

Literature Survey & Critique on Lean and comparative Operational Excellence Techniques

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ABSTRACT

An examination of the foundations and key principles of the selected approaches and programs exposes key and common similarities to Lean Principles in nearly all of them. Those commonalities are: understanding and reducing variation; systems thinking, and leadership. These concepts are at the core of the approach defined by Deming, which became TQC/TQM. These concepts are central to the Lean and Six Sigma approaches that are so often presented today. Understandably, skepticism is growing as every new approach is labelled as a fad. This need not be the case if greater care is taken by gurus and practitioners when investing in upgraded approaches. As we upgrade our computers to meet new requirements so must we invest to improve our Business Management Systems; that process is continual improvement.

RELEVANCE TO CONFERENCE THEME

Senior management are vested with the responsibility to produce strategy and policy that enables the organisation to establish clear plans to ensure productivity improvements can be made and new technologies can come to market and staff are skilled in the use of the new technologies. If achieved, this should begin to address long term viability of the organisation which may include the entry or continuance in niche offshore markets. Leadership and environments supporting innovation are imperative.

Having considered the principles of Lean with respect to the models presented, there is strong evidence that Lean should not be compared with these models but rather Lean has developed through a series of improvement opportunities arising out of these business models over the past four decades and should continue to do so.

A Special note thanks to Bob Welldon



1 INTRODUCTION

To comprehensively detail the vast variety of quality based approaches is far beyond the scope of this paper. An examination of the foundations and key principles of the selected approaches and programs exposes key and common similarities to Lean Principles in nearly all of them. Those commonalities are: understanding and reducing variation; systems thinking, and leadership. These concepts are at the core of the approach defined by Deming, which became TQC/TQM. These concepts are central to the Lean and Six Sigma approaches that are so often presented today.

Having reviewed the research in this area, in my opinion, there is a strong indication that the business community is becoming jaded by the seemingly endless line of programs that promise to cure all that ails business. Understandably, skepticism is growing as every new approach is labelled as a fad. This need not be the case if greater care is taken by gurus and practitioners when investing in upgraded approaches. As we upgrade our computers to meet new requirements so must we invest to improve our Business Management Systems; that process is continual improvement.

Despite the growing skepticism and notwithstanding the significant proportion of businesses whose unhappy experiences with the various quality based programs have led them to abandonment, the quality movement who appears to be the developer of these programs refuses to go away and it may well not as it works frequently enough to generate case studies and success stories that cause senior managers and financial controllers to salivate in anticipation.

In 1931, Dr. W. A. Shewhart published his seminal work, *Economic Control of Quality of Manufactured Product*. This is the first and perhaps most important book to bring a focus to understanding and reducing variation, although it accomplishes much more. Shewhart correctly identified quality as an economic issue. There is a price to be paid for poor quality. Usually, it is much higher than imagined or monitored; sometimes by orders of magnitude. In addition, he went to some lengths to explain that there was a price to pay for failing to understand the difference between random and non-random variation. He also identified the difficulties inherent with inductive reasoning, which have a significant bearing on any analytical study, or should do.

Senior management are vested with the responsibility that strategy and policy is produced that enables the organisation to establish clear plans to ensure productivity improvements can be made and new technologies can come to market and staff are skilled in the use of the new technologies. If achieved, this should begin to address long term viability of the organisation which may include the entry or continuance in niche offshore markets. Leadership and environments supporting innovation are imperative. (Gayle, 2007).



2 ACTIVITY BASED MANAGEMENT

Activity Based Management (ABM) is based on a simple principle, *activities consume costs*. ABM reports provide a powerful new basis to analyze Value vs Non-Value added costs, define cross-functional business processes and benchmark best practices across industries. ABM is not just a replacement for cost of sales and inventory valuation on the financial statements. ABM is a revised approach combining financial and operational information in a way that both can be used for improved decision making, it is a management information tool as opposed to a financial statement valuation method much the same as Lean. To fulfill this purpose requires that the information system take into account both the operational processes of the organisation and the resources costs as represented in the financial system. Shank (1993), describes how these then must be combined in such a way that they

- 1) reflect how the organizational process consumes resources and flows costs, and
- 2) capture in total the costs in the financial system to insure the financial integrity of the model.

