2004".

Miller (2005) indicates by eliminating waste VMMC enhanced capacity from existing assets. It is mentioned, planned buildings expansion was no longer necessary, which saved considerable financial resources:

- $1 million was no longer needed for a new hyperbaric chamber
- $1 to $3 million was saved since the endoscopy suites no longer needed to be moved elsewhere
- $6 million saved since a new surgery was no longer needed

4.42 Flinders Medical Centre (Adelaide, Australia)

Flinders Medical Centre is based in South Adelaide, it is general hospital, which a capacity of around 500 beds. Its Emergency Department (ED) is constantly busy, with some 50,000 patient visits per annum, out of which around 40% require admission.

According to Ben-Tovim et al (2007) Flinders Medical Centre has reported positive outcomes in both patient flow and staff turnover. It addressed problems of overcrowding, compromised safety, and high staff turnover in their ED. Within a short period of time, they saw results. Congestion decreased, whilst the time patients spend on average in the ED has noticeably fallen.

The number of patients, whom leave the department, without receiving full treatment has halved. 'Did not waits' as a percentage of arrivals fell from 7% of all arrivals to just over 3% and have been maintained at that level.

Streaming also decreased congestion by reducing the time patients spent in total within the ED. As Ben-Tovim et al (2007) indicates: "The average time that patients spent in the ED fell by 48 minutes in the first year after lean implementation". Jones & Mitchell (2006) point out the average waiting times within the ED fell by 25% (whilst approximately 70% of patients were attended to and went home within 4 hours of entering the ED).

In summary, Flinders found it could do 15-20% more work, now offers a safer environment to patients, whilst operating within the same budgetary constraints, utilising the same technology, capital equipment and buildings, and same personnel. There has been a noticeable improvement in costs, service quality to patients, delivery of services, and the morale of the workforce.

Chapter 5: Case Study: Empirical Evidence from The Royal Bolton Hospital

5.1 Overview

Royal Bolton Hospital in North West England is a large "District General Hospital", with in excess of 3,000 personnel, offering a capacity of almost 800 beds. It is an old hospital in Greater Manchester, which caters for a local population with above average levels of sickness in an area of high unemployment.

Over the past 5 years, Royal Bolton Hospital NHS Trust has witnessed very noticeable early gains, as a result of Lean implementation. Widely published achievements include a one third reduction in the number of deaths for patients having hip operations, paperwork fallen by 42% in the trauma unit, whilst there has been a 40% reduction in floor space requirements by the blood sciences department in general.

5.2 Key Findings at Royal Bolton Hospital

Fillingham (2008) mentions the following achievements:

1. Trauma-fractured hip mortality cut by 50%, length of stay down 33%
2. Blood Sciences-test turnaround times 3 to 10 times quicker, 40% floor space saving
3. Cataracts-new one shop established, patient visits cut by 50%
4. High risk joint replacement-complications reduced by 85%
5. Orthopaedic Trauma Mortality rates have fallen by a third, once services were reshaped and reconfigured to meet the requirements of the patients, as opposed to staff preferences
6. The amount of time it takes for a patient to progress from the accident and emergency department to an operating theatre has been cut by 38%.
7. Hospital wide, paperwork has been slashed by 42%, whilst the total time patients spend in the hospital has been dramatically cut by 32%.

This research investigation (interview with Ms Schenk- Service Improvement Director) in addition to Schenk (2006) confirmed following achievements:

Orthopaedic Day Care
1. "50% reduction in hospital visits"
2. "100% scheduling from clinic to lists"
3. "Reduced paperwork from 6 letters per patient to 2"

A&E 6S Exercise (Resuscitation Area)
1. "Excess stock returned-value £2500"
2. "Reduced adverse incidents"
3. "Improved response times"

Telephone Access Centre
1. "Calls answered increased from less than 40% to 88%"

5.3 **Case Study Evidence (2008/2009)**

5.31 Ophthalmology Unit

Since September 2007 the Ophthalmology Unit has provided a new 'one stop' service known as an Eye CAT (Clinical Assessment and Treatment) in the local community, in an environment of demand growth and meeting the Government 18 week delivery rule. To support this service the department altered the flow of patients by streaming them by specific clinical conditions groups e.g. cataracts, glaucoma, and minor operations. If the condition exits, it was decided what the 'best pathway for treatment' is as opposed to the traditional model (patient sees his GP and then a referral to a Consultant is made).

