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The Integrated Continuous Improvement Project

A thesis presented in fulfilment of the requirements for a masters of

Philosophy
In
Quality Systems

At Massey University, Palmerston North, New Zealand.

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2005

Abstract

This thesis represents the outcome of a research project undertaken to enhance the continuous improvement aspect of quality management in an engineering services company. The solution proposed involved creating an electronic reminder system to encourage colleagues to follow through on suggested improvements. This thesis describes the preparation, process, learning achieved and pitfalls encountered in the process of attempting to create such a system.

The proposed system was to be a robust, effective electronic system, which allows continuous improvement efforts (including their outcomes) to be visible from a central place; be intuitive to use; have facilities to report progress – at different levels and within different groups; create effective reporting to interested parties; and enable analysis and evaluation of nature and status of suggested improvements.

This thesis includes a review of literature relating to the Plan-Do-Check-Act (PDCA) cycle, continuous improvement, systems thinking, total systems intervention, and learning organisations, which were read in order to gain a clearer understanding of the shape of future continuous improvement systems.

The thesis describes the project methodology followed for the idea conception, design, and specification of the system, assessment of suppliers and of their proposed solutions.

Organisational influences that affected the project are discussed using five key filters – mechanical, organic, cultural, political and cybernetic – suggested in systems thinking literature, and project and thesis outcomes are described.

Acknowledgements

The writing of this thesis has been as fraught as most others, and is likely never to have been published without the patience, encouragement and guidance of two giants - my dear husband; and my supervisor, Don Houston. Without these men, I am unlikely to have achieved the understanding of Quality that I do today, and for this, they have my gratitude and thanks.

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1. Introduction

This thesis represents the outcome of a research project undertaken to enhance the continuous improvement aspect of quality management in an engineering services company. The solution proposed involved creating an electronic reminder system to encourage colleagues to follow through on suggested improvements. This thesis describes the preparation, process, learning achieved and pitfalls encountered in the process of attempting to create a robust, effective electronic system, which allows continuous improvement efforts (including outcomes) to: -

- be visible from a central place;
- be intuitive to use;
- have facilities to report progress – at different levels and within different groups;
- create effective reporting to interested parties; and
- enable analysis and evaluation of nature and status of suggested improvements.

1.1 Outline

Chapter 1 of this thesis includes a brief outline and provides contextual information on the subject matter, the research and the organization in which the research has taken place. Chapter 2 provides background to the project and to the organization.

Chapter 3 contains a review of the literature deemed relevant to the research and discusses findings on this material, which includes continuous improvement, reward systems, the Plan-Do-Check-Act cycle, learning organizations, and systems thinking.

Chapter 4 presents the research methodology and Chapter 5 presents the project methodology. Chapter 6 describes the content of the various phases of the project, while Chapter 7 describes what happened next, and the outcome of the project. Chapter 8 presents an alternative solution that has been implemented.

Chapter 9 presents the findings made because of the project and of the literature reviewed, and discusses these findings. Finally, Chapter 10 presents the conclusion.

1.2 Facets of Quality Management

Though they differ in detail, all quality management models seem to highlight the need to get things right consistently and find ways of improving how things are done. They emphasise the importance of leadership from the top, the buy-in and participation of all staff in initiatives, a focus on process and quality of product produced, and the need to improve continuously.

The DIFOTIS principle neatly includes a number of facets of Quality management for maintaining quality in a business. The acronym - DIFOTIS - is defined as follows: **Delivery In Full On Time and In** (or within) **Specification**. While the DIFOTIS acronym defines the elements required to maintain quality in product realization, it does not represent all the requirements a quality organization is expected to fulfil. Quality management is about more than maintaining consistency in product realization. There are additional requirements of

- Leadership by management;
- Involvement of all colleagues in Quality; and
- Continuous improvement within the organization.

A vast amount of literature can be found on the importance of active leadership of company initiatives (such as Quality) by management and the importance of employee participation in such initiatives, especially in the learning organizational genre of management literature. However, there appears to be little written on the implementation of the third additional requirement of continuous improvement. Existing literature seems to focus on the need to have (or do) continuous improvement, rather than provide guidelines on how to effectively implement such an initiative. Lack of helpful assistance in the literature is a key reason why the implementation of a continuous improvement system was chosen as the subject of this thesis.

Another key reason this subject was selected, is that continuous improvement is uniformly considered best practice in business excellence models, such as EFQM and the Baldrige Criteria for Performance Excellence¹, as well as in quality models.

The most obvious requirement of Quality is that the organization produces goods or services to a defined standard. This requires planning and documented processes to ensure that the standard is consistently achieved – this is the control aspect of quality. Unfortunately, in spite of having good systems in place to achieve control, it is necessary to conduct audits to regularly check and prove that controls are working (compliance), and also encourage improvement (action) in the methods followed. Improved methods are significant in ensuring that the organization retains an advantage over its competitors and does not lose market share to them.

An organization that is serious about implementing Quality must therefore ensure it has:

- clear standards with planned outcomes;
- control (through well documented processes);
- compliance (through an effective system of audits); and
- improvement mechanisms (a system that supports continuous improvement).

ISO 9001:2000 – *Quality Management Systems – requirements*² is the international standard formulated to outline the requirements of a stable and effective quality system. Most quality management initiatives in New Zealand are assessed to this standard. The standard includes aspects concerning control, compliance and continuous improvement in the organization. For example, continuous improvement is dealt with in clause 8.5 *Improvement*. ISO 9001 has always contained requirements for continuous improvement, but the re-release of the standard in 2000 included an increased emphasis on this aspect of quality.

¹ For more information on the Baldrige Criteria for Performance Excellence, visit www.quality.nist.gov. Retrieved 12 September 2005.

²ISO 9001: 2000 Quality Management Systems – requirements, Zurich: International Standards Organisation.

1.3 The Organization

The organization that was studied in this work is an engineering services company. It is a mature quality certified organization and has been certified to ISO 9001 for 10 years.

The company manages the control and compliance of quality management through -

- An excellent quality manual that clearly outlines the processes that control DIFOTIS for the organization;
- An effective system of audits in the form of scheduled audits which are team based, and annual system audits on each area; and
- A non-conformance control system that ensures that instances where non-conformance has occurred are adequately assessed and investigated.

The element of quality management that was not adequately developed in the organization was continuous improvement. More specifically, the organization needed to find a more effective way to close the improvement loop. This is particularly important as the company transitions from focussing on a single area of engineering to include markets of converging technologies, representing what were previously separate, if allied, engineering disciplines. The company would face greater competition for services in these new markets.

In terms of the PDCA cycle, The P (Plan) D (Do) and C (Check) parts of the system were all of a satisfactory standard, exceeding compliance with the requirements of ISO 9001, but the A (Act) aspects of the cycle were not working effectively. Although audits were completed and instances of non-conformance investigated, failure to follow through on recommendations arising from these reports resulted in limited improvement in the organization. This is increasingly important since the organization migrated to the new edition of standard ISO 9001. Introduced in 2000, the new standard places more emphasis on continuous improvement. In clause 8.5.1 of the standard, it states:

“The organization shall continually improve the effectiveness of the quality management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventative actions, and management review.”³

³ International Standards Organisation (2000). Clause 8.5.1. In *ISO 9001: 2000 Quality Management Systems – requirements*, Zurich: International Standards Organisation.

1.4 The Research

The objective of this research was to make the continuous improvement part of the PDCA cycle an effective reality in the organization. This was to be done through an integrated electronic intuitive system that dealt with all continuous improvement activities that formed part of the quality assurance effort in the organization. The PDCA cycle was chosen as a basis for research because it is touted as the obvious driver for continuous improvement in organizations. Additionally, little detail is available on the implementation of this cycle by organizations.

Changes to the current system had to achieve the greatest benefits in terms of systems improvements and cost savings, for the minimum cost.

