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# Applications of lean thinking: a briefing document

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# **Applications of Lean Thinking A Briefing Document**

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*February 2007*

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This report is the product of collaboration and contributions from all the members of the HACIRIC research team at the University of Salford.

February 2007

## EXECUTIVE SUMMARY

- This report has been put together by the Health and Care Infrastructure Research and Innovation Centre (HaCIRIC) at the University of Salford for the Department of Health. The need for the report grew out of two main simple questions,
  - Is Lean applicable in sectors other than manufacturing?
  - Can the service delivery sector learn from the success of lean in manufacturing and realise the benefits of its implementation?
- The aim of the report is to list together examples of lean thinking as it is evidenced in the public and private service sector. Following a review of various sources a catalogue of evidence is put together in an organised manner which demonstrates that Lean principles and techniques, when applied rigorously and throughout an entire organization/unit, they can have a positive impact on productivity, cost, quality, and timely delivery of services.
- The review and the examples listed are from various sources including books, Journal publications, Magazine articles, WWW Published articles, Departmental websites etc. It is not by any means an exhaustive review, however it provides a good indication of the applicability of Lean Service delivery including Healthcare.
- Appendix A illustrates the relevance of the evidence presented in the report across all five main areas / themes.
- The report assesses the examples in order of priority of applicability and relevance as follows:
  - ***Theme 1: Lean Applications in Healthcare;***
    - Includes examples of lean implementation in acute hospitals, medical offices and clinics. The examples demonstrate results including process improvement, cost reduction, increased flow of patients and reduction in waiting times. There is also a list of presentations and well structured guides on how to implement Lean and facilitate the adaptation of its philosophy in a Healthcare setting.
  - ***Theme 2: Reduction of Cost and Resource Utilisation;***
    - Demonstrates examples of diverse projects that have applied lean thinking and resulted in cost reductions, better resource and asset utilisation. The examples are mainly from the service delivery sector and within office orientated environments. Listed also in this section there are several approaches to implementation of Lean across sectors.
  - ***Theme 3: System redesign and Efficient reconfiguration;***
    - Includes examples on system adaptation, redesign and efficient reconfiguration of processes in the main, coming from the service delivery sector. They provide an insight of how important the alignment of everyday practice and Lean theory is.
  - ***Theme 4: Project Management Governance & Theme 5: Overall Visibility and System Mapping.***
    - These two sections include publications that demonstrate the importance of structured leadership and governance within projects when

implementing lean. It includes examples of strategic objectives flow-down and how lean can assist with system mapping and integration.

- Appendix A includes all themes and the examples demonstrate interdependence of lean applicability and results achieved. This makes explicit the fact that lean can be adapted in different settings and help organisations achieve a continuous improvement mentality and reach world class status.
- There are three main lessons that are evident in almost all of the examples presented in this report and form the cornerstones of the successful implementation of lean philosophy and its principles:
  - Lean is all about getting the right things, to the right place, at the right time, in the right quantity while minimizing waste and being flexible and open to change. More importantly, all of these concepts have to be understood, appreciated, and embraced by the actual employees who build the products and therefore own the processes. The cultural aspect of lean is just as important as the actual tools or methodologies.
  - Lean thinking begins with driving out waste so that all work adds value and serves the customer's needs. Identifying value-added and non-value-added steps in every process is the beginning of the journey toward lean operations
  - Lean principles can be — indeed, already are being — successfully applied to the delivery of services worldwide

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## 1. THEME 1: LEAN APPLICATIONS IN HEALTHCARE

### 1.1. Going Lean in Healthcare

*Institute for Healthcare Improvement, Innovation Series 2005, This paper is based on presentations made by the following experts during an IHI Calls to Action Series in January and February 2005: James P. Womack, PhD: Founder and President, Lean Enterprise Institute, Arthur P. Byrne, MBA: Operating Partner, JW Childs Associates LLC, Orest J. Fiume, MS: Co-author, "Real Numbers: Management Accounting in a Lean Organization" Gary S. Kaplan, MD, FACP, FACMPE: Chairman and CEO, Virginia Mason Medical Center, John Toussaint, MD: President and CEO, ThedaCare, Inc., Editor: Diane Miller, MBA: Director, IHI.*

Lean management principles have been used effectively in manufacturing companies for decades, particularly in Japan. The Institute for Healthcare Improvement believes that lean principles can be — indeed, already are being — successfully applied to the delivery of health care.

Lean thinking begins with driving out waste so that all work adds value and serves the customer's needs. Identifying value-added and non-value-added steps in every process is the beginning of the journey toward lean operations.

In order for lean principles to take root, leaders must first work to create an organizational culture that is receptive to lean thinking. The commitment to lean must start at the very top of the organization, and all staff should be involved in helping to redesign processes to improve flow and reduce waste.

Although health care differs in many ways from manufacturing, there are also surprising similarities:

Whether building a car or providing health care for patient, workers must rely on multiple, complex processes to accomplish their tasks and provide value to the customer or patient. Waste — of money, time, supplies, or good will — decreases value.

*For full report: Institute for Healthcare Improvement, 20 University Road, 7th Floor, Cambridge, MA 02138, Telephone (617) 301-4800, or visit our website at [www.ihp.org](http://www.ihp.org)*

### 1.2. A Lean Guide to Transforming Healthcare: How to Implement Lean Principles in Hospitals, Medical Offices, Clinics, and Other Healthcare Organizations.

*Zidel, Thomas G., ISBN 978-0-87389-701-3*

This book is an implementation manual for lean tools and principles in a healthcare environment. Lean is a growth strategy, a survival strategy, and an improvement strategy. The goal of lean is, first and foremost, to provide value to the patient/customer, and in so doing eliminate the delays, overcrowding, and frustration associated with the existing care delivery system. Lean creates a better working environment where what is supposed to happen does happen. On time, every time. It allows clinicians to spend more of their time caring for patients and improves the quality of care these patients receive. A lean organization values its employees and encourages their involvement in organizational initiatives which, in turn, sustains hospital-wide quality improvements. The opportunities for lean in healthcare are limitless.

It is an everyday guide; a companion to be referenced again and again as the organization moves forward with its lean transformation.

### **1.3. The lean enterprise academy**

The web site includes various sources and examples for Lean applicability in Healthcare

"Lean thinking is a way of streamlining the patient journey and making it safer, by helping staff to eliminate all kinds of waste and to treat more patients with existing resources. Originally developed by Toyota, it is now being successfully applied in hospitals across the world." *Dan Jones*

[http://www.leanuk.org/pages/lean\\_healthcare.htm](http://www.leanuk.org/pages/lean_healthcare.htm)

### **1.4. Best in Healthcare Getting Better with Lean.**

*Mayo Clinic Division of Cardiovascular Diseases improving patient-flow processes, George Taninecz, The Lean Enterprise institute. [www.lean.org](http://www.lean.org)*

Mayo Clinic Division of Cardiovascular Diseases improving patient-flow processes using 'lean'. "I'm not trying to change the moment of care, the touch moment between you and your patient. What I'm trying to change is the 95% of the time when the patient is not in your office and you're not seeing them or providing care to them. And that's the 95% where we have opportunity for improvement."(Dr. Ting). Following the initial lean work, cancellations and no-shows dropped from 30% to 10%. The number of high-yield patients rose from 150 per month to 200 per month. An appointment could be given 90% of the time on first contact.

Across the entire patient process, results were equally impressive:

- Process steps went from 16 to six.
- Clinical care time (face time with the doctor) rose from 240 minutes to 285 minutes.
- Wait time (from request for an appointment to finishing the pre-care consultation) fell from 33 days to three days, a reduction of 91%.
- First-time quality (not quality of care given, but the percentage of time that all material is available to anyone, allied staff or physician, to proceed with their role) rose from 5% to 65%.

*For more information about the lean work under way at the Mayo Clinic Division of Cardiovascular Diseases, please contact Dr. Henry Ting at [ting.henry@mayo.edu](mailto:ting.henry@mayo.edu)*

### **1.5. The Lean Healthcare Experience**

In this section you can find several success stories following lean implementation in several well-known healthcare institutions throughout North America, including critical care units, outpatient clinics and different laboratories. Lean works wherever there is a defined set of activities working to produce a product or service. Healthcare 'factories' such as diagnostic labs makes the introduction of Lean Healthcare more intuitive and the results initially more visible. The website demonstrates that once Lean becomes integrated in one area then it quickly spreads to other areas as well.

<http://www.leanadvisors.com/Lean/thinkers/casestudies.cfm>

### **1.6. NHS Lean Implementation handbook**

*NHS Lean Thinking Network, 2006*

[http://www.networks.nhs.uk/uploads/06/01/lean\\_implementation\\_handbook.doc](http://www.networks.nhs.uk/uploads/06/01/lean_implementation_handbook.doc)

### **1.7. Lean Six Sigma - Some basic concepts**

*Helen Bevan, Neil Westwood, Richard Crowe, Michael O'Connor, NHS Institute for Innovation and Improvement*

An effective combination of both approaches includes the value-maximising philosophy of Lean, underpinned by data-driven methods in decision making (from Six Sigma) focused on the customer (from Lean). All incentives and measures are reviewed (using Lean) to ensure global optimisation and minimisation of variation (from Six Sigma) would be a part of this.

The full benefits of Lean Six Sigma will only be realised when applied at both strategic and operational levels, with universal application only at the strategic level.

Application at the operational level results only in cost reduction, whereas application at the strategic level results in wider benefits for the organisation.

The NHS has found Lean Six Sigma is a promising improvement methodology that incorporates the best of Lean and the best of Six Sigma. It is very rare that two approaches to enhancing value, eliminating waste and reduce variation can be used in a complementary rather than in a competing way. See Figure 3.