Between October 2007 and April 2008, 7,000 new patients have been seen and over 18,000 follow up appointments made. In addition 2,200 procedures have been performed. All this has been achieved whilst waiting times have reduced and referrals have steadily risen. Excellent improvements have continued to be made including a 50% fall in patient visits.

5.32 Stroke Unit

Stroke was identified as a key area for improvement in Oct 2006, 600 new stroke patients were being admitted each year, and The Trust had 28 beds on a ward off the main site of the hospital. Only 43% of stroke patients admitted received specialised stroke care and there was a 30% higher mortality rate within Stroke than the national average.

Key problems identified included: disjointed and uncoordinated care (acute patients scattered over all of the wards, which then affected length of stay) and a lack of specialist clinical input.

As a result of Lean thinking improvements were made as follows:
1. Staff skills and knowledge were developed
2. An Early Support Discharge Team began
3. Identifying and planning both ward layout for commencement of a new Acute Stroke Unit (42 beds) and a series of Visual Management and 6S events for both acute and rehabilitation units.
4. Involving users of the service.

Table: Pre and post Lean Implementation: Stroke Unit.

		Baseline	Current
HSMR		130 Jan 07	109 Oct 08
Treated in Stroke unit		43%	99%
Swallow screen -24 hrs		59%	95%
Brain CT Scan - 24 hrs		46%	100%
Anti platelets prescribed		63%	100%
Weighed once during admission		65%	100%
Mood assessed by discharge		63%	100%
Length of Stay	2006 43 days	2007 29-27	2008 22- 18 days

[Source: Stroke Case Study, Bolton Hospitals NHS Trust. Nov 2008.]

The New Stroke Unit has a permanent Stroke Consultant, assisted by two Registrars / Senior House Officers and 90 specially trained nurses operating within the unit.

The length of stay has substantially fallen (50%), the mortality rate is also falling noticeably, and Royal Bolton Hospital now has a Sentinel Audit Score that is in the Top 5 nationally, and all this was achieved in a mere 2 years.

[Note: HSMR denotes Hospital Standardised Mortality Ratio, which is a risk weighted comparison with a base of 100. As of January 2009, the Royal Bolton Hospital score is 99, a significant improvement from January 2007].

5.4 Two Examples of Process Improvements from Royal Bolton Hospital

At Royal Bolton Hospital they have also seen the benefits from applying lean principles at the level of the clinical team within a ward environment. One of their earliest developments was that of a trauma stabilisation unit, an eight-bedded bay within one of their orthopaedic wards.

5.41 Trauma Stabilisation Unit (TSU)

Key Achievements

This investigation, confirmed Institute of Management Services (2006) data:

They redesigned the entire process over a nine month period, with the result that stabilisation improved, which meant access into theatre and discharge, occurred more rapidly now. According to the Institute of Management Services (2006) key achievements include:

1. Time taken to get a patient from A&E to an operating theatre cut by 38% (2.4 days to 1.7 days).
2. Paperwork across the unit has been slashed by 42%
3. The total time patients now spend in hospital has been cut by 32% (34.6 to 23.5 days)
4. There has been a dramatic fall in mortality by at least one third (in 2004/5 327 patients were admitted with fractured hips and 75 died (22.9%), whereas in the first half of 2005/6,164 admissions were made of which 24 people died (14.6%)).
5. Patients now recover faster and there is less demand placed on the rehabilitation ward.