Continuous improvement is an essential element in the implementation of an effective quality system. It is a philosophy that requires ongoing positive change in an organization through the application of solutions discovered by checking current performance, innovation and organizational learning. Few organizations are willing to share their findings on this topic, as it is perceived to highlight weaknesses within their organization, although it might be argued that the presence of any system will reflect a desire to improve. The existence of a robust, effective system should give confidence to management, shareholders and customers that the organization's standards will improve over time.

This thesis seeks to explore the implementation of a continuous improvement system into an organization. It examines existing literature on the topic, discusses the process followed, and outlines concerns and considerations for the successful implementation of such a continuous improvement tool. This thesis also describes the outcomes and learning moments arising from the project.

2. Background

The company in this study is a subsidiary of a holding company and provides engineering, asset management, and build and maintain services. There are about 300 colleagues and contractors in the organization.

The organization decided to seek certification to the ISO 9001 standard as it wanted to seek business opportunities in Australia and overseas. It also wanted to broaden its customer base within New Zealand and found that lack of certification to the quality standard had limited its ability to tender for and win work. The company received ISO 9001 certification in 1994 and was the first organization of its type to achieve this. After a promising start, however, the quality system fell into disrepair because documentation was not handled efficiently and kept current. The audits also did not appear to add value.

In 1998, responsibility for Quality was reassigned to the Human Resources Manager, who reports directly to the Managing Director, and is a member of the company's executive team. The company librarian was also responsible for managing Quality documentation, and together, they sought to kick-start the quality system and save the company's ISO 9001 certification.

To start the initiative, several changes were implemented. Quality documentation was renumbered into a more effective scheme, the documentation system was made completely electronic, and a new Quality Team was put in place to sell Quality as a concept within the organization. The electronic quality documentation system is now accessed daily (and so often that it is impossible to maintain it during normal working hours), receiving over 1000 hits per month. The organization's understanding of the need for Quality is now fairly well developed and most colleagues have once again come to value quality.

In 1999, the focus of the Quality Team turned to continuous improvement and the re-instatement of audits. The organization wanted to see increased savings as a result of quality, and this area was the focus of attention by its external auditors. There were concerns that the organization's weakness in this area would inhibit its ability to move to the new ISO 9001:2000 standard, which it was better suited to due to the nature of

its business. Currently, there are approximately 20 fully trained internal auditors and one full time auditor in the organization. The company also has a schedule of audits and most audit reports are visible to the whole organization electronically. The organization transitioned to the new ISO 9001:2000 quality standard in 2002.

In 2002, the organization sought to improve the system for handling non-conformances (correcting mistakes). While processes had been created for audits, and for the initiation, investigation and recommendations arising from non-conformance control, these were not effective. Auditors revealed their frustration with the minimal action taken on recommendations made. The Quality Team also realised that some instances of non-conformance were not being properly investigated, and that 'quick fixes', rather than long-term solutions, were too often implemented. This was the subject of a Quality Assurance project completed by the author. The project discussed in this thesis is a further development of that project in which an automated electronic non-conformance control system was created within the organization.

The non-conformance control system that was created was initially hailed as the organizational saviour and the number of instances of non-conformances raised doubled within a year. However, the project was not an unqualified success due to the following reasons:

- The system was overcomplicated;
- The software used could not cope with the level of programming which the system required;
- The system was very slow when operating across the LAN between offices;
- Intermittent failures resulted in files often needing to be reworked and made users wary of using it;
- The organization did not use the system as they were afraid of breaking it; and
- The follow through on audits and non-conformance control reports was poor, resulting in the same mistakes recurring and auditors becoming disheartened.

The organization decided that the way to progress the continuous improvement programme would be to integrate the separate initiatives, such as audits and non-conformances, into a single system that dealt with recommendations and their follow-up. This is what has been documented in this thesis.

3. Literature Review

Research into the body of knowledge on the subject of this thesis involved finding resources that wrote about dimensions of quality, learning organizations, systems thinking, continuous improvement and systems that support or limit it, such as reward systems and the PDCA cycle. Many relevant articles and books provided context and reflected aspects relevant to the topic at hand, but there were some that added little value as they were too focussed on a particular industry, type of company or an information systems approach.

3.1 Dimensions of Quality

Total Quality Management (TQM) is the theory of quality espoused today. It was popularised in post World War II Japan by, amongst others, W. Edwards Deming and Joseph Juran. Quality philosophies were brought together in effort to save post-war Japan from financial ruin caused partly by reputation for poor quality.^{4, 5}

Early quality principles included product inspection, statistical control of product, process control and organization-wide participation. To this, Total Quality Management theory added:⁶

- Management responsibility for Quality (introduced by Joseph Juran);
- Improvement as a way to prevent chronic losses and gain competitive advantage;
- Quality Planning (to prevent quality problems being introduced due to lack of good process);
- Quality by design (robust design will cause few quality problems later);
- Strategic quality planning (setting goals for improvement at management level);
- Organization-wide application of quality (moving beyond production into all processes from Sales to Research and Development); and
- Empowerment of all colleagues to achieve quality (e.g. through Quality Circles)

⁴ Godfrey, A.B. and Endres, A.C. (1994). The Evolution of Quality Management within Telecommunications'. In *IEEE Communications Magazine*, 32, 10, pp. 26 – 34.

⁵ Houston, D. (1997). 'Quality Concepts and Philosophies'. 143.719 - *Quality Management – study guide 1*, Massey University: Palmerston North.

⁶ Flood, R.L. (1993). *Beyond TQM*, John Wiley & Sons: Chichester, England.

In the literature reviewed, Early and Godfrey (1995)⁷ define Total Quality Management as “the processes, methods and systems that organizations use to delight customers, and, at the same time, help to reduce costs, increase revenue and empower colleagues”. M.J. Brower (1994) provides an alternative definition, stating that Total Quality Management is “a structured system for creating organization-wide participation in planning, and the implementing of a continuous improvement process to meet and exceed customer needs”.⁸ Some more general definitions of quality include one from the Quality Vocabulary standard (ISO 8402:1994) which defines the quality as “the totality of characteristics of an entity that bears on its ability to satisfy stated and implied needs.”⁹

Garvin (1988)¹⁰ states that “quality should be defined from the customers’ point of view”. He defines eight dimensions of quality that customers consider. They are performance, features, durability, reliability, serviceability, aesthetics, conformance and perceived quality.

Kruithof and Ryall (1994)¹¹ note that quality is not exclusive to the absence of defects; it is also the presence of value. A range of issues and perspectives need to be considered by organizations in managing quality. They describe quality as “consistently meeting the continuously negotiated expectation of customers and other stakeholders in a way that represents value for all involved”. Kruithof and Ryall’s list of quality characteristics include:

- Conformance to specifications;
- Value for money;
- Fitness for purpose;
- The absence of defects;
- Whatever satisfies, delights or exceeds the customer’s expectations; and
- Consistently meeting the negotiated requirements of the customer with a high degree of predictability.

⁷ Early, J.F. and Godfrey, A.B. (1995). But it takes too long. *Quality Progress*, July 1995, 51-55.

⁸ Brower, M.J. quoted in Murray, P. and Chapman, R. (2003). From continuous improvement to organizational learning: developmental theory. *The Learning Organisation*, Volume 10, Number 5, 272 – 282.

⁹ *ISO 8402:1994 Quality Management and Quality Assurance - Vocabulary*, Geneva: International Standards Organisation

¹⁰ Garvin, D. (1988). The multiple dimensions of quality, Chapter 4. In *Managing Quality: The strategic and competitive edge*, Free Press: New York.

¹¹ Kruithof, J. and Ryall, J. (1994). The Eye of the Beholder. In *The Quality Standards Handbook*, The Business Library: Melbourne, 11-22.

3.2 Continuous Improvement

3.2.1 What is Continuous Improvement?

Langley, Nolan and Nolan (1994)¹² write “continuous improvement comes from the application of knowledge” and requires an aim (what we are trying to accomplish), a vision (how we will know the change is an improvement) and a process (that progresses us through the changes needed to get from our aim to our vision).