A pragmatic approach is required; use Lean and Six Sigma where necessary, or use

Lean where Lean is necessary or Six Sigma where Six Sigma is necessary. Combining common sense (Lean) and common science (Six Sigma) offers the potential to achieve uncommon results.

*Web Link:*

[http://www.institute.nhs.uk/NR/rdonlyres/73BB5F94-469A-4440-B31E-90A57F921D48/0/NHS\\_LEANSIGMA.pdf](http://www.institute.nhs.uk/NR/rdonlyres/73BB5F94-469A-4440-B31E-90A57F921D48/0/NHS_LEANSIGMA.pdf)

### **1.8. Mayday Healthcare NHS Trust Example of lean thinking at Mayday Healthcare NHS Trust [2006] - Presentation**

[http://www.leanuk.org/articles/LHF1/LeanHealthcare\\_200601\\_Ben\\_Gowland.pdf](http://www.leanuk.org/articles/LHF1/LeanHealthcare_200601_Ben_Gowland.pdf)

### **1.9. Mapping the 18 week elective process at Bolton Example of lean thinking at Bolton NHS Trust [2006] - Presentation**

[http://www.leanuk.org/articles/LHF2/LHF2\\_david\\_fillingham.pdf](http://www.leanuk.org/articles/LHF2/LHF2_david_fillingham.pdf)

### **1.10. Lean-Six Sigma for Healthcare: A Senior Leader Guide to Improving Cost and Throughput**

*Chip Caldwell , Jim Brexler , Tom Gillem, ISBN 978-0-87389-647-4*

This book explains the powerful techniques of Lean-Six Sigma specifically for healthcare organizations, and focusing on the executive level. Successful Lean-Six Sigma deployment begins and ends with a focus on achieving strategic results. Lean-Six Sigma can aggressively improve throughput and quality while extracting significant costs within the organization. Lean Six Sigma will take leaders down a different path in the exploration and implementation of methods that drive quantum improvement, and this book will serve as the guide.

### **1.11. Going Lean - A Guide to Implementation**

*Peter Hines and David Taylor, March 2000*

This 52 page report was developed during the Lean Processing Programme - LEAP - (1997-2000), a research programme run by LERC and sponsored by the Engineering and Physical Science Research Council and a network of UK automotive/steel supply chain firms. The LEAP programme was designed to extend lean thinking into this particular group of firms and their associated customer base, seeking to make radical and incremental change both within and between firms as well as at the network level.

The report will help those individuals or companies understand the processes, framework and tools required to transform an organisation on lean lines

*Web Link:*

<http://www.cf.ac.uk/carbs/lom/lerc/centre/publications/downloads/goinglean.pdf>

### **1.12. Stop Rising Healthcare Costs Using Toyota Lean Production Methods: 38 Steps for Improvement**

*Robert Chalice, ISBN 978-0-87389-657-3*

This book is the only one currently available that presents a simple recipe of 38 lean steps for healthcare providers to reduce cost and improve quality. By taking these straightforward steps, healthcare providers can adopt the same lean methods which have enabled companies like Toyota to become so successful.

Focuses on how to understand and implement a 38-step recipe to reduce healthcare costs and improve quality at healthcare providers by using Toyota Lean Production methods; understand cost and quality issues facing healthcare in the U.S.; and implement a permanent organizational structure to continuously improve quality and cost within a healthcare organization.

### **1.13. 5S for Service Organizations and Offices: A Lean Look at Improvements**

*Sarkar, Debashis, ISBN 978-0-87389-677-1*

5S is a simple and immensely practical approach to quality improvement which, when implemented effectively, can transform the fabric of a company. Traditionally used in manufacturing companies for little more than housekeeping, its latent power has yet to be leveraged by service companies. The principles can also be applied to offices, education

institutes, and hospitals, as well manufacturing companies who wish to realize the full potential of 5S.

This hands-on book is based on the author's experience in catalyzing an enterprise-wide 5S implementation in India's largest private sector bank, spread across more than 700 locations not only in India but also in places such as Canada, Singapore, Dubai and London. This change initiative touched more than 15,000 people and had the involvement of employees across all levels of the organization. This book is based on all that he applied and learnt during this massive rollout.

5S can be converted to a management practice when implemented as a change initiative involving the organization at all levels, from the CEO to the process associate. Implementation requires an all-encompassing workplace system comprising structure, people, processes, practices, and infrastructure. Such a holistic implementation moves 5S away from being just another methodology and to an intervention that can change the hearts and minds of the employees, irrespective of the state of maturity of the organization in improvements.

#### **1.14. Design Rules, Metaroutines, and Boundary Objects – A Framework for Improving Healthcare Delivery Systems.**

*Manimay Ghosh, A dissertation submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Engineering MONTANA STATE UNIVERSITY , Bozeman, Montana , August 2006*

The healthcare industry in the United States has been fraught with medical errors, rising costs, and wastes for many years. Despite widespread adoption of Total Quality Management and Six Sigma programs, healthcare's woes continue unabated. The Toyota Production System (TPS), progenitor of lean manufacturing, is widely regarded as the most effective production system ever devised. It has been successfully adopted by manufacturing firms worldwide resulting in significant gains in efficiency and quality in companies of all sizes. The goal of this research is to determine whether principles from the Toyota Production System could be applied to a healthcare environment to improve its delivery systems.

Following an action research methodology, the work reported here describes how TPS principles were adapted and applied to generate sustainable improvements to hospital work processes. Using a combination of qualitative and quantitative research methods, the results of the intervention were scrutinized, resulting in several important contributions to the existing body of knowledge on TPS and organizational problem solving.

First, the design rules to construct work processes were found applicable to healthcare and were associated with better process outcome.

Second, the systematic problem solving methodology adapted from Toyota, a metaroutine, prompted individuals to jointly validate and create knowledge to improve work processes and adopt long-term, instead of a short-term, solutions.

Third, a problem-solving tool (also adapted from Toyota) provided a common language of solving problems in a cross-departmental setting and thus acted as an effective boundary object by members from different functional disciplines.

These three elements were tightly interwoven during the problem solving process, suggesting a framework for the design of any quality or process improvement program for helping organizations make efficient use of resources while improving quality of service. The

implications of this work are significant not only for hospitals, but for many other non-manufacturing sectors where improved work processes are desirable.

*Web Link:*

[http://www.montana.edu/etd/available/unrestricted/Ghosh\\_1206.pdf](http://www.montana.edu/etd/available/unrestricted/Ghosh_1206.pdf)

### **1.15. Bloated NHS to get the Tesco treatment**

*(Times, 15 June 2006)*

<http://www.timesonline.co.uk/article/0,,2-2226059,00.html>

### **1.16. A Toolkit for Redesign in Health Care**

*Patricia Gabow, Sheri Eisert, Amit Karkhanis, Andrew Knight, Paula Dickson, Prepared for: Agency for Healthcare Research and Quality, Rockville, Maryland 20850, [www.ahrq.gov](http://www.ahrq.gov), September 2005, AHRQ Publication No. 05-0108-EF*

In October 2003, Denver Health began a major effort to redesign/transform the process of care in the hospital in a comprehensive manner.

This document presents the following information:

A brief description of Denver Health gives context for the redesign process. It enables others to identify the attributes of their system that are similar to or different from those of Denver Health and to assess how these attributes may influence their application of the approach to redesign described below. Forces that compel health care systems to embark on redesign or system transformation.

In general, the steps to be taken in planning for redesign/system transformation are listed and discussed in the temporal sequence in which they occurred. Following these steps in this sequence will provide a robust approach for planning redesign.

Strategies for translating information gathered into proposed projects for implementation.

This is presented to show the depth and breadth of activities which can emerge from the planning process. Some of the proposed projects which emerged from Denver Health's planning process may be different from those that would emerge from another institution's planning, depending in part on the forces that affect the institution and the information arising from its external and internal data gathering. However, delineating the projects provides examples for consideration.

Potential metrics for use in the implementation phase. The metrics would vary to some extent, depending on the nature of the projects to be undertaken. However, the system metrics that suggested here should be useful capturing meaningful change at the system level.

The information detailed in this report provides an approach to redesign utilized by Denver Health. It is presented here with the intent to help others who wish to undertake the process of redesign or system transformation.

This document does not provide information on the actual implementation of the redesign process or data on outcomes of redesign.

### **1.17.Reducing waiting times in the NHS: is lack of capacity the problem?**

*Clinician in Management; Vol 12, (NHS Modernisation Agency) Silvester, K. 2004*

[http://www.wise.nhs.uk/NR/rdonlyres/5EF9230C-34D6-4094-A3BC-520A40B42823/1092/CIM12\\_3\\_Silvester.pdf](http://www.wise.nhs.uk/NR/rdonlyres/5EF9230C-34D6-4094-A3BC-520A40B42823/1092/CIM12_3_Silvester.pdf)

### **1.18.Using industrial processes to improve patient care**

*Young, T. et al. 2004, British Medical Journal. 17 Jan; Vol 328: 162-164*

<http://www.bmj.com/cgi/content/full/328/7432/162>

### **1.19.Can lean save healthcare?**

*Lean Enterprise Academy. 2006 Interview with Professor David Ben-Tovim on his experience applying lean to healthcare in Australia.*

[http://www.leanuk.org/articles/can\\_lean\\_save\\_healthcare.pdf](http://www.leanuk.org/articles/can_lean_save_healthcare.pdf)

### **1.20.Fixing Healthcare from the inside, today.**

*S Spear (2005), Harvard Business Review*

Today, you are about as safe in a U.S. hospital as you would be parachuting off a bridge or a building. But it doesn't have to be that way. Right now, some hospitals are making enormous short-term improvements, with no legislation or market reconfiguration and little or no capital investment. Instead of waiting for sweeping changes in market mechanisms, these institutions are taking an operations approach to patient care. In case after detailed case, this article describes how doctors, nurses, technicians, and managers are radically increasing the effectiveness of patient care and dramatically lowering its cost by applying the same capabilities in operations design and improvement that drive the famous Toyota Production System. They are removing ambiguity in the output, responsibilities, connections, and methods of their work processes.