Detailed Case Study Analysis

- Patients were streamed upon admission (into simple and complex) and complex patients were placed on the Trauma Stabilisation Unit (TSU).
- A multi-disciplinary team of staff including doctors, nurses, therapists and social workers worked together to standardise processes and streamline paperwork (Standard Work).

- Batch sizes were reduced, for example the ortho-geriatrician moved from weekly rounds on the ward to shorter, daily ward rounds (Flow).
- Trauma co-ordinators were empowered to seek out ill patients entering via A&E or languishing elsewhere on orthopaedic wards who needed the care of the TSU.
- The physical layout of the orthopaedic unit was re-organised to create the TSU incorporating the lean concept of visual management. It included, for example, colour coded boxes at each bedside in which the main items needed for that patient could be stored. This saved on nursing time walking backwards and forwards to the main store area. The colours on the bedside store boxes matched colour codes in the main storeroom too, which speeded up replenishment when that needed to take place.
- A visual management display was developed to give the ward team greater control of patient care interventions and keep track of the co-ordination needed between the different specialities and disciplines (Visual Management).

The results over a nine month period were spectacular. They included a 33% reduction in length of stay for this group of patients, a 42% reduction in paperwork and most importantly of all a 38% reduction in mortality. Over 60 lives have been saved in under two years since lean techniques have been applied to this set of patients.

5.42 Blood Sciences (Pathology) Department

Over a twelve month period the Pathology Department engaged over 100 staff in numerous training activities, process mapping exercises and rapid improvement events. They gradually evolved a plan to reshape the department.

Key Achievements

This research investigation along with data from the Institute of Management Services (2006) confirmed that:

Using Lean significant blockages in the system were identified and rectified, resulting in:
1. A reduction in time taken to process blood samples from around 24-30 hours to approximately 2-3 hours.
2. A reduction in staff numbers (who were then redeployed)
3. A reduction in space needed by the department by 50%
4. A reduction in the number of steps needed to accomplish the majority of jobs by 70%
5. A reduction in the time needed to complete most tasks by 90%
6. A reduction in staff 'journey' distance by 80%

Detailed Case Study Analysis

- What had historically been six discreet functions were drawn together into a single unit-the Lean Blood Sciences Laboratory.
- Walls were knocked through, equipment relocated and work processes fundamentally redesigned. This was by no means a straight-forward process!
- The Pathology management team were faced with almost daily set backs. Morale in the department went down rather than up and it was often hard to identify clear benefits but the team showed resilience and determination.

The team gradually picked off the problems one by one:
- They involved more and more staff in training activities and in improvement events.
- Slowly the benefits began to become clear. A typical blood sample's journey previously involved 309 steps, however once the work had been redesigned, this was drastically cut to only 57 steps. (Jones & Mitchell (2006)).
- Eighteen months later the team had generated 10% extra income with 2% fewer staff.
- The amount of floor space had been reduced by 40% which enabled testing work done elsewhere to be brought back in house and new contracts to be secured. Note, previously the Trust was considering a £1 million business case for an extension to the laboratory.
- The turnaround times for blood tests in the emergency department were dramatically reduced. At the outset they hadn't even been sure what they were! (Note in the case of urgent blood sample, after work redesign, necessary steps were reduced from 75 to 57). (Jones & Mitchell (2006)).
- What's more, once the target of a turnaround time of two hours was achieved the team themselves decided that it was time to make the target harder and raised the bar so that the new goal became a turnaround time of one hour, forty-five minutes (the team leader then set his sights on a one hour, thirty minutes target, once this new goal had been consistently achieved).

5.5 Concluding Remarks

Fillingham (2007) states: "implementing lean in a healthcare setting is far from easy but the potential gains are enormous: our early experience is that lean really can save lives". The reduction in hospital mortality rates-improvements in Orthopaedics and Stroke through Lean have been a major part of that, have been self evident and widely published. The hospital has set up new services, in order to stay competitive and plans to offer more 'user-friendly' services for patients. As mentioned above, in Ophthalmology, lean thinking was used to set up a 'one stop', low wait outpatient service.
Using the same line of thinking, the Trust is planning to address improvement in other Value Streams (pathways) particularly, in 2009/10, in high volume 'urgent medical admission' pathways which still present major challenges for the performance of the Trust.