The definitions and requirements outlined by international quality standards are outlined below:

AS/NZS ISO 9000:2000¹³ *Quality management systems – Vocabulary* defines continual improvement thus:

“recurring activity to increase the ability to fulfill requirements (3.1.2). NOTE: The process (3.4.1) of establishing objectives and finding opportunities for improvement is a continual process through the use of audit findings (3.9.6) and audit conclusions (3.9.7), analysis of data, management (3.2.6) reviews (3.8.7) or other means and generally leads to corrective (3.6.5) or preventive action (3.6.4).

AS/NZS ISO 9001:2000¹⁴ *Quality management systems – Requirements* translates this into a requirement to improve continually:

“The organization shall continually improve the effectiveness of the quality management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventative actions and management review.”

The Quality Management Principles Brochure notes that with the arrival of ISO 9001:2000, “an enhanced requirement for “continual improvement” has been

¹² Langley, G.J., Nolan, K.M. and Nolan, T.W. (1994). The Foundation of Improvement. In *Quality Progress, June 1994*, 81-86.

¹³ AS/NZS ISO 9000:2000. Clause 3.2.13 Continual Improvement. In *Quality management systems – Vocabulary*, Wellington: Standards New Zealand.

¹⁴ AS/NZS ISO 9001:2000. Clause 8.5.1 Continual Improvement. In *Quality management systems – Requirements*, Wellington: Standards New Zealand.

introduced into ISO 9001, defining a complete cycle to improve the effectiveness of the quality management system”.¹⁵

AS/NZS ISO 9004:2000 *Quality management systems – Guidelines for performance improvements*¹⁶ explains:

“Management should continually seek to improve the effectiveness and efficiency of the processes of the organization, rather than wait for a problem to reveal opportunities for improvement. Improvements can range from small-step ongoing continual improvement to strategic breakthrough improvement projects. The organization should have a process in place to identify and manage improvement activities. These improvements may result in change to the product or processes and even to the quality management system or to the organization.”

Juran perceived that Quality could be broken up into avoidable cost (defects, product failures) and unavoidable costs (prevention, inspection, sampling). This helped managers see where value could be gained by investing in quality improvement.¹⁷ Juran (1989)¹⁸ describes continuous improvement as making a breakthrough on a project by project basis. He defines a project as a “problem scheduled for solution”. Imai (1986)¹⁹ favours the description of improvement through small steps, describing it as “by definition slow, gradual and often invisible, with effects that are felt over the long run”. Imai only considers small-step change to be continuous improvement, whereas Juran considers innovation as part of the continuous improvement initiative. Differences in Juran’s and Imai’s definitions highlight disparities in perspective in the quality culture of the East versus that of the West.

From the Japanese perspective, the emphasis on innovation is seen as imbalanced. Imai (1986)²⁰ writes:

¹⁵ Quality Management Principles Brochure, available from <http://www.iso.ch>, downloaded 27/05/2003.

¹⁶ AS/NZS ISO 9004:2000. Clause 8.5.1 General. In *Quality management systems – Guidelines for performance improvements*, Wellington: Standards New Zealand.

¹⁷ Murray, P. and Chapman, R. (2003). From continuous improvement to organizational learning: developmental theory. In *The Learning Organisation*, 10, 5, 272 – 282.

¹⁸ Juran, J.M. (1989). Chapter 3. In *Juran on Leadership for Quality: an Executive Handbook*. Free Press: New York.

¹⁹ Imai, M. (1986). Improvement East and West, Chapter 2. In *KAIZEN: The Key to Japan's Competitive Success*. New York: McGraw Hill.

²⁰ Imai, M. (1986). Improvement East and West, Chapter 2. In *KAIZEN: The Key to Japan's Competitive Success*. New York: McGraw Hill.

“Innovation is seen as major changes in the wake of technological breakthroughs, or the introduction of the latest management concepts or production techniques. Innovation is dramatic, a real attention-getter. KAIZEN (continuous improvement), on the other hand, is often undramatic and subtle, and its results are seldom immediately visible. While KAIZEN is a continuous process, innovation is generally a one-shot phenomenon.”

At the heart of this debate is the adjective “continuous”. Imai highlights concern that ongoing improvement will stall if innovation is at the centre of improvement initiatives rather than a small (continuing) step philosophy. If an organization lauds only the “big bang” changes while forgetting the value of incremental adjustments, then improvement of an ongoing nature is likely to fall away because it does not result in adequate reward for those implementing the changes.

Deming (1989)²¹ provides a more balanced view, valuing both innovation and continuous improvement as is outlined in the fifth of his “Fourteen points for management”. It says “Improve continuously and forever every process for planning, production and service. Search continually for problems in order to improve quality and productivity and thus to constantly decrease costs. Institute innovation and constant improvement of product, service and process. It is management’s job to work continually on the system (design, incoming materials, maintenance, improvements to machines, supervision, training, retraining)”.

More recently, Warnack (2003)²² has highlighted the value of thinking of continuous improvement as more than a review process. It should be considered “as a complete set of tools and techniques that drive the business forward and are integrated throughout the quality management system”.

²¹ Deming, W.E. (1982). *Out of the crisis*. Massachusetts Institute of Technology: Massachusetts.

²² Warnack, M. (2003). Continual Improvement Programs and ISO 9001:2000. In *Quality Progress, March*, 42-49.

3.2.2 Why is Continuous Improvement important?

In 1986, Imai²³ wrote that continuous improvement is necessary to “maintain the status quo”. The following quote by Juran (1989)²⁴ elaborates:

“To maintain and increase sales income, companies must continually evolve new product features and new processes to produce those features. ... To keep costs competitive, companies must continually reduce the level of product and process deficiencies.”

Povey (1996)²⁵ echoes this sentiment, highlighting that firms who become complacent about improvement will soon be overtaken by their competitors. Continuing in the same theme, Porter (1993)²⁶, writing about the US National Quality Award (Baldrige) winners, notes that their involvement in continuous improvement began with “the assumption that market standards or expectations are rising at a faster rate than their companies’ normal rate of improvement”.

Robert H Waterman also points out that implementing continuous improvement is likely to improve profits and revenue, customer relationships and employee morale.²⁷ These should be strategic objectives of high performing companies.

Finally, Warnack (2003)²⁸ highlights the additional pressure recently placed on companies adhering to the new ISO 9001 standard “by incorporating continuous improvement features into the quality management system, as required by ISO 9001:2000”.

As previously noted, it was partly because of this increased emphasis that continuous improvement was chosen as the topic for this thesis.

²³ Imai, M. (1986). Improvement East and West, Chapter 2. In *KAIZEN: The Key to Japan's Competitive Success*. New York: McGraw Hill.

²⁴ Juran, J.M. (1989). *Juran on Leadership for Quality: an Executive Handbook*. Free Press: New York.

²⁵ Povey, B. (1996). *Continuous Business Improvement: linking the key improvement processes for your critical long-term success*, McGraw-Hill: Berkshire, England.

²⁶ Porter, A.M. (1993). Baldrige winners discuss continuous improvement path. In *Purchasing, January*, 55-58.

²⁷ Robert H Waterman in Harwood, C. (1998). *Kick down the door of complacency – Seize the power of continuous improvement*, Foreword, p.xii, CRC Press: USA.

²⁸ Warnack, M. (2003). Continual Improvement Programs and ISO 9001:2000. In *Quality Progress, March 2003*, 42-49.

3.2.3 Characteristics of Continuous Improvement

Saraph and Sebastian (1993)²⁹ write, “an organization can mount and sustain a true quality improvement effort only when it has a value system that promotes quality”. They further indicate that this can only occur with the support and direction of management. Harwood (1998)³⁰ takes this point further saying that “in order to be successful, the effort must be led by the top person in the organization”. It is extremely important that the organization be motivated to improve and be effective. This motivation needs to come from the leaders of the organization.