These changes--which can be done in the course of an ordinary workday, sometimes in a matter of hours--are designed to make the following crystal clear: Which patient gets which procedure (output)? Who does which aspect of the job (responsibility)? Exactly which signals are used to indicate that the work should begin (connection)? And, precisely how is each step carried out (method)?

Equally important, managers are being transformed from rescuers who arrive with ready-made solutions into problem solvers who help colleagues learn the experimental method. Thus, these hospitals are breaking free of the work-around culture that routinely obscures the root causes of so many problems, creates so much waste, and leads to so many unnecessary deaths

*Web Link:*

<http://harvardbusinessonline.hbsp.harvard.edu/hbrsa/en/search/saSearchResults.jhtml?Ntt=Fixing+Healthcare+from+the+Inside&N=0&Ntk=hbrsa&Ntx=mode%2Bmatchallpartial&x=12&y=11>

### **1.21. Lean Leadership in Healthcare, White Paper**

*Richard Doss, Cameron Orr*

The key to understanding how to implement Lean healthcare successfully is to realize that Lean leadership is an integral part of the Lean Operating System, not an afterthought.

The principles of Lean leadership can be applied in Healthcare, where 'Lean methods' can be used to realize the benefits predicted by the academic models. The principles are then developed into practical behaviours that can be demonstrated, understood and replicated using rapid learning techniques, with particular focus on team leadership.

Lean leadership links theoretical solutions and application in practice. Instituting this link is the difference between superficial attempts at implementing Lean—where the tools and techniques are evident, but the behaviours haven't changed—and full transformational deployments where the entire organization embraces Lean from the bottom up and the top down.

The critical success factor for accelerating the adoption of Lean in healthcare organizations is leadership. The healthcare leader's key role in leading other stakeholders in the value stream is examined, and comparisons are made to leadership in various Lean operating systems.

Healthcare organizations have a growing number of opportunities to embark on the Lean journey, yet the claimed benefits often lack credibility. This leads to the danger that a "Lean" façade is bolted onto the existing operations to attempt to convince demanding insurance payers, regulatory agencies, patients, and doctors that they are forward-thinking organizations, and that their apparent skills in Lean will earn them another "tick in the box." This paper outlines the practical benefits of embracing Lean to fundamentally change the healthcare value stream, to improve the working systems of doctors and nurses, to provide compassionate care to their patients, and to deliver lasting tangible benefits to the community as a whole.

<http://www.rwd.com/docs/Lean%20Leadership%20White%20Paper.pdf>

[www.rwd.com](http://www.rwd.com)

### **1.22. Project Production Systems for Delivery of Lean Health Care Facilities and Services**

*Presentation by Iris D. Tommelein, Professor, Project Production Systems Laboratory / CITRIS, UC Berkeley, CITRIS in Europe June 20, 2006*

[http://www.citris-uc.org/files/2006-06-20-CITRIS\\_Europe/6.2-Tommelein.pdf](http://www.citris-uc.org/files/2006-06-20-CITRIS_Europe/6.2-Tommelein.pdf)

### **1.23. Making the NHS into a lean machine**

*(BBC News, 14 June 2006)*

<http://news.bbc.co.uk/1/hi/health/5076126.stm>

### **1.24. NHS should embrace lean times**

*(Society Guardian, 8 June 2006)*

<http://society.guardian.co.uk/health/story/0,,1792365,00.html>



**1.25. Flying the flag.**

*Taylor, J. 2006, Health Service Journal; 6 Apr Suppl. Vol 116 (6000):12-13.*

<http://www.dh.gov.uk/assetRoot/04/13/38/97/04133897.pdf>

**1.26. Wait watchers.**

*Mathieson, S. 2006 Health Service Journal; 16 Mar Suppl. Vol 116 (5997): 4-5,7,9.*

[http://www.institute.nhs.uk/NR/rdonlyres/137223B8-31C1-49AF-BFD9-ABC526021A61/0/HSJintell\\_supp160306.pdf](http://www.institute.nhs.uk/NR/rdonlyres/137223B8-31C1-49AF-BFD9-ABC526021A61/0/HSJintell_supp160306.pdf)

**1.27. Think yourself thin**

*Jones, D.T., Filochowski, J. 2006.. Health Service Journal; 6 Apr Suppl. 116 (6000): 6-7.*

<http://www.dh.gov.uk/assetRoot/04/13/38/97/04133897.pdf>

**1.28. NHS Institute for Innovation and Improvement [2006]**

<http://www.institute.nhs.uk/ServiceTransformation/Lean+Thinking.htm>

**1.29. NHS Lean thinking network (NHS Institute) [2006]**

<http://www.networks.nhs.uk/networks.php?pid=211>

**1.30. 1st lean healthcare forum (Lean Enterprise Academy) [January 2006]**

[http://www.leanuk.org/pages/lean\\_healthcare\\_200601.htm](http://www.leanuk.org/pages/lean_healthcare_200601.htm)

**1.31. 2nd lean healthcare forum (Lean Enterprise Academy) [June 2006]**

[http://www.leanuk.org/pages/lean\\_healthcare\\_200606.htm](http://www.leanuk.org/pages/lean_healthcare_200606.htm)

**1.32. 3rd lean healthcare forum (Lean Enterprise academy) [October 2006]**

[http://www.leanuk.org/pages/lean\\_healthcare\\_200610.htm](http://www.leanuk.org/pages/lean_healthcare_200610.htm)

## **2. THEME 2: REDUCTION OF COST AND RESOURCE UTILISATION;**

### **2.1. Office Kaizen: Transforming Office Operations into a Strategic Competitive Advantage**

*Lareau, William, ISBN 978-0-87389-556-9*

Many business functions have been significantly improved through the use of a variety of quality techniques, but for the most part office and administrative functions have not kept pace. Most companies find it difficult to reduce costs in the office without noticeable sacrifices in performance. Some progressive companies are seeing improvements in their office environments through the use of Office Kaizen™, which emphasizes making continuous improvements over the long haul. Office Kaizen: Transforming Office Operations Into a Strategic Competitive Advantage presents a unified, consistent approach that enables businesses to establish a strategic competitive advantage by significantly improving the efficiency, quality and productivity of their office and administrative processes.

### **2.2. Service Operations Management - Improving Service Delivery**

*Graham Clark, Robert Johnston, ISBN: 0273683675*

This book provides a comprehensive and balanced introduction to service operations management. Building on the basic principles of operations management, the authors examine the operations decisions that managers face in controlling their resources and delivering services to their customers.

Combining a practical approach with a detailed theoretical underpinning, this book provides tools, frameworks and techniques for operational analysis and improvement and sets operations management within the wider business context, bringing a valuable perspective to this growing area. Each chapter includes definitions of key terms, real-world examples and case studies with exercises, questions to test your understanding and recommended further reading to deepen your knowledge.

### **2.3. The Machine That Changed the World.**

*James P. Womack, Daniel T. Jones, and Daniel Roos (Macmillan, 1990).*

This landmark study of the automobile industry, it explains lean production to the world for the first time, and discuss its profound implications for society. It is based on the largest and most thorough study ever undertaken in any industry: the MIT five-million-dollar, five-year, fourteen-country International Motor Vehicle Program's study of the worldwide auto industry.

Written at an historic time in the evolution from mass to lean production, the book's insights, the thoroughness of its research, its global scope, and its lessons for managers, labour leaders, and government officials make it a landmark that is still valuable.

#### **2.4. Good management – Lean Machine**

*David Murphy and Ann Esain in Health Service Journal (Nov 2006)*

At the heart of this project were two workshops, an information booklet and templates for participants, all built on a policy deployment approach known as *hoshin kanri*, a Japanese term for strategic direction-setting.

The four best practice themes are as follows:

- Collate and manage the policy portfolio – prioritisation and forward planning; named policy leads and review dates; developing cross-sector communities around key policy areas.
- Redesign policy processes: using four field maps; planning effective policy deployment; agreeing organisational development and improvement plans.
- Improving quality and efficiency: eliminating eight types of policy waste (lean thinking); addressing quality for policy users.
- A culture of policy leadership: leaders as role models; developing lean thinking in the policy team.

A pilot involved the mental health policy team of the Welsh Assembly government. It was supported to use lean thinking to map a core policy process and make improvement plans. The team examined the policy-making process rather than the content, resulting in a number of redesign projects on new policies.

The belief is that policy leaders who adopt a lean management approach will be able to make substantial capacity gains while addressing quality improvement, benefiting healthcare and, ultimately, patients.

*Web Link:*

<http://www.hsj.co.uk/healthservicejournal/Print.do?announcementDate=&pageId=7575>

#### **2.5. Evaluation of the lean approach to business management and its use in the public sector.**

*Office of Chief Researcher, Scottish Executive Social Research, Radnor Z., Walley, P., Stephens A., Bucci, G., (2006).*

This research aimed to evaluate the application of Lean in the public sector to consider if it is an appropriate means to embed a culture of continuous improvement. The research consisted of a literature review; case studies of eight public sector organisations, predominantly based in Scotland; a survey of Scottish-based public sector organisations who believed they were implementing aspects of 'Lean'; and an evaluation of the implementation and impact of a Lean methodology in three pilot sites.