Chapter 6: Discussion and Recommendations

The case study results from the preceding two chapters clearly indicate that lean techniques can be used successfully within a healthcare environment. More generally, the results indicate the context invariant nature of the lean principles between manufacturing and service environments.

6.1 Introduction

Clinical practice within any hospital setting is often 'process rich' and hence provides vast opportunities with respect to improving the 'delivery of patient care'. Key questions need to be asked and addressed regarding any hospital environment:

- Are 'hospital discharges' delayed as a result of vital tests not arranged or carried out?
- Are 'planned discharges' delayed due to poor pre planning in respect of what the patient requires immediately before or after discharge?
- Are errors in medications taken by patients or prescribed to patients after discharge common?
- How high is the incidence of 'preventable infections', likewise 'medical errors' within the hospital environment?
- Is it common for patients to be 'readmitted to the same hospital' for the very same illness as a result of errors in communicating the correct 'discharge instructions' to the patient?

The above scenario outlines a very small number of cases, when care offered has been below optimal, as a result of numerous 'suboptimal processes' that still exist today in various UK hospitals. It has been demonstrated that organisation wide, improvement techniques, such as 'lean thinking' can have a profound impact on variables such as cost, efficiency, patient quality and safety, and the delivery of care offered. It has also been pointed out that 'prevention of errors and infections' can and do lead to 'improved mortality and morbidity rates', whilst at the same time a considerable saving in financial resources for the hospital concerned.

It has been shown that consultants have a large degree of power and control at their respective hospitals, and hence it is vital to engage them in any reform process. Consultants and likewise their 'clinical colleagues' will not accept nor adopt proposed changes unless they can see visible (tangible) benefits for their individual clinics and for their respective patients. Hence, any proposed 'change initiative' has to be adapted to ensure the needs and preferences of individual consultants/ clinicians are met and fully understood. Consultants need to feel they are spearheading the change initiative, as opposed to having 'change initiatives' imposed upon them, by another body.

A major issue with respect to 'hospitalised' patients is the process of discharge, which often in the case of the elderly involves the transfer of care to either an 'outpatient department' or a specialist nursing home environment. Currently in the UK, the service is often not linked and often results in patients

having several complications requiring re-hospitalisation, unnecessary deaths, or the patient suffers from their illnesses over a longer period of time.

6.2 Discussion of 'Ideal State' Hospital Sector

In the ideal world, patient's needs should be matched up to available healthcare services, in order to ensure that the patients receive their required treatment, when they actually need it and hence without waiting, and where it is required.

Commentators on healthcare such as Castro et al (2008), Crump (2008), Foley (2006), and Westwood and Silvester (2007) advocate a set of practical measures, which can help ensure a closer match between available capacity and patient demand:

1. **Get quality right first time**- It is vital to halt processes and rectify problems as they appear. Hospital managers need to find solutions to potential problems as soon as they arise. An organisation culture that seeks to prevent problems from happening in the first place is desirable. Never blame the person, blame the process (the system) and always provide sufficient encouragement to staff ensuring that they find a solution to problems and share new found knowledge.

2. **Aim for 'faster work flow' and without batching or delays**- It can be argued processes need to operate 'at the rate of demand placed on them'. Hence, if queues or waiting lists develop, it is a sign that this is not the case. In a hospital setting it is advisable to balance out the 'patient flow' by reducing potential batch sizes, increasing the frequency of internal deliveries, whilst at the same time balance out 'internal demand'.

3. **Workloads should be levelled out**- It is essential to have 'stability' in hospital 'work processes' in order to ensure potential problems are easily detected and rectified, thus ensuring a cycle of successive improvements. Hospital managers need to understand the complexity of the demand placed upon the process, and the existing capacity that is available to meet that potential demand, and hence aim to balance the two, upon which other improvements initiatives can be based.