Povey (1996)³¹ highlights the role of continuous improvement in “harnessing the creative ability of the entire workforce to identify and solve the problems that impact their ability to do their job”. If employee buy-in does not exist, a continuous improvement initiative could be viewed as another method of downsizing, or incriminating those who are “just trying to do their job”. In the same paper, Povey (1996)³² states the importance of continuous improvement initiatives being customer focussed, involving “knowing what their needs are and by knowing how well those needs are being satisfied by the organization”. This point by Povey (1996) is important because it signals that continuous improvement initiatives cannot afford to become insular. Instead, they must, as Stephen Covey (1989)³³ writes, “begin with the end in mind” and ‘the end’ in business is, ultimately, to please the customer so as to profit from their investment in the business.

In his article concerning the possible integration and linking of ISO 9001 Quality Management systems with other business improvement tools such as Six Sigma³⁴ and

²⁹ Saraph, J.V and Sebastian, R.J (1993). Developing a Quality Culture. In *Quality Progress*, September, 73-78.

³⁰ Harwood, C. (1998). *Kick down the door of complacency – Seize the power of continuous improvement*, CRC Press: USA.

³¹ Povey, B. (1996). *Continuous Business Improvement: linking the key improvement processes for your critical long-term success*, McGraw-Hill: Berkshire, England.

³² Povey, B. (1996). *Continuous Business Improvement: linking the key improvement processes for your critical long-term success*, McGraw-Hill: Berkshire, England.

³³ Covey, S.R. (1989). *Seven Habits of Highly Effective People*, Information Australia: Melbourne.

³⁴ For more information on Six Sigma visit <http://www.isixsigma.com> or Gupta, P. (2004) *Six Sigma Business Scorecard: Ensuring performance for profit*. McGraw-Hill, Sydney.

the Baldrige Criteria for Performance Excellence³⁵, Warnack (2003)³⁶ suggests that linking business improvement programs with an organization's quality management system can reduce the likelihood of failure (due to the non-incorporation of measures that ensure consistency and sustainability of the overall business improvement programs employed). The reason for this is that integration would:

- Create a single point of reference for all continuous improvement activities;
- Clearly define the critical features of the business improvement program;
- Use an established internal audit methodology that can be tailored to the specific needs of the business improvement program; and
- Ensure ongoing effectiveness of that particular program while supporting the requirements of ISO 9001:2000 in integrating continuous improvement features into the documented quality management system.

3.2.4 Benefits of Continuous Improvement

Juran (1989)³⁷ states that "the effects of a successful quality improvement project show up in the form of improved results – for example, greater saleability and lower costs". Povey (1996)³⁸ takes this concept further by measuring the benefits of continuous improvement as both tangible, having an effect on the bottom line, and intangible, by improving workplace morale. A continuous improvement initiative should therefore improve the organization's revenue as well as attitudes within the organization.

Buckler (1998)³⁹ proposes that management led performance improvement (via continuous improvement or innovation) will require behavioural change (changing what we do and how we do it), and that will require acquiring and developing new knowledge, attitudes and skills. Buckler (1998) also describes a continuous improvement system as a filter to trap learning data so that it can be transformed into knowledge and behavioural change that will ensure improvement.

³⁵ For more information on the Baldrige Criteria for Performance Excellence visit www.quality.nist.gov. Retrieved 12 September 2005.

³⁶ Warnack, M. (2003). Continual Improvement Programs and ISO 9001:2000. In *Quality Progress, March 2003*, 42-49.

³⁷ Juran, J.M. (1989). *Juran on Leadership for Quality: an Executive Handbook*. Free Press: New York.

³⁸ Povey, B. (1996). *Continuous Business Improvement: linking the key improvement processes for your critical long-term success*, McGraw-Hill: Berkshire, England.

³⁹ Buckler, B. (1998). Practical steps towards a learning organisation: applying academic knowledge to improvement and innovation in business processes. In *The Learning Organisation* 5, 1, 15-23.

3.2.5 Why Continuous Improvement Initiatives Fail

In his book 'Quality is Free' (1979)⁴⁰, Crosby notes that it is important for an organization to be ready for continuous improvement before it is implemented. He warns Improvement practitioners "people, who have put improvement programs of any kind into their company, always feel that others are not for it". In light of this, it is unsurprising that much is written about why Continuous Improvement initiatives fail. Povey (1996)⁴¹ notes that "change or improvement are too often used as a euphemism for job cutting".

The literature reviewed also included a following list of inhibitors to continuous improvement:

- Lack of commitment by some managers (Povey, 1996)
- Organizational empires (Povey, 1996)
- Lack of knowledge (Povey, 1996)
- Lack of resource (Povey, 1996)
- Resistance to change (Povey, 1996)
- Cross-company processes but functional organization (Povey, 1996)
- Lack of program effectiveness due to insufficient administrative oversight (Warnack, 2003)⁴²
- Gradual reduction of program visibility and focus (Warnack, 2003)
- Poor understanding of how the program will link to key processes and functions within the organization (Warnack, 2003)
- Missing or poorly defined requirements for program reviews (Warnack, 2003)
- Lack of management commitment (Russell, 2004)⁴³
- Failure to change a culture of shooting the messenger (Russell, 2004)
- Mind-set that conformance to specifications and procedures is enough (Russell, 2004)
- Mind-set that quality costs instead of creating wealth (Russell, 2004)
- Failure to prevent recurrence of problems (Russell, 2004)

⁴⁰ Crosby, P.B. (1979). *Quality is free: the art of making quality certain*, Penguin Books: Auckland.

⁴¹ Povey, B. (1996) *Continuous Business Improvement: linking the key improvement processes for your critical long-term success*, McGraw-Hill: Berkshire, England.

⁴² Warnack, M. (2003). Continual improvement programs and ISO 9001:2000. In *Quality Progress, March*, 42-49.

⁴³ Russell, J.P. (2004). 12 Ways to add value to audits. In *Quality Progress, June*, 78-84.

- Failure to find inputs to continually challenge the organization to meet higher competitive standards (Russell, 2004)
- Failure to involve people in the continual improvement process (Russell,2004)

The importance of management commitment is highlighted by the fact that all three authors include it in their list of inhibitors. Madu and Kuei (1995)⁴⁴ further point out that “a firm must undergo a transformation to change its traditional management approach to total quality management”, and that top management “must take the lead to instill quality into all the functional areas of a corporation”.

Sahney’s second law of quality progress has defined this as an equation (Sahney (1992) ⁴⁵:

“The quality progress accomplished in any organization is directly proportional to

- a) The square of (degree of senior management commitment in using the principles of TQM).
- b) The degree of all employees actually using the principles of TQM.”

Preece and Anthony (2002)⁴⁶ support this and expand that the missing link is often related to the lack of correlation between the organization’s strategy, which is almost always set by management, and the organization’s continuous improvement efforts.

3.3 Reward Systems

Some material reviewed discussed the effect of reward systems on the implementation of continuous improvement systems such as the one proposed in this thesis. A well-known adage states, “what gets measured gets done”⁴⁷. This is the strength of the Balanced Scorecard⁴⁸ business improvement model. It proposes that key performance indicators be assigned to assess the performance of critical areas of the business to ensure that the right results are being achieved, and that no area is being ignored at the expense of another (less critical) driver. It should be noted that by increasing

⁴⁴ Madu, C.N. and Kuei, C. (1995). *Strategic Total Quality Management: corporate performance and product quality*, Quorum Books: Westport.

⁴⁵ Sahney, V.K and Walden, G.L. (1992). Success and Management Leadership. In *Hospital Management International* (Yearbook), 176-180.

⁴⁶ Preece, D. and Anthony, J. (2002). *Understanding, Managing and Implementing Quality*, Routledge: London.

⁴⁷ Quoted by Tom Peters: Peters, T. (1986). ‘What gets measured gets done’, http://www.tompeters.com/col_entries.php?note=005143.