The research found a key difference between Lean in the public service sector and that used in manufacturing. In manufacturing, the emphasis is on a set of management tools and techniques that are used to standardise processes. Within the public sector, however, there is engagement with the principles of Lean, but less with the full range of tools and techniques. Most organisations, for example, used just a few tools, such as value stream mapping.

Two models of Lean implementation are used in the public sector, and can be described as Full Implementation of the philosophy and the use of Rapid Improvement Events. Examples of Full Implementation, which is considered to be embedding of Lean principles and broad

use of different Lean tools including the use of Rapid Improvement Events, are more difficult to identify in the public sector. This approach aligns improvement to strategy taking a whole systems perspective.

Most case study sites use a Kaizen approach, often described as a 'Kaizen Blitz' or 'Rapid Improvement Event (RIE)'. The RIE approach uses rapid improvement workshops to make small, quickly introduced changes. Rapid Improvement has three phases. It begins with a 2-3 week preparation period, followed by a 5-day event to identify changes required and a 3-4 week follow up period after each event when changes are implemented.

The research found two types of outcomes from lean: tangible and intangible, the former referring to measurable outcomes, and the latter referring to more qualitative outcomes.

There was a wide range of tangible outcomes reported, including:

- Improving customer waiting times to first appointment in the health sector from an average 23 to 12 days;
- Improving service performance in failure demand from 82% to 15% in four weeks;
- Improving processing times by two thirds in one local government department;
- Achieving more work in less staff time;
- Bringing services up to a standard;
- Improvement of customer flow time for patients of 48%;
- Reduction in staffing and costs of 105 person reduction in manpower and £31m ;
- Budget saving in 10 months.
- There was also a range of intangible outcomes delivering benefits to the customer, the organisation and the staff which can be summarised as:
  - Process change to speed up the process;
  - Culture change to focus on customer requirements and encourage joined-up Working;
  - Greater focus on prevention rather than correction of errors;
  - Support for the development of a culture of continuous improvement;
  - Greater understanding of the whole system and how it fits together;
  - Better understanding of the needs of the customer;
  - Improved performance measurement and use of data to manage performance;
  - Greater staff satisfaction and confidence in themselves and the organisation.

In summary, the research found that Lean can drive efficiency improvements but cannot necessarily be used for the primary purpose of making cash savings in particular through reductions in staff numbers.

Analysis from the research with organisations in the Scottish public sector, together with evidence from the literature, indicates that Lean is transferable to the public sector and can be used to develop more seamless processes, improve flow, reduce waste and develop an understanding of customer value. Lean is most suited to organisations with high volume, repeatable tasks that allow greater standardisation and integration, supported by a less hierarchical management structure that allows empowerment and engagement of the workforce. However, to ensure greater successes, organisations require an awareness or realisation of the need for improvement; the capacity within the organisation to deal with

change; and an organisational culture which is receptive to understanding the customer and process analysis and is able to use relevant data to drive improvement.

For longer-term impact and sustainability, implementation of lean should be tied to more strategic objectives. By tackling the barriers and ensuring the provision of the factors contributing to success, this research finds that Lean is a suitable methodology for improving performance and embedding a continuous improvement culture in the public sector.

*The full report can be obtained from the:*

*Office of Chief Researcher, 4th Floor West Rear, St Andrew's House, Edinburgh EH1 3DG*

## **2.6. The new improvement frontier - Developing lean administration**

*Journal of STRATEGIC DIRECTION, VOL. 21 NO. 11 2005, pp. 33-35, DOI 10.1108/02580540510630731, Emerald Group Publishing Limited, ISSN 0258-0543*

Lean concepts offer a way to streamline and eliminate waste from office and administrative processes and achieve significant business performance and economic gains.

For many manufacturers, attempts to introduce and sustain quality programmes within office environments have often proven extremely difficult, and have typically failed to achieve their intended outcomes. Yet, the need for administrative improvement is vital. Consider that office functions, from design and development to marketing, quoting, order entry, scheduling, purchasing and accounting, can represent 60 to 80 percent of the lead-time, and effort related with delivering a product and meeting the customer's demands. If these are not performing effectively, then company performance will suffer significantly, regardless of the design, innovation and quality of the physical product.

## **2.7. Freedom from Command and Control: Rethinking Management for Lean Service.**

*John Seddon, ISBN: 978-1-56327-327-8, Productivity Press, 2005 Pages: 238*

John Seddon applies the Toyota Production System (TPS) to service organizations. It explains how the traditional command-and-control management paradigm of top-down decision making has created high costs and poor service quality.

Managers are left detached from their employees and remote from their operations. Seddon demonstrates that a change in management thinking, one from decision making based on activity-related measures (such as budgets, standards, and targets) to purpose-related measures (such as putting customers first and improving services) can help managers reconnect with their operations, see the waste caused by the current organization design, and exploit opportunities for improvement.

This book states that the service industry is fundamentally different from manufacturing and shows how TPS principles must be transformed for application in service organizations. Through extensive case material, it explains the difference between command and control and systems thinking and illustrates how the latter leads to improved service, better revenues, lower costs, and higher staff morale.

<http://www.lean-service.com/home.asp>

## **2.8. The Lean Service Machine**

*Cynthia Swank, Harvard Business Review, October 2003, pp. 123-129*

There have only been a few articles written on how Lean principles can be applied to service organizations, so this article is a welcome addition. The article explores how Jefferson Pilot Financial, a full-service life insurance and annuities company, utilized ideas from Lean manufacturing to streamline their operations.

Jefferson Pilot Financial felt that "Like an automobile on the assembly line, an insurance policy goes through a series of processes, from initial application to underwriting, or risk assessment, to policy issuance." Therefore, they felt the Lean approach would be appropriate for their situation. Jefferson Pilot Financial started with a Model Cell, which would process policies that came through a specific group of Jefferson Pilot Financial's independent advisers. Seven different design principles of Lean manufacturing were applied simultaneously to the cell's work:

Placing linked processes near one another—Under Jefferson Pilot Financial's old system, work groups were located by function and worked on different floors. Applying this Lean principle, people from different functions were co-located into the cell.

Standardizing procedures—File systems which had been organized according to the idiosyncratic approaches of individuals were converted to a new standardized system. The physical work space for data entry was also standardized.

Eliminating loop-backs—Procedures were developed so that employees did not have to process the same item twice.

Setting a common tempo—the "takt" time was calculated for completing processing of an application. Then employees were encouraged to innovate to reduce the time needed.

Balancing loads—a previously unbalanced system was replaced by a system that guaranteed that every team received the same number of applications to process.

Segregating complexity—by separating out the applications that needed extra processing time, the simpler applications were processed faster than before.

Posting performance results—Jefferson Pilot Financial prominently displayed the cell's hourly productivity rate along with the company's expectations. An area next to the display boards was set aside so employees could quickly discuss ways to solve performance problems that arose.

After significant success for the model cell, the best practices were documented and rolled out to other work cells. In spite of some initial skepticism, the performance improvements persuaded managers and employees to embrace the Lean approach.

## **2.9. Successful implementation of Six Sigma: benchmarking General Electric Company**

*Kim M. Henderson, James R. Evans, Benchmarking: An International Journal, Volume 7 Number 4 2000 pp. 260-282*

The Six Sigma phenomenon has followed the TQM movement as the thrust for many companies seeking to improve their performance and effectiveness. The purpose of this paper is to review the basic concepts of Six Sigma, its benefits, and successful approaches for implementation. In particular, it benchmarks the practices of the General Electric Company, one of the leaders and innovators in implementing the process. Conclude that

keys for successful implementation include upper management support and involvement, organizational infrastructure, training, tools, and links to human resources-based actions.

*Web links:*

<http://www.emeraldinsight.com/Insight/ViewContentServlet?Filename=Published/EmeraldFullTextArticle/Articles/1310070403.html>

GE's own customer service page

[http://www.electricinsurance.com/about\\_02/customerservice.asp?VCF=A](http://www.electricinsurance.com/about_02/customerservice.asp?VCF=A)

GE, 6 Sigma and Red Robin Restaurants

[http://www.ge.com/stories/en/20408.html?category=Finance\\_Business](http://www.ge.com/stories/en/20408.html?category=Finance_Business)

## **2.10. Bringing Lean to the office**

*Len Tischler, Quality Progress, July 2006, pp 32- 38, www.asq.org*

This article demonstrates how a team of college students used lean to streamline processes in their university's admissions office. The students were able to reduce a process that took two to three weeks to about one day.

Lean is a better way to begin improvement than are traditional quality approaches: There are fewer initial tools to learn, the whole process can be done very quickly, and the results can be more powerful than any single traditional quality improvement effort.

*Web Link:*

<http://www.qualitypress.asq.org/pub/qualityprogress/past/0706/qp0706tischler.pdf>

## **2.11. The Lean, Green Service Machine**

*Narayan Nallicheri, T. Curt Bailey, and J. Scott Cade, Resilience report 11/08/2004*

*Strategy and Business magazine by Booz Allen Hamilton.*

Organizations that apply manufacturing principles in service environments can achieve profound improvements in operational cost structure, service levels, and end-product quality, while also enhancing product time to market and increasing revenue. The potential value of a leaner service model is best demonstrated by the similarity of the challenges faced by service organizations today and those already addressed by many manufacturers. Among these challenges is the need to:

- Improve operations and reduce costs by engineering business processes for speed and quality.
- Separate common from unique product characteristics to extract the most value from commoditized processes and to maximize the gains from variety.
- Adopt tailored business streams to segment simple and complex offerings and to industrialize the routine while saving more flexible processes for products targeted at the few customers who demand them (and will pay for them)
- Push decision making and responsibility to frontline managers who interact directly with customers

*Web Link:*

<http://www.strategy-business.com/resilience/rr00013?pg=all>

### **2.12. Service with a Smile**

*Lean Solutions beyond the Factory Floor , In Industrial Engineer, August 2006, pp 40-44*

*Web Link:*

<http://www.lean.org/Community/Registered/ArticleDocuments/Published%20BHE%20Article%20on%20Lean%20Servicing%20IIE%20Mag%20August%202006.pdf>

### **2.13. Lean Service Organisations: The Toyota Business Model**

Presents a typical approach to improve a Service or Public sector organisation through lean.