4. **Selective Improvements**- It is recommended to begin lean implementation on a selective basis, beginning in areas, where substantial financial resources can be saved, whilst ensuring capacity is not reduced at any potential 'bottlenecks'. Otherwise, the 'flow of patients' would slow down, the length of stay would increase, the resultant being lower revenue generation for the hospital.

5. **Standardise tasks**- It is essential to have and use 'standardised practices and procedures', as a basis from which the process itself can be improved upon. Repeatable elements of work should be analysed, variations measured and investigate reasons why they occur, with a view to helping staff have

dependable processes. Simplification of procedures and processes will lead to greater efficiency.

6. <u>Dedicated Improvement Expertise</u> – As Westwood & Silvester (2007) suggest, it is essential to develop internal capability within hospitals prior to and whilst lean techniques are being implemented. This would help to ensure a culture that accepts change and the need for successive improvements develops within hospitals.

7. <u>Role of Doctors/ Clinicians</u> - Castro et al (2008) based on their interviews with 170 general managers and heads of clinical departments in UK hospitals, suggest that ''clearly defined roles'' for doctors with regard to how hospitals are managed and run, at the same time as updating their skills, may offer a solution to how hospitals could be better managed.
What's more, hospitals whose general managers have a clinical background had overall management scores higher than other hospitals did. It suggests it is particularly important for the NHS to help clinicians become better leaders, since that should improve the overall management of NHS hospitals and ultimately, the quality and productivity of the health care they provide.

8. <u>Patient and Information Flow</u>- It is vital to organise activities on the basis of 'patient and information' flows, as opposed to on the basis of functional divisions/ departments. Someone in a hospital needs to be responsible for the whole 'value stream' and have the authority to eliminate blockages and delays as they occur.

9. <u>Increase Number of Lean Managers</u>- It is vital that lean managers are 'highly visible' and be located close to 'value adding work'. Managers are there to enhance the 'value stream', they need to make improvement decisions on the basis of consensus, yet implement them immediately.

10. <u>Day to day acceptance of Lean</u>- Managers and key personnel within hospitals should be aware of daily problems as they occur, and seek explanations for their occurrence, whilst always looking to find immediately workable solutions. Key managers and staff should actively participate in Kaizen events, which advocate the theme of 'continuous improvement'. Intention is to provide an ever increasing 'quality of service' to patients, the minimisation of 'clinical errors' (as a result of analysing the hospital processes) and not blaming the relevant staff member concerned.

The following table (see Foley (2006)) highlights the difference between Traditional and Lean Thinking in the UK NHS:

Command & Control traditional thinking	Patient-centred, 'Lean', process management
Top down decision making concerning processes separated from those actually operating the process	Those actually operating the processes heavily involved in decisions around them
Function specialisation, departments, budgets, roles, splitting-up the value stream	Value-stream oriented processes and roles
Leadership & management motivated by extrinsic factors (crises, targets, fads)	Leadership & management intrinsically motivated by continuous improvement and curiosity about their organisation
Manage budgets, departments	Manage the system
Guarded attitude to suppliers, partners (e.g. Social services, PCTs, GPs)	Open partnership for one aim: better patient service

[Source: Seddon (2005)]

6.3 Lean Healthcare Solutions / Recommendations

Numerous commentators on lean healthcare such as Batalden & Splaine (2002), Castro et al (2008), Crump (2008), Fillingham (2008), Miller (2005), Seddon (2005) and Westwood and Silvester (2007) put forward a list of possible lean healthcare solutions:

1. Improve Productivity

Batalden & Splaine (2002) argue, that while hospital personnel may be working hard, this does not imply they are "working smart" or actually on "value adding activities". The majority of tasks that staff must accomplish are often "non value adding" activities. This is the result of the processes already built into the existing system. Hospital personnel have little choice but to follow existing procedures and processes as recommended. It is the existing systems that are at fault.