The process starts with an operational flow model of the business process and then attaches costs to the resources. This approach aligns closely with Lean methodologies. Costs accumulate in relation to the flow of activities. Costs are applied directly to the resources that consume these costs (Turney, 2005). The advantages of this ABM approach fundamentally aligns with many Lean principles:

- Because the business process model is dynamic, simulation and "what if" analysis can be done to evaluate business decision alternatives.
- Productivity improvements, sensitivity analysis, process changes and investment justifications can all be evaluated via the model.
- The model integrates the business process and the cost system, promoting understanding of how process affects cost.
- It helps identify key performance measurement opportunities.
- It provides strategic financial and operational decision support.

The Model Approach is a structured approach starting from the existing understanding of the business process and the existing cost system and concluding with ABM process improvement. It can be used for an entire business organization, a division or department or a function. In large organizations, it is often advisable to execute a pilot project first to develop skills, train team members and facilitators and obtain prompt results and payback. We can demonstrate strong connections between ABM and Lean thinking.

Turney (2005), argues ABM using his Model Approach goes far beyond Activity Based Costing in its usefulness. ABC certainly gives a better distribution of costs that



traditional methods, but it still presents a financial view of the organization. ABM and can provide a business decision making tool that can be used to manage and improve the business.

3 BUSINESS PROCESS MANAGEMENT

Inside organisations that are doing various kinds of process "work"-whether improvement projects, technology enhancements or process definition and documentation—we often hear a lot of confusion and frustration because people sometimes mean different things when they use the word "process." The most common frustration happens when two people are talking at different "levels" of process—with one person perhaps talking about a big end-to-end process such as order fulfillment while the other person is talking about a single task but one with multiple steps and considerable complexity—yet both are using the term "process" Lean methodology also defines process and similarly fails to be definitive.

While business process management (BPM) is a hot topic among business and IT circles, you may be surprised to know that this technology has a long and complex history. In fact, business processes are hardly a new concept. The notion of business processes and business process reengineering (BPR) discussed later can be traced back to as early as the 1920's, when it was known as Methods and Procedures Analysis—always searching for new ways of restructuring workflows or improving business organizations. Indeed, business processes have been around for decades, but the BPM technology we know today initially evolved in the 80's, when desktop computing was introduced. Applications like word processing and spreadsheets provided a solid means for organizations to improve and measure individual processes. Process measurement is a core management technique of Lean Thinking.

BPM was born from the need to streamline internal processes and connect internal and external tasks. This could be likened to Customer Touch Points in both Lean and Six Sigma.

Hammer and Stanton (1999), argue that addressing end-to-end processes, 'BPM cuts across departments, applications, and users. BPM manages the efficiency and effectiveness of business processes throughout your organization, which helps your employees, as well as your customers, partners, and suppliers. BPM not only promises to improve the processes of today, but because of its adaptable and flexible technology, it ensures a smooth transition for the inevitable changes of tomorrow.'

A critical factor in the Lean methodology.

Most process management literature calls for first identifying the key business processes and then developing a process map for each. A process map establishes the inputs and outputs of a process, its customers and suppliers, and the key measures that characterize its performance. Processes are then flow-charted to identify the high-level tasks required

for process execution (Eckes, 2001). Process maps provide a critical understanding of how each process works and what can be done to improve its performance. Documenting both material and information process flows is the first step in defining a problem and relating it to a desired solution.

In fact, it is often the interconnections between the processes, rather than the individual processes themselves, that give a business its competitive advantage (Porter, 1996). An enterprise map traces the key activities of a business and establishes the critical dependencies that exist between such activities. It focuses on the handoffs between the processes. Lean begins with defining the strategy and policies before developing processes to support them.

4 BUSINESS PROCESS RE-ENGINEERING

Business processes are simply a set of activities that transform a set of inputs into a set of outputs (goods or services) for another person or process using people and tools. We all do them, and at one time or another play the role of customer or supplier.