<http://www.prweb.com/releases/2006/6/prweb396795.htm>

### **2.14. Pull Thinking®: Harness the Power of Pull to Fuel Growth and Ignite Performance by Aligning People, Culture, and Purpose**

*Kenneth E. Meyer, ISBN 9-726-4030-4*

A step-by-step, easy-to-share approach that details how you can quickly optimize human performance and open the way to greater profitability. More than a good read, this book delivers hard-and-fast tools you can immediately put to work, with plenty of case studies, supportive learning examples and practical, real-world guidance for team leaders.

### **2.15. Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain**

*J. Ben Naylor, Mohamed M Naim, Danny Berry, International Journal of Production Economics, Vol 62, 107 -118, 1999 Elsevier Science B.V., 1999.*

As the lean thinking and agile manufacturing paradigms have been developed there has been a tendency to view them in a progression and in isolation. This article shows that this is too simplistic a view. The use of either paradigm has to be combined with a total supply chain strategy particularly considering market knowledge and positioning of the decoupling point as agile manufacturing is best suited to satisfying a fluctuating demand and lean manufacturing requires a level schedule. This view is supported by consideration of a PC supply chain case study.

*Web Link:*

<http://www.eng.uc.edu/icams/resources/scm/Leagility-%20Integrating%20the%20lean%20and%20agile%20manufacturing%20paradigms%20in%20the%20total%20supply%20chain.pdf>

### **2.16. Six Sigma for Financial Services: How Leading Companies Are Driving Results Using Lean, Six Sigma and Process Management**

*Rowland Hayler and Michael Nichols, ISBN 0-07-147037-9*

The book focuses on applying Six Sigma to mission-critical financial operations and concentrates on process improvement. "Six Sigma" for financial services delivers the framework and tools needed to conduct operations at the highest level of performance and precision.



It demonstrates a step-by-step approach for improving process maturity and effectiveness- and realizing value for money for all stakeholders involved.

### **2.17. Lean thinking: banish waste and create wealth in your corporation**

*Womack, James P., Jones Daniel T., ISBN: 0684810352*

Lean Thinking is a generalization of the basic concepts so they can be applied to any company in any industry.

In the first part the authors begin by summarizing the five inherent principles in any lean system:

1. Correctly specify value so you are providing what the customer actually wants,
2. Identify the value stream for each product family and remove the wasted steps that don't create value but do create muda (waste),
3. Make the remaining value-creating flow continuously to drastically shorten throughput times,
4. Allow customer to pull value from your rapid-response value streams as needed (rather than pushing products toward the customer on the basis of forecasts),
5. Never relax until you reach perfection, which is the delivery of pure value instantaneously with zero muda.

In the second part, the authors describe in detail how managers in a wide range of companies and industries - small, medium and large, North American, European and Japanese - transformed their business by applying the principles of lean thinking. Chapters are devoted to Pratt and Whitney, Wiremold, Lantech in North America, Porsche in Germany, and Showa Manufacturing in Japan.

### **2.18. Lean Solutions - How Companies and Customers Can Create Value and Wealth Together**

*Daniel T. Jones, James P. Womack, ISBN: 0743275950*

The book addresses the massive disconnect that exists today between consumers and providers. As consumers, we have a greater selection of higher quality goods and services to choose from, yet our experience of obtaining and using these items is more frustrating than ever. At the same time, companies find themselves with declining customer loyalty, greater challenges in fulfilling orders, and a general sense of dissatisfaction in connecting with their customers. In this book, lean production experts Womack and Jones show consumers and companies alike how they can align their goals to achieve greater value with less waste.

### **2.19. Lean Consumption**

*J.P. Womack and D T. Jones, Harvard Business Review, pp58- 68, March 2005*

Lean production transformed manufacturing. Now it's time to apply lean thinking to the processes of consumption. By minimizing customers' time and effort and delivering exactly what they want when and where they want it, companies can reap huge benefits. The authors of this book believe that consumers will be quick to learn their role in lean consumption. Most of us would surely embrace the opportunity to solve our consumption

problems completely, getting just what we want, when we want it, where we want it, at an attractive price from a small number of stable providers, with no waste of our time, and with no unpaid work.

The real challenge lies with the retailers, service providers, manufacturers, and suppliers that are not used to looking at total cost from the standpoint of the consumer and are even less accustomed to working with customers to optimize the process of consuming. Lean production has clearly triumphed over similar obstacles in recent years to become the dominant global model. Can lean consumption, its logical companion, be far behind?

### **3. THEME 3: SYSTEM REDESIGN AND EFFICIENT RECONFIGURATION;**

#### **3.1. Discovering the Lean Supply Chain: Transforming Supply Chain Operations into a Lean Differentiator**

*Mario Deluzio - Superfactory*

Organizations today often face their greatest struggles when converting factual demand signals into pull-based schedules for those customers actively contributing to the growth and success of the business. An effective Lean supply chain strategy must provide the disciplines, methods and tools necessary to segment the customer against growth and value-contributing factors, link trading partners through collaborative planning & forecasting regimens, match supply and demand for the most appropriate use of enterprise-wide capacity and drive the selection & integration of strategic suppliers that offer the skills necessary to augment the entire supply chain for the benefit of the ultimate customer.

[http://www.superfactory.com/articles/Deluzio\\_lean\\_supply\\_chain.htm](http://www.superfactory.com/articles/Deluzio_lean_supply_chain.htm)

#### **3.2. Value Stream Management: Eight Steps to Planning, Mapping, and Sustaining Lean Improvements**

*Don Tapping, Tom Luyster, and Tom Shuker, ISBN 1563272458*

The Value Stream Management System simplifies the planning process for lean implementation, ensuring quick deployment and greater success. It links the metrics and reporting required by management with the lean tools needed on the manufacturing floor. The central feature of this illustrative and engaging book is the value stream management storyboard, a tool representing an eight-step process for lean implementation. The storyboard brings together people, tools, metrics, and reporting into one visual document.

Tapping, Luyster, and Shuker stress the importance of reaching beyond single-point kaizens to ensure a sustainable lean implementation process. Many people use the value stream map as an individual tool, but not within the context of a proven overall system. Value Stream Management: Eight Steps to Planning, Mapping, and Sustaining Lean Improvements shows you how to use mapping as part of a complete system for lean implementation.

The final outcome of Value Stream Management is the creation of a complete, visual plan for lean transformation - and the mastery of the skills required to implement that plan. Instead of just using Toyota Production System Tools, the authors encourage you to create your own lean production system.

### **3.3. Application of lean production and agile manufacturing concepts in a telecommunications environment.**

*Michael Robertson, Carole Jones (1999), International Journal of Agile Management Systems 1/1 [1999]*

Agile manufacturing, a strategy developed from lean production methods, is aimed at providing companies with the capabilities to succeed in the twenty-first century, serving ever more sophisticated customer demand. In this paper, the application of this strategy, originally developed for manufacturing industry, is described in a telecommunications context. Examples of ways in which it is being used in BT are presented.

Recent changes in the organisation of the customer services part of BT apply some of the principles of lean and agile manufacturing. Responsibility for the entire telephony and provision service for residential and small business customers, from call centre reception of orders/faults through to the field engineering workforce are now in a new customer services division. This allows a focus on optimisation of the whole process, not sub-optimisation of individual functions such as sales or operations. Process thinking leads to the breakdown of departmental barriers and allows process measures to be reviewed from a customer perspective.

### **3.4. Application of Lean Management Principles to Election Systems**

*Tomer Posner (2006), Submitted to the Department of Mechanical Engineering in Partial Fulfilment of the requirements for the Degree of Master of Science in Mechanical Engineering at the, Massachusetts Institute of Technology - February 2006*

Applications of lean can be found in the phases of technology development, production, deployment, poll management and more. By following a structured approach based on Lean, the efforts to advance voting solutions in the US can gain in efficiency, security, privacy and credibility over their current state. These are adapted to deal with the voting environment, which imposes a unique set of challenges and follows priorities different from normal corporations. Additional Lean elements, such as eliminating irregularities through standardization, improved training and process transparency are reviewed.

The development and deployment of Brazilian voting system is presented as an example of how Lean elements can be used in the voting setting. While not intentionally created by the Lean model, the design, deployment and current use of the Brazilian system is highly complimentary to this model.

The transition from paper to electronic voting in Brazil is used as an example of a well structured process of creating an effective and sustainable voting solution. The report focuses not only on the voting machine itself, but on the process as a whole – from the legislative validation of the transition, to the development phase and finally to deployment and use.

### **3.5. Exploration of internal service systems using lean principles**

*John Maleyeff, Rensselaer Polytechnic Institute, Hartford, Connecticut, USAManagement Decision, Vol. 44 No. 5, 2006, pp. 674-689, Emerald Group Publishing Limited 0025-1747, DOI 10.1108/00251740610668914*

**Purpose** – The purpose of this paper is to attempt to provide insight into the management of an internal service system derived from a perspective of Lean management. These internal service systems would exist within professional service units of development, engineering, information technology, human resources, and consumer affairs.

**Design/methodology/approach** – A meta-analysis of approximately 60 internal service systems was performed. The objectives of the meta-analysis were: identification of structural similarities; categorization of wasteful activities; tabulation of typical problems; and synthesis and exploration.