Lean implementation allows for greater efficiency in the use of scarce hospital resources, improves "patient service quality and satisfaction", whilst at the same time lower costs and capital equipment expenditures. Hence hospital personnel become more productive without working any harder-but merely by performing productive "value added work", as opposed to wasting their time on unproductive "non value added" tasks.

2. Improve Patient 'Turn-Around' Time

Any decrease in "Turn-around Time" will have a positive impact for patients progressing through hospitals. Likewise clinicians/ staff waiting for information and or (test) results would also benefit. The resultant is that the patient/

healthcare personnel receive the information needed quicker, which then allows the patient to receive the care they need a lot sooner.

Batalden & Splaine (2002) indicate additional benefits include a much reduced "risk of complications" arising, since information is readily available, whilst the "waiting time for treatment is lower". This then means, scarce resources such as a consulting room/ medical equipment is made available for another patient far sooner than previously.

3. <u>Minimise Hospital Running Costs</u>

It is argued that hospital 'operating costs' can be substantially lowered by the elimination of various inherent wastes that are present in any UK hospital today. Two areas of interest include:

1.1 <u>Stock Holdings</u>- most healthcare/ medical products carry a lot number and expiry dates. In a typical hospital, staff members are routinely busy. Hence, stock replenishment is often made on the basis of 'estimation'. However, this then leads to excessive stock that then expires prior to being used. There is a 'financial burden' here. Additionally, it is often the case that new replacement stock is often placed on top of existing stock in a container, resulting in the older stock not being used prior to their expiry dates, and thereafter being destroyed. In addition to the financial implication, there is the increased risk of using an expired product, as a result of overstocking.

Lean advocates a straightforward 'First In, First Out' (FIFO) mechanism that operates in conjunction with a 'Just In Time' system. This would allow hospitals to save thousands of pounds on stock holdings, find alternative uses for expensive buildings used currently for storage of excessive stock, no longer be necessary to hold 'off site' storage facilities, substantially cut the time and manpower necessary to manage the stock holdings, lower the risk of 'dispensing' an 'expired product', whilst reducing the scrap cost resulting from damage and replacement product costs.

1.2 <u>Standardisation</u>- whereby standardised practices and procedures will promote 'consistency in the process' ensuring that errors are not only reduced but are difficult to make in the first place. This then helps to lower hospital running costs. 'Rework' in the healthcare environment is not only expensive but at the same time it can lead to increased frustration levels amongst staff, which then decreases 'morale and productivity' amongst the workforce. Such an environment would only lead to further errors and increased levels of frustration amongst both patients and staff, and needs to be avoided as far as possible.

4. <u>Error Proofing-Improving Patient safety</u>

Miller (2005) points out the UK Department of Health in a 2000 report, estimated that "adverse events occur in approximately 10% of hospital admissions or about 850,000 adverse events a year". The 2000 report further indicated, in the UK "consequent additional hospital stays alone cost about £2,000 million, and paid litigation claims cost the NHS around £400 million

annually, in addition to an estimated potential liability of £2,400 million for existing and expected claims''.

It has to be noted that since healthcare errors may and can make the difference between possible life and death, it is vital to prevent them from occurring in the first place. Hence, when reshaping and standardising clinical and operating processes, it is vital to be aware of any possible step, where an error is likely to occur, and hence design an error proofing system to prevent it from occurring in the first place. Early detection of a problem will prevent it from impacting upon any subsequent steps in the hospital process.

5. <u>Improve Patient Wait Times</u>
Any prolonged delay in receiving treatment increases the risk of 'life threatening' complications. In addition the 'status' of the patient may alter by the time they receive the required treatment, hence different treatment may be more appropriate now/ or a task may need to be repeated. This will have a cumulative effect, causing subsequent patients to wait longer for treatment as well. By eliminating inherent wastes, there can be a substantial reduction in patient waiting times within a hospital setting.