⁴⁸ Kaplan, R.S. and Norton, D.P (1996). *The Balanced Scorecard*. Harvard Business School Press: Boston, Massachusetts.

emphasis on critical areas, other less critical areas are likely to be neglected in terms of performance. Kerr (1975)⁴⁹ provides this explanation: “The formal reward system should positively reinforce (desired) behaviours, not constitute an obstacle to be overcome”.

One problem area that Kerr (1975) identifies is the lack of specification due to difficulty in quantifying delivery on objectives. While the organization may be hoping for employee effort in one area, which is hard to quantify, it is far more likely to receive effort in the areas it rewards. In an earlier paper, Kerr (1973)⁵⁰ describes this issue in relation to management-by-objectives (MBO) systems where employees are asked “to set challenging, risky goals, only to face smaller pay checks and possibly damage careers if these goals are not accomplished”.

Barnard (1964) captures the essence of the issue⁵¹ in his description of the “zone of indifference”. He states that “a person can and will accept a communication as authoritative only when..., at the time of his decision, he believes it to be compatible with his personal interests as a whole”.

Kerr (1975) uses the example of (possibly unintentional) reward systems existing in the Vietnam and Second World Wars to highlight and contrast their effect. In Vietnam, the soldiers knew that if you were injured you were sent home (the ultimate reward), whereas Second World War soldiers knew they would not be going home until the war was won. This significantly changed their behaviour. An application of this in the continuous improvement system might relate to non-conformances – a person is less likely to report a failure if he or she knows it may impact their bonus for the month or year.

⁴⁹ Kerr, S. (1975). On the folly of rewarding A, while hoping for B. In *Academy of Management Journal* 18, 4, 769-782.

⁵⁰ Kerr, S. (1973). Some modifications in MBO as an OD Strategy. In *Academy of Management Proceedings*, 39-42, reproduced in Ott, J.S. (1989) *Classic Readings in Organizational Behaviour*. Wadsworth, Belmont, pp.114-126.

⁵¹ Barnard, C.I. (1964). *The Functions of an Executive*. Harvard University Press, Cambridge: Massachusetts.

3.4 Plan-Do-Check-Act

Where continuous improvement initiatives are undertaken, almost all the literature reviewed indicated that the process followed was the Plan Do Check Act (PDCA) cycle or a derivative thereof. This may be attributed to the cycle adhering to the process involved in any decision to make a change, whether cooking a meal or building a castle.

The PDCA cycle is attributed to Shewhart, and is also referred to as the Shewhart Cycle. It was popularised by W. Edwards Deming (1982)⁵², who was a student of Shewhart. Followers of Deming sometimes refer to it as the Deming Wheel or Cycle.

In summary, the cycle suggests there are four steps to better processes:

- (1) Plan what you will do and how you will go about it
- (2) Do what you planned, the way you planned to do it
- (3) Check what you have done, how successful the process was, and how well it has achieved your goal
- (4) Act on any imperfections to smooth and improve the process

Many quality theorists use PDCA as the basic mechanism to drive quality improvement in the organization. Povey (1996)⁵³ describes the PDCA cycle, as “the basic building block for business improvement...It is so fundamental to improvement that all employees should be trained in its use (and the basic analysis tools that it utilises) The ultimate objective is for this approach of PDCA to become ingrained in the approach all employees bring to problem-solving.” Deming (1982) claims the PDCA approach is integral to achieving the final point of his 14 points of management – “Take action to accomplish (or put everyone to work to achieve) the transformation” (to Quality).

A number of variations on the PDCA cycle were found in the literature, including:

1. Houston and Lawrence (2004)⁵⁴ suggest that the Plan Do Check Act (PDCA), be followed by a Standardise, Do, Check, Act (SDCA) cycle.

⁵² Deming, W.E. (1982). *Out of the crisis*. Massachusetts Institute of Technology: Massachusetts.

⁵³ Povey, B. (1996) *Continuous Business Improvement: linking the key improvement processes for your critical long-term success*, McGraw-Hill: Berkshire, England.

⁵⁴ Houston, D. and Lawrence, K.A. (Eds.) (2004). *Quality Improvement Course 143.785 Notes, Study Guide 1*, Massey University, Palmerston North.

The purpose of the migration from PDCA to SDCA in follow-up phases would be to encourage the integration of improvements into the new “normal” process, before attempting to move on to the next cycle of improvements.

2. Platje and Wadman (1998)⁵⁵ suggest that the PDCA cycle, should in fact be thought of as a spiral, with the intention (similar to that presented by the SDCA model above), of ensuring that improvements become integrated while further improvement is considered, and to account for time.

Platje and Wadman (1998) also observe that in this theoretical framework, the cycle would never end but the size of the revolution should become increasingly tight as improvements occur. They suggest modifying the PDCA acronym to PIDCAM that is Plan, Implement, Do, Check, Assess/Act, and Management.

PIDCAM has two advantages from a project management perspective:

- By including both Implement and Do, it is possible to differentiate between the activities of the project manager, and the activity of the team in rollout;
- By including the Management phase, signoff of the current cycle, and approval for the next cycle, can be obtained to keep up the impetus of the continuous improvement effort.

3. Lee and Dale (2004)⁵⁶ offer yet another alternative to the PDCA cycle with particular reference to policy deployment, or Hoshin Kanri (having the target and the means), in the acronym CRISP – Catch, Reflect, Improve, Scrutinize, Pass which was originally developed by Mulligan et al. (1996)⁵⁷.

The process is summarised by Lee and Dale (2004) as follows:

“Essentially, CRISP entails each individual and team catching the policy, reflecting and improving upon it but, before passing the policy up and down the

⁵⁵ Platje, A. and Wadman, S. (1998). From Plan-Do-Check-Action to PIDCAM: The further evolution. In *International Journal of Project Management*, August, 16 (4), pp.201-209.

⁵⁶ Lee, R.G. and Dale, B.G. (2004). Policy Deployment: modelling the CRISP process, in *Total Quality Management and Business Excellence*, September, 214(7), 603-610.

⁵⁷ Mulligan, P., Hatten, K. and Miller, J (2004). From issue-based planning to hoshin: different styles for different situations. In *Long Range Planning*, 29(4), 473-484.

hierarchical chain, having their work scrutinized by the previous level to ensure that the reflection and improvement are in line with the original policy.”

4. Long (1992)⁵⁸ describes the PDCA cycle using the terms “Measure-Change-Measure-Make It Stick”.
5. The Service Design and Management Model presented by Ramaswamy (1996)⁵⁹ contains the four critical elements of the PDCA cycle, including:
 - Defining design attributes (P)
 - Specifying performance standards (P)
 - Generating and evaluating design concepts (P)
 - Developing design details (P)
 - Implementing the design (D)
 - Measuring performance (C)
 - Assessing satisfaction (C)
 - Improving performance (A)
6. The JUSE Seven Step Method of Process Improvement described in Rao et al. (1996)⁶⁰ is an expanded version of the PDCA cycle.
 - Select and describe the problem (P)
 - Study the present system (P)
 - Identify possible causes (P)
 - Plan and Implement Solution (D)
 - Evaluate Results (C)
 - Standardise the solution (A)
 - Reflect on process and develop future plans (...P)

² Long, A. (1992). *The Manager's and Supervisor's Guide to Continuous Improvement*. Alan Long Quality Pty Ltd: Diamond Creek.

³ Ramaswamy, R. (1996). *Design and Management of Service Processes*. Addison-Wesley Publishing Company, Massachusetts, 46-48.

⁴ Rao, A. et al. (1996). *Total Quality Management: a cross functional perspective*. John Wiley & Sons, New York, 199-203.

3.6 Learning Organizations

Senge (1990)⁶¹ describes the implementation of quality control and total quality management as underpinning the first phase of a learning organization. Wang and Ahmed (2003) further note that the philosophies of total quality management and learning organizations are mutually dependent. "Organizational learning is an intended outcome of TQM as there is correlation between process improvements and organizational learning. Continuous improvement is aimed to achieve incremental innovation, therefore the learning organization dedicates to incremental innovation through effective learning mechanisms"⁶². They describe three levels of learning mechanisms:

- Single loop learning – learning what is wrong
- Double loop learning – learning how to fix what is wrong
- Triple loop learning - questioning existing products, processes and systems to find areas of failure, and asking how the organization should adapt strategically for the future market place in light of what has already been learned.