**Findings** – Internal service systems have numerous common structural characteristics, including the importance of information, process flows across functions, many hand-offs of information, hidden costs and benefits, and no explicit motivation for urgency. The wasteful activities can be classified into seven groups: delays, reviews, mistakes, duplication, movement, processing inefficiencies, and resource inefficiencies. The most common problems included a lack of standard procedures, long service times, communication breakdowns, and poor personnel management.

**Research limitations/implications** – Critical insights valuable to a manager of an internal service system are: it is likely that the main service provided is information; it is likely that cross-functional coordination is required; and it is likely that people play a critical role in the system's performance. These insights can form the basis of cross-function cooperative improvement efforts.

### **3.6. Developing, implementing and transferring lean quality initiatives from the aerospace industry to all industries.**

*Dennis F.X. Mathaisel and Clare L. Comm, Managing Service Quality, Volume 10. Number 4, 2000, pp. 248±256, MCB University Press. ISSN 0960-4529*

Japanese companies, particularly Toyota, first began building quality into their products and becoming lean. Consequently, researchers associated with the international motor vehicle industry initially identified the 'lean' manufacturing paradigm in the US automobile industry. Building upon their successes, the US aerospace industry initiated a study to ascertain whether a similar initiative focused on launch vehicles and spacecraft would bring value to military and commercial aerospace stakeholders in their ongoing efforts to be lean. This paper presents the findings of this investigation. It explores the relevance and value of the lean concepts to the US defence launch vehicle, spacecraft, and space operations industries, and it ascertains if there is interest within space industry firms in establishing a lean initiative similar to that of the automotive industry. Further, the relevance of lean manufacturing to other industries is considered.

### **3.7. Creating and Implementing Lean Strategies**

*Philip Atkinson, Management Services, Productivity, February 2004*

In this article Philip Atkinson focuses on how organisations can prepare for, create, and develop a 'Lean' strategy that fits their operations and deals with the key issues that strengthen the business and eliminates those that put their business at risk.

He describes this process as a "relentless commitment to do more with less, speeding up service delivery and using resources to best effect."

*Web Link:* <http://www.philipatkinsonconsulting.com/pdf15.pdf>

### **3.8. Applications of Business Process Simulation and Lean Techniques in British Telecommunications PLC**

*Simon Dennis, Ben King, Martin Hind, Stewart Robinson, Proceedings of the 2000 Winter Simulation Conference, J. A. Joines, R. R. Barton, K. Kang, and P. A. Fishwick.*

Business processes are increasingly key to the success of companies in the service industry. It is important that these processes are designed and maintained to deliver the most cost effective and efficient results. Simulation is being used in conjunction with other techniques to improve the performance of BT's processes, to evaluate new ideas and to plan operational resource requirements. The examples in this paper discuss firstly, the use of Value Stream Analysis (VSA) to identify inefficiencies in business processes and how simulation is used to evaluate improvement plans/ develop future business scenarios derived from this, and secondly how simulation is used to match available resources to workloads.

### **3.9. Using Simulation to Optimise and Understand Lean Service Delivery**

*Kumar Venkat and Wayne W. Wakeland , Proceedings of the 2006 Spring Simulation MultiConference*

This paper describes the application of discrete event simulation to understand and optimize a lean service process. Simulation is being used increasingly in the design and improvement of lean manufacturing systems. The case study of a lean auto repair facility demonstrates the significant role that simulation can play in the design of a cost effective system. This lean service system eliminates queues by carefully scheduling appointments. A consequence of this type of system is that customers may sometimes need to wait for a considerable time outside the system before the start of their appointments. The simulations show that the "time to appointment" can be optimized in conjunction with other metrics such as utilization of repair technicians and work in process. Simulation can clarify the exact nature of the trade-off between customer satisfactions and cost-effective delivery of service. They also show that perturbations introduced by customers arriving late to their appointments can be absorbed with minimal impact provided there is some slack in the system. This finding may help to ameliorate one of the primary concerns regarding the lean service model.

*Web Link:*

<http://www.arenasimulation.com/pdf/LeanSimulation.pdf>

### **3.10. The way Fujitsu used 'lean' to improve service delivery**

The article talks about some interesting way of translating manufacturing improvements to services.

Fujitsu sees Lean thinking as a distinct step in the company's evolution towards ever-better service, and as a practical commitment to the betterment of the many value chains in which it operates. We're therefore implementing the Lean philosophy within a comprehensive approach known as 'Sense and Respond', to make sure that Lean thinking becomes engrained in every aspect of an organisation's activities.

"Lean" is an attitude that anyone can buy into, and everyone can apply. Lean techniques don't call for complex technological support or mind-bending "employee reorientation". Embedding Lean thinking within an organisation is certainly no quick fix and requires a holistic approach to transformation. But it's a journey well worth taking. Going Lean means

getting back to the reason we're here in the first place – to help people achieve great things, every day.

<http://www.fujitsu.com/uk/news/insights/S4B/21-leanthinking.html>

### **3.11. Production-Line Approach to Service**

*Levitt, T, Harvard Business Review, Vol. 50, No5, pp20-31*

All industries are, effectively, service industries. Some industries merely have greater service components than others. Many so-called service industries such as fast food, mutual funds, and credit cards have applied manufacturing solutions to people-intensive service problems. To gain benefits, managers should consider the problems and desired output; how to redesign the process and install new tools that automate the job; and how to control people's behaviour and channel their choices. The primary objective is to serve the customer's needs efficiently and effectively, and to make customer service an integral part of what the customer buys.

### **3.12. Service Management: An Evaluation and the Future**

*Evert Gummesson, International Journal of Service, Industry Management, Vol. 5 No. 1, 1994, pp. 77-96. MCB University Press, 0956-4233*

This article presents general management paradigm shifts and their connection to services addressing specific service management issues for the future. It differentiates between a societal macroperspective on services supplements the management microperspective

The document provides a good theoretical background on the following two main topics:

Management Paradigms and Paradigm Shifts

In approaching the service management of the future the article concentrates in a series of management paradigms. Paradigms consist of values and procedures that control our thinking and behaviour. In organisations they represent an organisational culture; in academe they constitute the foundation of scientific research. In order to initiate innovation and change, the paradigms must be made explicit; it is the first step towards questioning their adequacy and taking full advantage of new approaches and techniques.

Changing Values of Management

In order to emphasize the importance of values, three management paradigms have been identified (Gummesson, 1993a): the manufacturing paradigm, the bureaucratic-legal paradigm and the service paradigm. They should not be mixed up with the type of organization where they historically originated. They are meant as archetypes that make the management values more distinct.

*Web link:*

<http://www.emeraldinsight.com/Insight/ViewContentServlet?Filename=Published/EmeraldFullTextArticle/Pdf/0850050105.pdf>

### **3.13. Understanding Service Businesses: Applying Principles of the Unified Services Theory**

*Scott E. Sampson, John Wiley & Sons, 2001, ISBN 0471210501*

This book introduces the reader to the Unified Services Theory, which defines both "services" and the issues that make services management distinct from traditional management of organizations which are not services. The presentation is applied, with more than 150 student exercises which can be assigned by the instructor. Most of the exercises are to be performed relative to each student's "target service business" which is a service business of particular interest to each student. Allowing the students to tailor their analysis to their own interests help provide for an extremely interesting and relevant course.

### **3.14. Spirit and community at Southwest Airlines: An investigation of a spiritual values-based model**

*John Milliman, Jeffery Ferguson, David Trickett, Bruce Condem, Journal of Organizational Change Management, Volume 12 Number 3 1999 pp. 221-233, ISSN 0953-4814*

One important issue is whether spirituality in the workplace can be used only to benefit employees or can it be developed also to the advantage of organizations? The purpose of this article is to articulate a model of how spiritual values can be integrated into organizations and then assess how this model predicts organizational behaviour in one company, Southwest Airlines (SWA). The application of this model provides insights into how and under what specific conditions spiritual values can positively impact both profitability and employee attitudes in organizations. Implications for both research and practice are discussed.

*Web link:*

<http://www.emeraldinsight.com/Insight/ViewContentServlet?Filename=Published/EmeraldFullTextArticle/Articles/0230120305.html>

### **3.15. "Lean" service: in defence of a production - line approach**

*David E. Bowen and William E. Youngdahl, International Journal of Service Industry Management, Vol. 9 No. 3, 1998, pp. 207-225, MCB University Press, 0956-4233*

In this article, the authors make the case that manufacturing logic has and, even should still, transfer to service operations. The argument against the production-line approach to service rests on an increasingly outdated view of manufacturing operations. In many cases, services are "reindustrializing" by applying new models based largely on progressive manufacturing technologies – in both operations and human resource management.

*Web Link:*

<http://www.emeraldinsight.com/Insight/ViewContentServlet?Filename=Published/EmeraldFullTextArticle/Pdf/0850090301.pdf>

### **3.16. Transactional Six Sigma and Lean Servicing**

*Leveraging Manufacturing Concepts to Achieve World-class Service* , Betsi Harris Ehrlich, ISBN: 1574443259.

Service industries have traditionally lagged manufacturing in adoption of quality management strategies and Six Sigma is no exception. While there are a growing number of books on applying the hot topics of Six Sigma and Lean Manufacturing concepts in a manufacturing environment, there has not been a mainstream book that applies these techniques in a service environment, until now. Transactional Six Sigma and Lean Servicing: Leveraging Manufacturing Concepts to Achieve World Class Service is a ground breaking "how-to" book that serves as a practical guide for implementing Six Sigma and Lean Manufacturing methods in a transactional service oriented environment. It uses real case studies and examples to show how Six Sigma and Lean Servicing techniques have been implemented and proven effective in achieving substantial documented results. Lean Servicing is the author's own term used to describe the application of Lean Manufacturing concepts to transactional and service processes. Liberal use of examples, graphics, and tables will assist you in grasping the difficult concepts. Transactional Six Sigma and Lean Servicing covers both theory and practical application of Lean Servicing, Six Sigma DMAIC and Six Sigma DFSS concepts and methods so you can implement them effectively in your service organization and achieve reduced costs and a new level of service excellence.