You may see business processes pictured as a set of triangles as shown in Figure 1 below. The purpose of this model is to define the supplier and process inputs, your process, and the customer and associated outputs. Also shown is the feedback loop from customers.

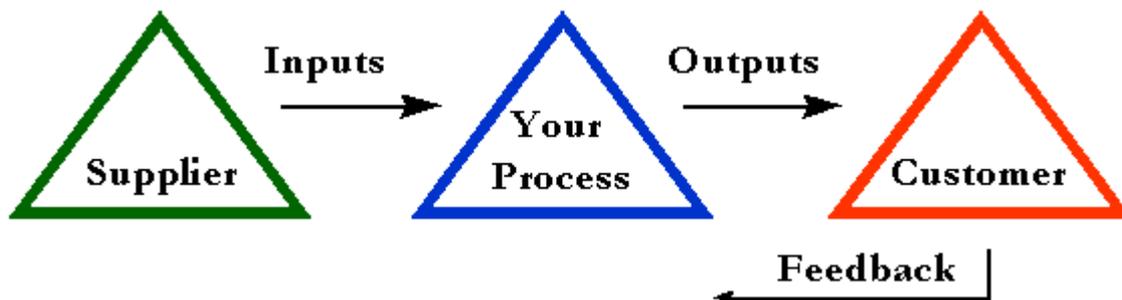


Figure 1: Standard Business Process

In figure 2 below illustrates the basic steps. Beginning by documenting what you do today, establish some way to measure the process based on what your customers want, do the process, measure the results, and then identify improvement opportunities based on the data you collected. You then implement process improvements, and measure the performance of the new process. This loop repeats over and over again, and is called continuous process improvement. This is also referred to as business process improvement or functional process improvement, etc.

Over the last 10 years, the literature indicates several factors have accelerated the need to improve business processes. The most obvious is technology. New technologies (like the Internet) are rapidly bringing new capabilities to businesses, thereby raising the competitive bar and the need to improve business processes dramatically.

Another apparent trend is the opening of world markets and increased free trade. Such changes bring more companies into the marketplace, and competing becomes harder and harder. In today's marketplace, major changes are required to just break even. It has become a matter of survival for most companies.

BPR relies on a different school of thought than continuous process improvement. Reengineering may assume the current process is irrelevant - it doesn't work, start over.

Such an approach is pictured below. It begins with defining the scope and objectives of your reengineering project, then going through a learning process (with your customers, your employees, your competitors and non-competitors, and with new technology). Given this knowledge base, you can create a vision for the future and design new business processes. Given the definition of the "to be" state, you can then create a plan of action based on the gap between your current processes, technologies and structures, and where you want to go. It is then a matter of implementing your solution.



Breakthrough Reengineering Model

Figure 2: Reengineering process

In summary, the extreme contrast between cyclic continuous process improvement and business process reengineering lies in where you start (with today's process, or with a clean slate), and with the magnitude and rate of resulting changes.

In Six Sigma, there are two major processes DMAIC (Fix and existing process) and DMADV (Define, Measure, Analyze, Design, Verify. Design for Six Sigma or new product/service introduction). 95% of the literature related Six Sigma with DMAIC. BPR is more aligned to DMADV.

Whilst Lean tends to respect the approach of the continuous approach to improvement, statistical analysis of systems through Six Sigma techniques may indicate the reengineering approach is required. This is where the two methodologies compliment each other.

5 TOTAL QUALITY MANAGEMENT

The ability of organisations to adapt to new customer requirements on a global market is of vital importance for a long-term success. During the last decades, this has influenced many organisations to work with quality issues on a strategic level and total quality management (TQM), has frequently been used as a management strategy to develop organisations' quality strategies and initiatives. TQM Promoted "Story Boards" as does Lean.



In 1995, the Lawler, et al. report concluded that companies that deploy more extensive employee involvement tend to more broadly apply TQM practices and report higher TQM outcomes than those companies that have less highly developed employee involvement. An issue also supported by Lean literature.

There are three basic principles to TQM. They are:

1. Process - all employees serve customers through process;
2. People – all variation can be reduced and all processes improved through people;
3. Variation – all processes are adversely affected by variation.