The PDCA cycle represents a method of learning that uncovers what is, or is not, going to plan, and how that plan could be improved. However, as Murray and Chapman (2003)⁶³ comment, "while the continuous improvement concept promotes constant refinement and improvement (e.g. Deming's Plan, Do, Check, Act cycle), this is more at a basic level of organizational learning – behavioural routines and learning actions are more consistent with the step by step approach". This is described as adaptive learning.

Murray and Chapman (2003) argue that continuous improvement initiatives are hampered by a one-dimensional approach to developing capabilities because they focus on one way of learning. As an improvement, they suggest that a multiple approach to learning should be adopted to add a new dimension to the framework. This is referred to as 'unbounded learning', which encompasses both adaptive and generative learning techniques, as well as allowing the development of capabilities and

⁶¹ Senge, P. (1990). The leader's new work: building learning organizations. In *Sloan Management Review*, 32, 1, 1–23.

⁶² Wang, C.L. and Ahmed, P.K. (2003). Organizational learning: a critical review. In *The Learning Organization*, 10, 1, 8-17.

⁶³ Murray, P. and Chapman, R. (2003). From continuous improvement to organizational learning: developmental theory. In *The Learning Organisation*, 10, 5, 272-282.

flexibility in style of learning (dependent on the situation) to accommodate changes within the culture and environment. Generative learning would include doing continuous improvement on the continuous improvement system, having continuous improvement as the dominant way of life and turning the organization into a learning organization.

Giesecke and McNeil (2004)⁶⁴ describe a learning organization as one that is “skilled at creating, acquiring, and transferring knowledge and at modifying its behaviour to reflect new knowledge and insights”. When Senge (1990)⁶⁵ introduced the idea of learning organizations, he proposed that the most successful corporations would be learning organizations because “the ability to learn faster than your competitors may be the only sustainable competitive advantage”.

Love et al. (2004)⁶⁶ propose that there are three distinctive yet interrelated elements of a learning organization – actions, mindset and a learning environment - with the greatest obstacle being the effective transfer of knowledge.

Buckler (1998)⁶⁷ proposes a six-stage learning model: Ignorance, Awareness, Understanding, Commitment, Enactment, and Reflection. He also describes four requirements managers must define to provide a focus for learning activity:

- Variation/Data Analysis – how can we measure performance and capability of our business system?
- People/Psychology – how do our mental models affect our team’s behaviour and us?
- Learning/Knowledge Acquisition – how do people learn?
- Systems/Process – what is meant by systems thinking, and how can we implement it?

Murray and Chapman (2003)⁶⁸ write, “in comparison to total quality management, the learning organization is a knowledge-based company that continually challenges the

⁶⁴ Giesecke, J. and McNeil, B. (2004). Transitioning to the Learning Organization. In *Library Trends*, 53, 1, 54-67.

⁶⁵ Senge, P. (1990). *The fifth discipline: the art and practice of the learning organisation*, Century Publishing: London, 4.

⁶⁶ Love, P.E.D., Huang, J.C., Edwards, D.J. and Irani, Z. (2004). Nurturing a learning organisation in construction: a focus on strategic shift, organizational transformation, customer orientation and quality centred learning. In *Construction Innovation*, 4, 113-126.

⁶⁷ Buckler, B. (1998). Practical steps towards a learning organisation: applying academic knowledge to improvement and innovation in business processes. In *The Learning Organisation* 5, 1, 15-23.

way it learns by constantly scanning both the internal and external environment". Systems' thinking provides one way of scanning this environment.

The literature read on learning organizations, caused the writer to perceive an interaction between the PDCA cycle (as the core process in TQM) and Buckler's six stage learning model (described above) as illustrated in the figure below.

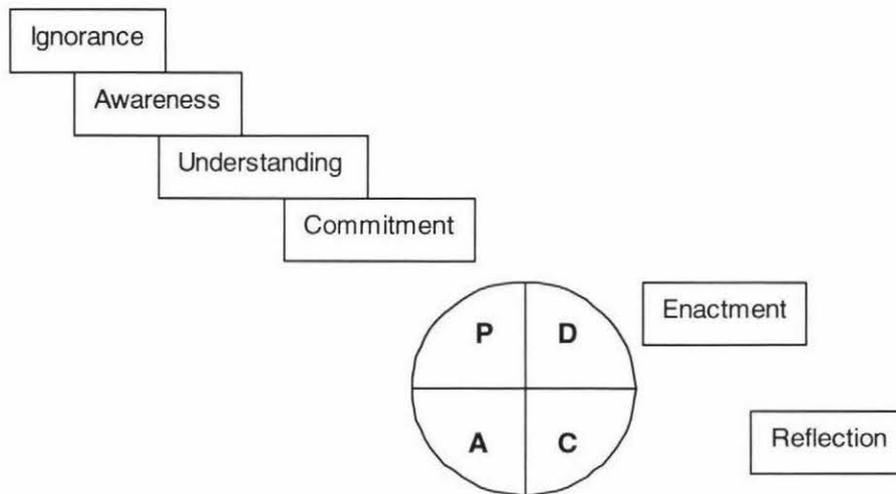


Figure 1: Connecting Bucklers' Six-stage learning model and the PDCA cycle.

3.7 Systems Thinking

Ackoff (1991)⁶⁹ describes a system not as the sum of its parts, but rather as the product of their interactions. This relates very well to the model proposed by Flood (1993)⁷⁰, who describes systems thinking as looking through a microscope using different filters or metaphors. The filter, or metaphor used, enables the viewer to focus on a particular set of organizational issues and enables the participants to see threats and weaknesses that would otherwise be hidden. Each filter assumes that an organization is a particular type of system and will thus result in different methods of dealing with perceived issues.

⁶⁸ Murray, P. and Chapman, R. (2003). From continuous improvement to organizational learning: developmental theory. In *The Learning Organisation*, 10, 5, 272-282.

⁶⁹ Ackoff, R. (1991) *Ackoff's Fables: Irreverent reflections on business and bureaucracy*, John Wiley & Sons: New York.

⁷⁰ Flood, R.L. (1993) *Beyond TQM*, John Wiley & Sons: Chichester, England.

Flood describes five main metaphors: -

- mechanistic (a closed system)
- organic (a living system)
- political (a power system)
- cultural (a family)
- brain (a cybernetic system)

Extending this filter example, Flood presents an approach called Total Systems Intervention (TSI) which relies on accepting and fully understanding a problem faced by management, through use of a filter, and using a variety of tools to address it. Total System Intervention has three phases:

- The creativity phase – during which the metaphors described above are applied to the business to enable creative learning about it and the dominant metaphor, is selected.
- The choice phase – during which tools or methods are selected that will be most effective in intervening in the characteristics the metaphor has highlighted.
- The implementation phase – where the tools and methods are applied and intervention in the system occurs with the result that coordinated change is made in those aspects of the organization required to ensure its efficient and effective functioning.

Total System Intervention and the use of metaphors enable management to make an informed choice of which methods will be most effective in dealing with a set of organizational issues. Flood (1993)⁷¹ notes that it is important not to just implement the changes but also to ensure that the system remains viable – that it will continue successfully without unravelling. Stafford Beer (1981)⁷² was the champion of the philosophy of a Viable System Model (VSM), which he called ‘the brain of the firm’.

Flood (1993) asserts that the Viable System Model “results from a well-crafted approach to organising five main management functions as a viable system-in-focus” along with a hierarchical system called ‘recursion’. Recursion highlights that the VSM currently in focus is a subsystem of a larger VSM not currently being focussed on, and similarly has its own subsystems, which are equally not being focussed on.