### **3.17. Lean Six Sigma for Service: How to Use Lean Speed and Six Sigma Quality to Improve Services and Transactions**

*Michael L. George, ISBN: 0071418210,*

The aim of the book is to bring Lean Theory & Six Sigma improvement out of manufacturing and into services. Much of the U.S. economy is based on services rather than manufacturing. "Lean Six Sigma for Services" fills the need for a service-based approach, explaining how companies of all types can cost-effectively translate manufacturing-oriented Lean Six Sigma tools into the service delivery process. Filled with case studies detailing dramatic service improvements in organizations from Lockheed Martin to Stanford University Hospital, this bottom-line book provides executives and managers with the knowledge they need to: reduce service costs by 30 to 60 percent; improve service delivery time by 50 percent; and expand capacity by 20 percent without adding staff.

### **3.18. Service productivity: Towards a conceptualization of the transformation of inputs into economic results in services.**

*Christian Grönroos and Katri Ojasalo, Journal of Business Research 57 (2004) 414– 423*

The productivity of a process is related to how effectively input resources are transformed into value for customers. For the needs of manufacturers of physical products, there are widely used productivity concepts and measurements instruments. However, in service processes, the underlying assumptions of these concepts and models do not hold. For example, manufacturing-based productivity models assume that an altered configuration of input resources in the production process does not lead to quality changes in outputs (the constant quality assumption). However, in a service context, changes in the production resources and productions systems do affect the perceived quality of services. Therefore, using manufacturing-oriented productivity models in service contexts are likely to give managers wrong directions for action. Research into the productivity of services is still scarce because of the lack of viable models. The purpose of the present article is to analyse the



requirements for the development of a productivity concept for service operations. Based on the analysis, a service productivity model is developed. According to this model, service productivity is a function of (1) how effectively input resources into the service (production) process are transformed to outputs in the form of services (internal efficiency), (2) how well the quality of the service process and its outcome is perceived (external efficiency or effectiveness) and (3) how effectively the capacity of the service process is utilized (capacity efficiency). In addition, service productivity as a learning experience and directions for developing measurement models for service productivity are discussed.

*Web Link:*

<http://www.sciencedirect.com/science/article/B6V7S-45C1WRX-2/2/8d3bf1a684944ebe45e6bdd7b40c3118>

### **3.19. Service operations management: return to roots**

*Robert Johnston, International Journal of Operations & Production Management, Vol. 25 No. 12, 2005 pp. 1278-1297, Emerald Group Publishing Limited, 0144-3577 - DOI 10.1108/01443570510633657*

**Purpose:** Over many years there has been an emergence of a large-scale, worldwide academic movement concerned with the management of services. This paper, originally published in 1999, aims to chart the role and impact of operations management (OM) on this movement and to propose that the key focus for service academics should be with the application of frameworks and techniques.

**Design/methodology/approach:** A conceptual discussion and approach are taken.

**Findings:** Suggests that as the service movement has grown, with increasing overlap between the subjects of operations, marketing and HRM for example, there is a need to "return to roots". Contends that service academics, in their bid to develop cross-functional service management material, may have lost, or inadvertently ignored, the strength of their core disciplines. Refocusing on the traditional strengths of OM, such as performance quality, design, and operational improvement, might help provide a greater rigour to the developing subject of service management.

*Web Link:*

<http://docserver.ingentaconnect.com/deliver/connect/mcb/01443577/v25n12/s13.pdf?expires=1169123733&id=34703375&titleid=1076&accname=University+of+Salford&checksum=27E3A81E31943B86AF01E09ADDD180B6>

### **3.20. Why are UK Managers failing to adopt Lean Concepts to Improve the Delivery and Quality of Public Services?**

*Presentation by Dr Bob Barker and Kamran Zamir, European Centre for Business Excellence, 33 Park Square West, Leeds, West Yorkshire, [www.ecforbe.com](http://www.ecforbe.com)*

[http://www.nationalschool.gov.uk/organisational\\_development/performance\\_improvement\\_team/Downloads/X06/Efficiency\\_Conference\\_06\\_Bob\\_Barker\\_presentation.pdf](http://www.nationalschool.gov.uk/organisational_development/performance_improvement_team/Downloads/X06/Efficiency_Conference_06_Bob_Barker_presentation.pdf)

## 4. THEME 4: PROJECT MANAGEMENT GOVERNANCE

### 4.1. "Integrating 'lean' and 'high reliability' thinking"

*Smart, P., Tranfield, D., Deasley, P., Levene, R., Rowe, A. and Corley, J. Proceedings of the I MECH E Part B Journal of Engineering Manufacture, Vol. 217 No. 5, pp. 733-9., 2003.*

This paper illustrates how recent tragedies have been shown to be threatening to the medium-term sustainability of organizations designed and developed solely on the basis of short-term efficiency gain. Over the past 30 years, Western organizations have institutionalized this emphasis on efficiencies through the implementation of Japanese management philosophies, such as lean thinking. This situation has assisted the removal of vital adaptive and responsive capacity or 'organizational slack', necessary for organizations that need to contend with complex and dynamic environments. The authors argue for the need to challenge managerial mindsets and re-engage a pluralist metaperspective both at the level of strategic purpose and organizational configuration. In particular, it suggests that, in addition to the efficiency model, a complementary and to some extent alternative set of 'high-reliability' organization (HRO) design principles are required. They focus on the notion of creating an HRO that privileges integrity in the achievement of medium- and long-term goals over short-term efficiency gains. Integrating both 'lean thinking' and 'high-reliability' principles is a requirement for post-modern managers operating in their roles as organizational engineers, if mission accomplishment is to be realized.

### 4.2. "Cracking the code of business"

*Emiliani, M.L., (2000), Management Decision, Vol. 38 No. 2, pp. 60-79.*

Large public companies restructure themselves on a regular basis with the primary goals of achieving better financial performance and demonstrating responsiveness to shareholder interests. However, it is well known that such discontinuities typically result in great stress and confusion amongst employees, particularly over how to achieve new stretch goals. Key functions such as engineering, manufacturing, purchasing, quality, and finance often pursue separate paths to achieve function-specific goals. This paper utilizes the principles and tools of lean production to decode the CEO's mandates and deliver practical, solutions-oriented tools to employees to help achieve stretch business goals. This creates an effective bridge between the language of the CEO and engineering, manufacturing, purchasing, quality, and finance functions. Coupled with LEAN BEHAVIORISM, an environment can be created that enables widespread employee alignment and commitment to challenging business conditions. The result is the first framework that unifies technical and behavioural components of management.

*Web link:*

<http://docserver.ingentaconnect.com/deliver/connect/mcb/00251747/v38n2/s1.pdf?expires=1168882942&id=34626588&titleid=1152&accname=University+of+Salford&checksum=9ED5EE7D7C4565B2A4DCD92A7537EED9>

### 4.3. Lean Thinking and Strategic Asset and Service Management

*An MRO Software "Best Practices Series" White Paper, Copyright 2005 MRO Software, Inc.*

This paper investigates the impact of lean thinking on one of the support functions, the maintenance department. Companies that implement lean thinking should consider strategic asset and service management approaches to help improve reliability while optimizing the cost of maintenance and operations across a wide range of asset classes.

*Web Link:*

<http://www.mro.com/corporate/pdf/LeanMfgandSAM.pdf>

## 5. THEME 5: OVERALL VISIBILITY AND SYSTEM MAPPING

### 5.1. A case study in applying lean sustainability concepts to universities.

*Clare L. Comm, Dennis F.X. Mathaisel (2006), International Journal of Sustainability in Higher Education, Vol. 6 No. 2, 2005, pp. 34-146 Emerald Group Publishing Limited 1467-6370, DOI 10.1108/14676370510589855*

Historically, higher education has been one of the slowest to change its practices and approaches due to a variety of reasons: public schools' funding by the state, raising enough money in a private school, and the amount of time it requires implementing and measuring a change. However, since almost any college or university is a collection of smaller departments, offices, and divisions, there is ample opportunity for eliminating waste and redundancy and focusing on the core competencies of the institution: teaching and doing research.

**Purpose** – To apply the concepts of lean and sustainability to higher education.

**Design/methodology/approach** – A questionnaire was developed, administered to 18 public and private universities and analyzed.

**Findings** – The focus in higher education is now on cost reduction or budget containment initiatives. Although these initiatives were not implemented with the knowledge that they were implementing "lean" practices, their application has often reduced waste, improved operational efficiency, and contributed to sustainability

### 5.2. Lean Kaizen: A Simplified Approach to Process Improvements

*George Alukal and Anthony Manos, ISBN 978-0-87389-689-4*

To compete successfully in today's economy, organizations need to be as good as or better than their global competitors. This goes not only for quality, but also for costs and cycle times (lead time, processing time, delivery time, set-up time, response time, etc.). Lean addresses these needs in its emphasis on teamwork, continuous training and learning, produce to demand ("pull"), mass customization and batch size reduction, cellular flow, quick changeover, and total productive maintenance.

Originally applied in manufacturing settings, lean has now migrated to non-shop floor activities: in business support functions, such as sales, customer service, accounting, human resources, engineering, purchasing; within manufacturing firms; and also in purely service areas like finance, government, and healthcare.