6. <u>Quick Setup and Changeover</u>
Westwood and Silvester (2007) amongst others mention a ''standardised setup and changeover process'', which indicates clearly the person responsible for each task(s), what equipment and tools are necessary, where they are stored, in what sequence tasks should be carried out, how the tasks are to be carried out, and the procedure for notifying others when they are needed or when the task is accomplished, is vital for improving operational efficiency in a healthcare setting.
It is also suggested that the 'transfer or discharge of patients' is staggered during the day, as far as practically possible. This would help since hospital personnel can cope better with a steady 'flow of work' as opposed to often a large, unmanageable batch at a set time on certain mornings (after a Doctor's ward round). This would have a positive impact on subsequent patient waiting times.

6.4 <u>Specific Lean Implementation Measures:</u>
Commentators on healthcare including Aherne (2007), Jones and Mitchell (2006) and Westwood and Silvester (2006) recommend the following specific measures:

1. Within any hospital a ''lean facilitator'' needs to be appointed on a full-time basis in order to plan and put in place a package of ''education and training'' measures, in order to increase awareness of lean techniques, and how such techniques can be used effectively within a healthcare setting.
2. The next step involves selecting a small group of enthusiastic ''lean champions'', who can drive forward various lean techniques, with the 'full support' and respect of their fellow work colleagues.

3. The use of external Management Consultants is to be curtailed. The NHS is encouraged to instead invest heavily in the education and training of its own in-house staff. These in-house experts can then go on to implement the required changes in order to improve hospital processes and systems.
4. Genuine managerial commitment and dedicated support for staff members is vital for lean implementation to be successful
5. Staff members should be genuinely 'empowered' in order to make decisions about processes within the hospital, so that success can be achieved and sustained over the long term.
6. Hospital personnel should be given greater involvement and responsibility, along with a "sense of ownership" of various processes. This will foster greater commitment and loyalty within the workforce, improving staff morale.
7. There is an immediate need to educate, train and "empower" all staff at all levels within UK hospitals, with respect to the impact that a successful lean implementation exercise can offer.

6.5 General Hospital Improvement Measures

According to healthcare experts such as Batalden & Splaine (2002), Crump (2008), Jones & Mitchell (2006), and Westwood & Silvester (2006) the following are a limited set of recommendations for general hospital improvements:

1. Balance capacity and demand
Batalden & Splaine (2002) argue the root cause of delays, is often scheduling systems that did not account for variation in demand. It is essential to identify and plan for known changes in available capacity, for example, staff leave, training, and equipment maintenance. Plan capacity around the variation in demand and allow for excess capacity to meet variation in demand (match staffing to demand for care, this may mean reducing levels on some days to allow for increases on other days).

2. Focus on whole patient pathway
Diagnostics are often highlighted as a bottleneck in elective care. This is because the speed of clinical investigation and clinical decision making depends on diagnostic services. However, in turn, diagnostic services rely on the transportation of patients and samples they need to test. This means that the turnaround time for test results will depend on the porters or other transportation turnaround time.

3. Take into account and plan along every stage of a patient's pathway
Each step of every process is planned for and scheduled so that everyone involved is aware of what work is expected and when it will arrive (for example patients attending for day surgery). This reduces delays. Booking and scheduling in necessary tests and procedures in advance is suggested.

4. Non value added activities to be reduced

Jones & Mitchell (2006) mention five items that add little value, yet have a noticeable impact on delays as:
1. Patients attending hospital on different days for alternative tests
2. Time wasted looking for essential equipment or vital information
3. Repetition of work for example duplicating paperwork
4. Unwarranted appointments and 'follow ups' thereafter
5. Unwarranted 'diagnostic tests' and unnecessary repeat 'diagnostic tests'

5. <u>Vital to keep the 'flow' moving and treat patients in the order of arrival</u>
The main impact of doing things in turn is to reduce the difference in waiting times between patients. Therefore, it reduces maximum waits and improves patient experience. This will increase the chances that all patients are seen within 18 weeks.
Tovim et al (2007) indicate patients should be seen in order of arrival. This streaming would have an immediate impact and also decreases congestion by decreasing the overall time patients would spend in any department.