⁷¹ Flood, R.L. (1993). *Beyond TQM*, John Wiley & Sons: Chichester, England.

⁷² Beer, S. (1981). *The Brain of the Firm*, Wiley: Chichester, England.

The five management functions are: Policy, Intelligence, Control, Coordination and Implementation. All management information is dealt through these functions. Flood (1993)⁷³ writes, “each function of the VSM contributes to attaining viability, and it can be argued, viability depends on the management process being carried out employing a quality approach. In other words, quality and viability are complementary concepts in management”. This last point is of particular interest as one can see the PDCA as representing the activities in a continuous improvement system, while the VSM presents the management of the activities. Figure 2, below, illustrates.

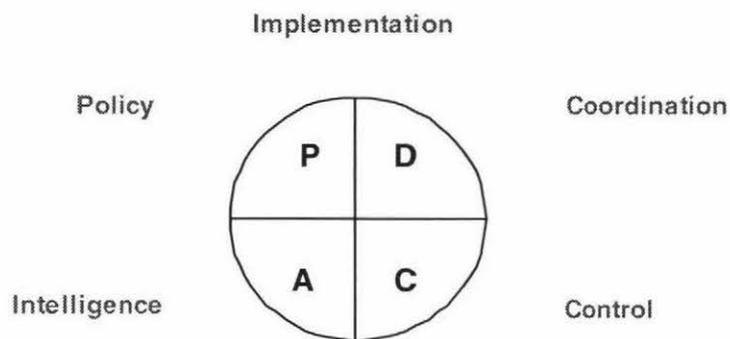


Figure 2: Connecting VSM management functions to the PDCA cycle.

Thus, the PDCA cycle requires the system in which it operates to be viable if it is to produce worthwhile results. If an organisation plans, carries out, checks and further refines (acts) on an issue where the greater system is unstable, badly managed or not viable there is unlikely to be traction for the proposed changes - and even if there is, these changes may worsen the situation rather than improve it.

In section 3.6 of this thesis, a correlation between PDCA and organizational learning has already been described - the PDCA cycle springs from consciousness arising in triple-loop learning (evaluating why we do what we do in the way we do it) and seeking to improve it (the commitment phase of Buckler's⁷⁴ six-stage learning model). If there is an interrelationship between PDCA, representing the process of total quality management (TQM) and models for organizational learning; and there is an interrelationship between PDCA as the action part of the continuous improvement cycle, the total system intervention model and the associated viable system model; then it

⁷³ Flood, R.L. (1993). *Beyond TQM*, John Wiley & Sons: Chichester, England.

⁷⁴ Buckler, B. (1998). Practical steps towards a learning organisation: applying academic knowledge to improvement and innovation in business processes. In *The Learning Organisation* 5, 1, 15-23.

must be possible to draw the interrelationship of the three processes. This is what the writer has attempted to illustrate in figure 3 below:

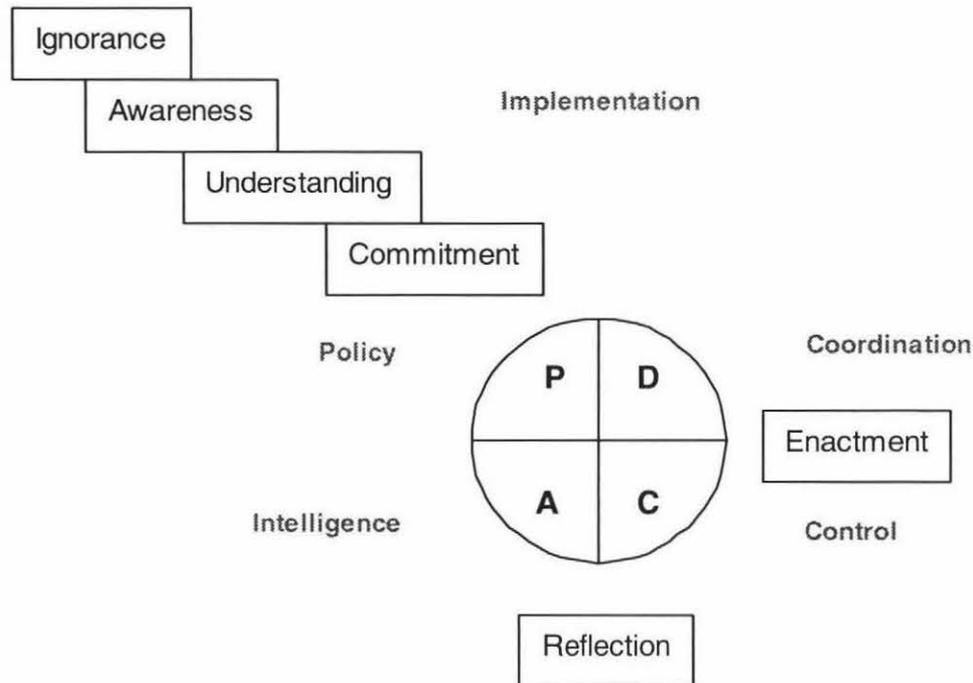


Figure 3: Correlating Butlers' Six-stage learning model and VSM management functions to the PDCA cycle.

3.8 Summary of Findings from Literature Review

This literature review provides a definition for total quality management and discusses dimensions of quality. Amongst other things, the dimensions have highlighted the importance of including a customer perspective in improvement systems.

Continuous improvement has been defined and its characteristics have been noted. In addition, the importance of continuous improvement has been considered, along with the benefits it brings and reasons for the failure of some continuous improvement initiatives.

The application of the Plan-Do-Check-Act Cycle to continuous improvement initiatives has been considered, as have alternatives to the PDCA cycle such as CRISP, the JUSE seven-step model and reworking of the cycle (PIDCAM). This has resulted in a deeper understanding of the content of the phases of the PDCA cycle, and the phases that an effective continuous improvement process should contain.

Learning organizations and organizational learning theories have been considered as ways to extend the value of continuous improvement and the PDCA cycle. Systems thinking has also been considered as a driver for such a system.

The literature reviewed provided little direct practical help in developing the electronic system that was proposed as part of this thesis. It has, however, confirmed the importance of continuous improvement, provided insights into the PDCA cycle and extended understanding of how to make improvement continuous through learning organization and systems thinking theory. The literature also signalled difficulties with the implementation of continuous improvement systems – a fact that this thesis confirms.

4. Research Methodology

In conducting the research for this thesis, the following steps were followed:

Topic selection
Refine the topic options
Literature Review
Scope the solution
Define the project process
Find and assess existing products
Design and implement the solution
Describe the findings
Discuss the outcomes
Draw conclusions

The process followed in each of these steps is described briefly below.

4.1 Topic Selection

In considering a topic for this thesis, the writer decided that the subject had to:

- be something pertinent to quality assurance as it is currently applied;
- produce something which would add to the body of knowledge on quality;
- be something the writer could study within the organization in which she was based;
- add value to that organization;
- be a manageable size; and
- relate to an area of quality on which some literature had already been written.

4.2 Refine the Topic Options

Once a few possible subjects had been selected, they were graded according to the selection criteria stated above. The criteria were weighted according to their importance and ideas were assessed for their strengths, weaknesses, opportunities and threats, as applied within the organization. For example, unless the topic could be

studied within the organization, research would be almost impossible to perform. If the topic did not add value to the organization, the study would have little hope of succeeding or even of being completed.

4.3 Literature Review

Once the preferred topic had been chosen, literature was reviewed to establish how other organizations had dealt with similar issues. The review also looked at previous examples of continuous improvement systems and the systems underlying them, such as the PDCA cycle or reward systems, and systems flowing on from them, such as total system intervention and learning organization.

4.4 Scoping the Solution

In order to scope the solution, it was necessary to establish first what the shortcomings of the current continuous improvement systems were and to establish what was not going to plan, so that an ideal solution could be scoped to deal with ongoing issues. To this end, the writer completed an analysis of the strengths and weaknesses of the current systems, and examined current and potential opportunities and threats. This type of analysis is called a SWOT analysis.