The intended audience for this book is any quality or operational professional who wants to start their lean journey or enhance their career opportunities. After introducing the concepts of lean and kaizen, various building blocks of a lean enterprise are described. After reading this book, any reader will have a foundation of what is understood today as "lean."

### **5.3. Lean Manufacturing and the Environment**

*Research on Advanced Manufacturing Systems and the Environment and Recommendations for Leveraging Better Environmental Performance. United States Environmental Protection Agency, Solid Waste & Emergency Response (5302W), Policy, Economics, & Innovation (1807T), EPA100-R-03-005,*

The U.S. Environmental Protection Agency (EPA) sponsored a study on lean manufacturing in 2000 that included a series of case studies with the Boeing Company to explore the relationship between lean production and environmental performance. The study found that lean implementation at the Boeing Company resulted in significant resource productivity improvements with important environmental improvement implications. The Boeing case studies also found evidence that some environmentally sensitive processes, such as painting and chemical treatment, can be more difficult to lean, leaving potential resource productivity and environmental improvements unrealized. These findings led EPA's Office of Solid Waste and Emergency Response (OSWER), in partnership with the Office of Policy, Economics, and Innovation (OPEI), to pursue new research to examine further the relationship between lean manufacturing and environmental performance and the regulatory framework. The goal of this effort is to help public environmental agencies understand ways to better leverage lean manufacturing, existing government environmental management programs and initiatives, and regulatory requirements in the hope that even greater environmental and economic benefits will result.

*Web Link:*

<http://www.lean.org/Community/Registered/ArticleDocuments/EPA%20leanreport.pdf>,  
[www.epa.gov/innovation/lean.htm](http://www.epa.gov/innovation/lean.htm)

### **5.4. What is lean thinking?**

*Cardiff Business School. Lean Enterprise Research Centre brochure): 5-6*

<http://www.cf.ac.uk/carbs/lom/lerc/centre/publications/downloads/lerc%20brochure.pdf>

### **5.5. Pragmatic Agile™**

*Presentation by David Hicks – RADTAC, Martin Freeman – Profund, Responding to the Challenge of Change , 7 – 9 November 2006, London, UK*

**APPENDIX A**  
**APPLICATION OF LEAN THINKING**  
**THEMES MATRIX**

# Appendix A- Application of Lean thinking Themes Matrix

## APPLICATIONS OF LEAN THINKING

Report reference	Source Title	Theme 1 Lean Applications in Healthcare	Theme 2 Reduction of Cost & Resource Utilisation	Theme 3 System Redesign & Efficient Reconfiguration	Theme 4 Project Management Governance	Theme 5 Overall Visibility System Mapping	Generic Application Across Sectors
1.1	Going Lean in Healthcare	x	x	x		x	
1.2	A Lean Guide to Transforming Healthcare: How to Implement Lean Principles in Hospitals, Medical Offices, Clinics, and Other Healthcare Organizations.	x	x	x	x	x	x
1.3	The lean enterprise academy	x	x	x	x	x	x
1.4	Best in Healthcare Getting Better with Lean.	x	x	x			
1.5	The Lean Healthcare Experience	x	x	x	x	x	
1.6	NHS Lean Implementation handbook	x	x	x	x	x	
1.7	Lean Six Sigma - Some basic concepts	x	x	x			
1.8	Mayday Healthcare NHS Trust Example of lean thinking at Mayday Healthcare NHS Trust [2006]	x	x	x			
1.9	Mapping the 18 week elective process at Bolton Example of lean thinking at Bolton NHS Trust [2006]	x	x	x	x	x	
1.10	Lean-Six Sigma for Healthcare: A Senior Leader Guide to Improving Cost and Throughput	x	x		x		x
1.11	Going Lean - A Guide to Implementation	x	x			x	x
1.12	Stop Rising Healthcare Costs Using Toyota Lean Production Methods: 38 Steps for Improvement	x	x		x	x	
1.13	5S for Service Organizations and Offices: A Lean Look at Improvements	x		x		x	x
1.14	Design Rules, Metaroutines, and Boundary Objects - A Framework for Improving Healthcare Delivery Systems.	x		x		x	x
1.15	Bloated NHS to get the Tesco treatment	x		x		x	x
1.16	A Toolkit for Redesign in Health Care	x		x			
1.17	Reducing waiting times in the NHS : is lack of capacity the problem?	x		x		x	
1.18	Using industrial processes to improve patient care	x		x			
1.19	Can lean save healthcare?	x		x			
1.20	Fixing Healthcare from the inside, today.	x		x		x	
1.21	Lean Leadership in Healthcare, White Paper	x			x	x	
1.22	Project Production Systems for Delivery of Lean Health Care Facilities and Services	x					
1.23	Making the NHS into a lean machine	x					
1.24	NHS should embrace lean times	x					
1.25	Flying the flag.	x					
1.26	Wait watchers.	x					
1.27	Think yourself thin	x					
1.28	NHS Institute for Innovation and Improvement [2006]	x					
1.29	NHS Lean thinking network (NHS Institute) [2006]	x					
1.30	1st lean healthcare forum (Lean Enterprise Academy) [January 2006]	x					
1.31	2nd lean healthcare forum (Lean Enterprise Academy) [June 2006]	x					
1.32	3rd lean healthcare forum (Lean Enterprise academy) [October 2006]	x					
2.1	Office Kaizen: Transforming Office Operations into a Strategic Competitive Advantage		x	x			x
2.2	Service Operations Management - Improving Service Delivery		x	x	x	x	x
2.3	The Machine That Changed the World.		x	x		x	x

**APPLICATIONS OF LEAN THINKING**

Report reference	Source Title	Theme 1 Lean Applications in Healthcare	Theme 2 Reduction of Cost & Resource Utilisation	Theme 3 System Redesign & Efficient Reconfiguration	Theme 4 Project Management Governance	Theme 5 Overall Visibility System Mapping	Generic Application Across Sectors
2.4	Good management - Lean Machine		x	x	x	x	x
2.5	Evaluation of the lean approach to business management and its use in the public sector,		x	x	x	x	x
2.6	The new improvement frontier - Developing lean administration		x	x		x	x
2.7	Freedom From Command and Control: Rethinking Management for Lean Service.		x	x	x	x	x
2.8	The Lean Service Machine		x	x		x	x
2.9	Successful implementation of Six Sigma: benchmarking General Electric Company		x	x			x
2.10	Bringing Lean to the office		x	x			x
2.11	The Lean, Green Service Machine		x	x		x	x
2.12	Service with a Smile		x	x	x	x	x
2.13	Lean Service Organisations: The Toyota Business Model		x	x	x	x	x
2.14	Pull Thinking®: Harness the Power of Pull to Fuel Growth and Ignite Performance by Aligning People, Culture, and Purpose		x	x			
2.15	Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain		x	x		x	
2.16	Six Sigma for Financial Services: How Leading Companies Are Driving Results Using Lean, Six Sigma and Process Management		x			x	x
2.17	Lean thinking: banish waste and create wealth in your corporation		x		x		x
2.18	Lean Solutions - How Companies and Customers Can Create Value and Wealth Together		x			x	x
2.19	Lean Consumption		x				x
3.1	Discovering the Lean Supply Chain: Transforming Supply Chain Operations into a Lean Differentiator			x			
3.2	Value Stream Management: Eight Steps to Planning, Mapping, and Sustaining Lean Improvements			x		x	x
3.3	Application of lean production and agile manufacturing concepts in a telecommunications environment.			x		x	x
3.4	Application of Lean Management Principles to Election Systems			x			x
3.5	Exploration of internal service systems using lean principles			x			x
3.6	Developing, implementing and transferring lean quality initiatives from the aerospace industry to all industries.			x		x	x
3.7	Creating and Implementing Lean Strategies			x	x		x
3.8	Applications of Business Process Simulation and Lean Techniques in British Telecommunications PLC			x			x
3.9	Using Simulation to Optimise and Understand Lean Service Delivery			x			x
3.10	The way Fujitsu used 'lean' to improve service delivery			x			x
3.11	Production-Line Approach to Service			x			x
3.12	Service Management: An Evaluation and the Future			x			
3.13	Understanding Service Businesses: Applying Principles of the Unified Services Theory					x	
3.14	Spirit and community at Southwest Airlines: An investigation of a spiritual values-based model					x	
3.15	Lean service: in defense of a production - line approach		x	x		x	x
3.16	Transactional Six Sigma and Lean Servicing						x
3.17	Lean Six Sigma for Service: How to Use Lean Speed and Six Sigma Quality to Improve Services and Transactions					x	x
3.18	Service productivity: Towards a conceptualization of the transformation of inputs into economic results in services.						
3.19	Service operations management: return to roots					x	x
3.20	Why are UK Managers failing to adopt Lean Concepts to Why are UK Managers failing to adopt Lean Concepts to Improve the Delivery and Quality of Public Services?				x	x	x

**APPLICATIONS OF LEAN THINKING**

Report reference	Source Title	Theme 1 Lean Applications in Healthcare	Theme 2 Reduction of Cost & Resource Utilisation	Theme 3 System Redesign & Efficient Reconfiguration	Theme 4 Project Management Governance	Theme 5 Overall Visibility System Mapping	Generic Application Across Sectors
4.1	Integrating 'lean' and 'high reliability' thinking				x	x	x
4.2	Cracking the code of business				x	x	x
4.3	Lean Thinking and Strategic Asset and Service Management				x	x	x
5.1	Lean Kaizen: A Simplified Approach to Process Improvements					x	x
5.2	A case study in applying lean sustainability concepts to universities.						x
5.3	Lean Manufacturing and the Environment					x	x
5.4	What is lean thinking?						x
5.5	Pragmatic AgileTM						x