<http://www.deming.org>

The basic assumption of TQM is that companies get better by small-step continuous improvement. Lean strongly supports this approach. This is done through the basic approach to reduce process variation, improve product reliability and customer satisfaction. An improved intervention strategy that ensures that we train staff in tools, organise improvement teams taking the lead from senior management and as Change agents being that of Internal quality leaders who delivered knowledge to others (Pyzdek, 1999).

While TQM is reported as an effective process for improving organisational functioning, its value can only be assured through a comprehensive and well thought out implementation process as per Lean principles. In recent years, the literature on change management and leadership has grown steadily, and applications based on research findings will be more likely to succeed. The size of the workforce is a key factor in the time it takes to introduce and establish the TQM system among the employees and also the costs for developing co-workers and implementing TQM.. Some authors such as Harari (1997), who presents ten major reasons for the failure of TQM initiatives and Eskildson (1994), who states, based on survey results that many organisations do not succeed with their TQM efforts question the actual benefits of implementing TQM. Pyzdek (1999), summarizes the criticism of TQM over the years and adds some new aspects. Hence the varied views of skepticism of change management.

If an organization has been historically reactive and has no skill at improving its operating systems, there will be both employee skepticism and a lack of skilled change agents. If this condition prevails, a comprehensive program of management and leadership development may be instituted (Sugarman, 1988).

TQM has left enduring legacies which are obvious in Lean methods. They include:

- Quality Matters (Today quality is a given!)
- Customer focus is essential
- Continuous Improvement is necessary to compete in business



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- Understand your business processes
 - Measure them! and understand variation.
 - Challenge the rule: Quality ↑ Cost ↑ (eg defects – prevention costs more)

6 SIX SIGMA

The concept called Six Sigma was born in Motorola in the 1980's, but it has a long and tradition that reaches back to the 1920's. Six Sigma is not only a quality initiative but it is also endorsed by many as a business strategy. Six Sigma brings a focus onto the cost of quality. The literature generally agrees that about half of the costs associated with waste, rework and non-compliance can be traced to product design, development, and process design (Nunnally and McConnell, 2007). There are many quite simple tools and techniques that are used in project work to isolate key variables. The various fishbone or Ishikawa diagrams, flow diagrams, frequency distributions, Pareto charts, and simple two variable correlations are some examples that are promoted through Lean methods. There is a place for sophisticated statistical techniques, but equally there is a place for the simpler approaches that everyone can master such as those promoted through Lean thinking. A search for the key variables that provides greatest leverage need not always involve heavy-duty statistics. Whilst promoted as a strategic approach such as Lean is, Six Sigma is better aligned with process improvement. Lean and Six Sigma fundamentally use the same tools through the DMAIC processes but a key difference is that Lean lends itself to formulation of strategy and policy development, where Six Sigma isolates itself to identifying and isolating specific process variations through statistical analysis (Eckes, 2001). Neither is better and as previously discussed the two methods compliment each other and can be effectively used in conjunction with one another.

7 CAPABILITY MATURITY MODEL INTEGRATION

The CMM Integration (CMMI) Project was formed in 1997 to:

- build an initial set of integrated models;
- establish a framework to enable integration of future models; and
- create an associated set of appraisal and training products.

The purpose of the CMMI effort is to:

- support process and product improvement;
- to reduce redundancy and eliminate inconsistency experienced by those using multiple standalone models; and



- integrate disciplines such as systems engineering and software engineering, which are inseparable in a product development endeavour.

An organization may choose an approach to process improvement from either of the following:

- process area capability; and
- organizational maturity.

CMMI provides a proven sequence of improvements, each serving as a foundation for the next level of maturity. It also permits comparisons across and among organizations by the use of maturity levels whilst providing a single rating that summarizes appraisal results and allows comparisons among organizations.

The Model allows you to select the order of improvement that best meets your organization's business objectives and mitigates your organization's areas of risk whilst enabling comparisons across and among organizations on a process area by process area basis (<http://www.deming.org>).