6. <u>Separate short term from long term care</u>
Crump (2008) mentions care processes should be separated out into those required by patients who would spend relatively short periods (up to 72 hours) in the hospital, and those required by longer staying patients. A short stay medical surgical ward of some 20 beds should be developed for the majority of patients admitted as an emergency.

7. <u>Community based schemes</u>
The proportion of the population aged over 65 is increasing, which increases overall demands for healthcare. Vissers et al (2005) indicate one response to this anticipated rise in demand has been the development of community-based schemes for delivering care that has traditionally been supplied in acute hospital beds, e.g., the use of community-based rehabilitation teams in order to provide daily non urgent care for stroke victims. The rationale behind such measurement is based on widely accepted research which indicates that ''at least 20% of acute bed use by the elderly in hospitals is avoidable'', which implies the required care could be provided in an alternative non-acute environment (McDonagh et al, 2000). Hence, these 'community-based schemes' lessen the demand for 'acute beds' in hospitals, whilst also facilitating more timely discharge of patients from hospital and back into the community.

6.6 <u>Conclusion</u>

Lean approach can be relatively easily applied, with minimal investment in training, very rapidly generating major improvement gains for adoptive hospitals. By focusing on determining what is of genuine value and hence the elimination of failure demand (additional demand for services created by a failure to perform the service correctly the first time), in conjunction with effective lean implementation, can assist hospitals in achieving significant improvements in operational cost and the quality of service they can deliver to their patients.

The 'quality of service' patients can receive can be enhanced by:
1. Promoting 'day surgery' as the norm in lieu of 'planned surgery'
2. Radically improve the admissions process, whilst co-ordinating discharge processes better
3. Ensuring a far quicker and more effective diagnosis process exists.

All UK hospitals have to tackle implementation in a coordinated way, to get more sustainable results. The key is to start with just one or two areas and transform their performance completely, in essence creating the building blocks to be replicated throughout the department/ hospital later. This approach focuses management's attention on the lean programme.

One of the challenges of transferring lean techniques into the UK hospital sector, is the lack of readily available reference examples (physical hospitals tours that outline key achievements obtained / written case study material), which would demonstrate to interested hospital managers/ clinicians, how applying lean manufacturing techniques and tools can work in a healthcare setting and the profound impact it can have. Current visible tangible benefits encourage future implementation elsewhere. It can be noted however, there is plenty of widely available research from other sectors, such as manufacturing, financial services and retail with success being associated with lean implementation (see Ruffa (2008)).

UK hospitals in general have to transform themselves into 'learning organisations', learning to adapt, accept change, and with the aid of lean implementation seek ways to improve their often outdated processes and procedures. The potential for improvement is vast and indeed limited only by available financial resources. 'Service quality' delivered to patients can be substantially improved. Early adopters in the UK such as Royal Bolton and Hereford Hospitals have demonstrated lean implementation can lead to dramatic improvements in the 'quality and efficiency' of services offered. Hospital management and the governing body that controls hospitals, have a duty to conduct a 'cost-benefit' analysis in order to determine whether lean techniques can positively impact upon the quality, cost, and efficiency of the services it provides to its patients.

In conclusion as the above analysis has shown and re-affirmed by Grunden (2009), improving quality within a hospital setting actually reduces costs, lean drives forward improvements in the healthcare sector, but without genuine commitment from senior management all efforts will grind to a halt. Overall, it is a 'people-first' philosophy, which ultimately underpins lean, and that lean tools are secondary in importance to human relationships within the healthcare environment. 'Real transformation' only begins once 'front line' workers are in a position to utilise and implement new found knowledge as a result of lean implementation and engage in a process of continuous improvement.
The concept of Lean thinking is still very much a novel idea to those in charge of running UK hospitals. However as some early adopters have shown, we must remain very optimistic and positive about the potential benefits of applying lean concepts into UK hospitals.

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