Some of the benefits that organizations have experienced as they complete the upgrade to CMMI include:

- more explicit linkage of management and engineering activities to business objectives;
- improved visibility into the product life cycle and engineering activities;
- leveraging from additional areas of best practice (e.g., measurement, risk management, and supplier management);
- more robust high-maturity practices;
- visibility into additional organizational functions critical to their products and services; and
- tighter coupling to relevant ISO standards.

CMMI provides a measuring stick against which the existing organisation processes can be assessed. The gaps between the actual organisational activities and model provide the organisation with the list of improvements which can be prioritised in process improvement projects using Lean, Six Sigma, or BPR.

Whilst CMMI is a popular and comprehensive process improvement model especially in software and Defence industries, it is far more complex than Lean, requires significant specially trained staff and significant time to maintain the approach within larger organisations and objective reviews by industry peers. Lean represents the opposite of these factors involving lesser skilled staff who are able to work with simple tools and principles and for organisations to work a pace affordable to them.

8 CONCLUSION

Having considered the principles of Lean with respect to the models presented, there is strong evidence that Lean should not be *compared* with these models but rather Lean has developed through a series of improvement opportunities arising out of these business models over the past four decades and should continue to do so.

The Evolution of Process Management

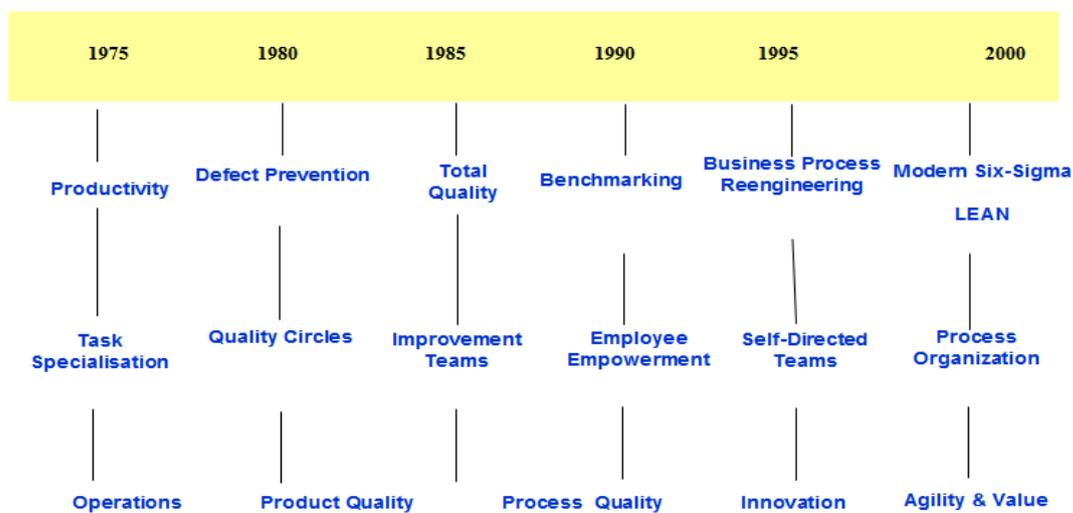


Figure 3: The evolution of Process Management

Figure 3 shows the continual development of quality and business process improvement methods leading to the practitioners tools box that exists today and this is the area where practitioners of improvement have failed to educate organisations where Lean is considered as another fad.

Lean has embellished the best of the various approaches and has quite correctly, not overstepped into areas such as Six Sigma statistical methods and CMMI that have far more potential for complexity. Lean promotes the involvement of people who do the work as part of the improvement cycle supporting the principles that management may define what and why, whereas people conducting the work have a greater input into the how a process may be managed which in my opinion is the greatest attribute of any change programme.

BIBLIOGRAPHY AND REFERENCES

- Berliner, C. and Brimson, J. A., (1988), *Cost Management for Today's Advanced Manufacturing*. Harvard Business School Press, Boston.
- Brimson, J. A., (1991), *Activity Accounting*. Wiley Publications, New York.



Cooper, R. and Kaplan, R. S., (1991), *The Design of Cost Management Systems*. Prentice Hall, Englewood Cliffs NJ.

Deeks, J., (1976), *The Small Firm Owner-Manager*, Praeger Publishers, New York, NY.

Deming, W. E., (1988), *Out of the Crisis*, MIT, Cambridge, MA.

Dutta, S. and Manzoni, J. (1999), *Process Reengineering, Organisational Change and Performance Improvement*, MCGraw Hill pp62-78.

Eckes, G. (2001), *The Six Sigma revolution: how general electric and others turned process into profits* (New York, NY: John Wiley & Sons Ltd).

Eskildson, L. (1994), "Improving the odds of TQM's success", *Quality Progress*, Vol.27, pp.61-63

Gayle, Avery. (2007), *Vision and values can offset labour drought*, BRW 3-9 May 2007 pp56-57.

Gordon, Dale, (2007), *Using Lean to Meet Quality Objectives*, ASQ Quality Progress – April 2007, ASQ Publications, www.asq.org.

Hammer, M and Stanton, S., (1999), *How Process Enterprises Really Work*, Harvard Business Review, November – December 1999.

Harari, O., (1997), "Ten reasons why TQM doesn't work", *Management Review*, Vol. 86 No. 1, pp. 38-44.

Harry and Schroeder, (2000), *Six Sigma*, Currency Doubleday, New York.

Hicks, D. T., (1992), *Activity Based Costing for Small and Mid-Sized Businesses*. John Wiley, New York.

Hines, P. and Taylor, D., (2000), *Going Lean, A Guide for Implementation*. Cardiff Lean Enterprise Research Centre, Cardiff Business School.

Hopp and Spearman, (1996), *Factory Physics*, McGraw Hill, Boston, MA.

Ishikawa, K., (1980), *QC Circle Koryo*, JUSE, Tokyo.

Johnson, H. T. and Kaplan, R. S., (1987), *Relevance Lost*. Harvard Business School Press, Boston.

Johnson, H. T., (1992), *Relevance Regained*. The Free Press, New York.

Lawler Edward E. III, Mohrman, Susan Albers, and Ledford, Gerald E. Jr., (1995) *Creating High Performance Organizations: Practices and Results of Employee Involvement and Total Quality Management in Fortune 1000 Companies*. San Francisco: Jossey-Bass Publishers.



Leavy, B., (2004), *Outsourcing strategies: opportunities and risks* *Strategy & Leadership* Volume 32 Number 6 2004 pp. 20-25.

Nunnally and McConnell, (2007), *Six Sigma in the Pharmaceutical Industry*, CRC Press, Boca Raton, FL.

Porter, M. (1996) *What is strategy?* *Harvard Business Review* 74(6) pp. 61-78.

Pyzdek, T., (1999), ``A road map for the quality beyond control'', *Quality Progress*, Vol. 32 No. 13, pp. 33-8.

Ricondo, I. and Viles, E., (2005), *Six Sigma and Its link to TQM, BPR and Lean and the Learning Organisation*. *International Journal Six Sigma and Competitive Advantage* 1 (3) pp323-354.

Scherkenbach, W. (1988) *The Deming Route to Quality and Productivity*, CEE Press, Washington DC.

Shank, J. K. and Govindarajan, V., (1993), *Strategic Cost Management*. The Free Press, New York.

Shewhart, W. A., (1931), *Economic Control of Quality of Manufactured Product*, Van Nostrand, New York.

Shewhart, W. A., (1939), *Statistical Method From the Viewpoint of Quality Control*, The Graduate School, The Department of Agriculture, Washington D.C.

Sugarman, B., (1988). "The Well Managed Human Service Organization: Criteria for a Management Audit," *Administration in Social Work*. 12(2), 1727.

Thompson, Arthur A. Jr., Strickland A.J III, and Gamble John E., (2005), *Crafting and Executing Strategy*, 14th ed., McGraw-Hill. Boston.

Turney, Peter B. B., (1991), *Common Cents*. Cost Technologies Inc.

Turney, Peter B. B., (2005), *Activity-based costing*, McGraw-Hill, ISBN 0071440372

Viljoen, J & Dann, S., (2003). *Strategic Management*, 4th Edition, Prentice Hall, Malaysia

<http://www.deming.org>