4.5 Define the Project Process

To ensure that the project was thoroughly researched before implementation, and that the result would be robust, the organization's existing system development methodology was adopted. This involved six phases from idea conception and preliminary analysis through the design and definition phases to implementation.

4.6 Find and Assess Existing Products

Local suppliers were approached to establish what appropriate products were available, and an internet search was completed to find what other alternative systems existed

that could provide the solution, or contribute to its effective implementation. The resulting options were assessed with the most appropriate three analysed in depth.

4.7 Design and Implement the Solution

The design and installation of the solution took the form of a project, which is the major body of work written up in this thesis. There are six stages to this project, including: Idea Conception, Preliminary Analysis, System Architecture, Functional Design, System Construction and Implementation. Details of how this was done are outlined in more detail the project methodology section of this document.

The balance of the research required is documented in this thesis.

4.8 Describe the Findings

The findings of the project process are documented.

4.9 Discuss the Outcomes

The outcomes of the project are discussed and points of learning were described.

4.10 Draw Conclusions

A summary and discussion reflecting similarities and differences to reviewed literature are provided.

5. Project Methodology

The following method was used to develop the project work associated with this research.

5.1 The Project Team

The project to develop the new system was proposed by the writer (who was the Librarian), sponsored by the Executive Representative for Quality with the support of the Quality Team, and assisted by a Systems Analyst, the Applications Development Manager and others from around the organization who were called on as their assistance was required. The majority of the project work was completed by the writer and the systems analyst.

5.2 The System Development Lifecycle

This process was designed by the Applications Development Manager and was used by the quality improvement project team to ensure that the project remained on track and was appropriately documented. This is the standard process for designing new software systems in the organization. It contains six phases, described in Figure 4, below.

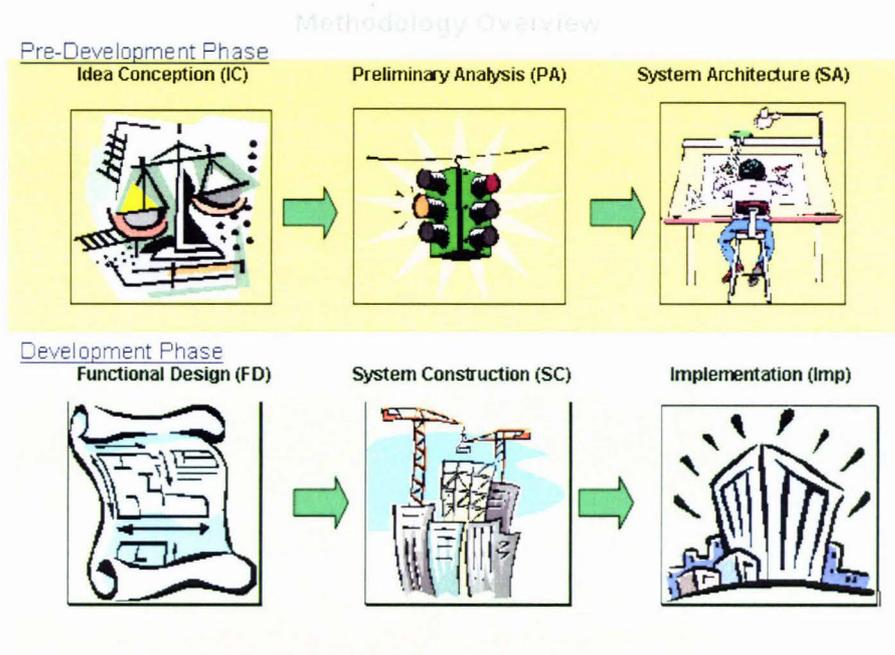


Figure 4: The System Development Methodology used in this project.

5.2.1 Idea Conception Phase (IC)

This phase introduces the proposed idea in sufficient detail in effort to gain support for a preliminary analysis of the opportunity to take place. The output of this phase comprises of a short paper, less than 10 pages long, giving background and describing the problem and issues that need addressing. It should also highlight risks and constraints, and include a request for permission, and a budget to proceed to the preliminary analysis phase of the project.

5.2.2 Preliminary Analysis Phase (PA)

During the Preliminary Analysis phase, the idea proposed in the Idea Conception phase is analysed in sufficient detail to establish whether development cost to the organization is justified. This phase includes considering:

- the current system,
- the objective of the proposed new system,
- the alternatives that might exist,
- how the system will integrate into the organization,
- how the new system will work with other existing systems,
- the costs versus the benefits of implementation for the organization

The result of this phase is a report providing a recommendation to those who will consider approving the project for development. Once approval to proceed is achieved, design can begin in earnest.

5.2.3 System Architecture Phase (SA)

This phase defines the software architecture requirements of the system. It provides rules and standards governing the development and operation of the system, as well as outlining the overall functioning of the system. The purpose of this phase is to ensure that software requirements are clearly defined. Additionally, further analysis completed in this phase sharpens the previously estimated investment.

5.2.4 Functional Design Phase (FD)

As indicated in the title, this phase includes the detailed design of functionality required in the system from a user perspective. At the end of this phase, and with the information from the system architecture phase, the software developers should have all the information they require to design the new system, or to adapt an existing product, to meet the needs of the organization. The output of this phase includes detailed documentation on each part of the system and its requirements, an outline of

the requirements for implementation in terms of resources and training, as well as a timeline.

5.2.5 System Construction Phase (SC)

This phase could also be called the Build phase as it is in this phase that the data and process models are built. In this phase, the prototype is extensively tested prior to release to verify that functional design and system architecture requirements are met by the new system. In addition as a part of this phase, documentation is also prepared for implementation and includes user guides; training material; work instructions for installation and maintenance; and program manuals providing details on the design and modification of the system. The requirements of this phase result in a live electronic system and documentation to support it. This phase transforms the plans for a new system into reality.

5.2.6 Implementation Phase (IMP)

This is the final phase of the project. In this phase, the new system is released into production. It may be released initially to selected users so that final verification can occur and work instructions and training can be tweaked. Once verification is complete, the system is ready to be rolled out to the whole organization. Finally, the new system is accepted as complete by the sponsor and the project is closed.

6. Scoping the New System

At the beginning of this project, the organization already had an electronic non-conformance control system. However, the system was unstable and the writer had recommended that it should be replaced and extended to include other continuous improvement functions.

6.1 Phase 1: Idea Conception Phase (IC)

To gain approval for the project, it was necessary to sell the idea to key people in the organization so that support would be forthcoming. This involved presenting the Quality Team with a short paper that indicated the proposed idea, benefits and costs, for approval. The paper was three-pronged – looking at the value of change, the need for change, and ideas presented as a solution.

6.1.1 The Value of Change

The paper indicated how the proposed continuous improvement system would add value to the organization. The proposed system would:

- assist the organization in achieving its vision “to be a world-class, agile, customer-intimate wireless solutions company that connects and unites people”;
- assist the organization to sustain its certification to ISO 9001, which is considered a requirement of the business. The updated ISO 9001 standard, released in 2000, requires certified organizations to have effective mechanisms for dealing with continuous improvement initiatives;
- support other company continuous improvement initiatives such as the Baldrige Criteria for Performance Excellence⁷⁵, and the Balanced Scorecard⁷⁶;
- seek to be a one-stop-shop for continuous improvement activities;

⁷⁵ For more information on the Baldrige Criteria for Performance Excellence, visit www.quality.nist.gov. Retrieved 12 September 2005.

⁷⁶ Kaplan, R.S. and Norton, D.P (1996). *The Balanced Scorecard*. Harvard Business School Press: Boston, Massachusetts.

- enable the effective follow-up of recommendations arising from improvement activities; and
- enable a much higher level of organizational learning because both issues and suggested improvements would be recorded in a central place and could be analysed.

6.1.2 The Need for Change

The need to change from the status quo was the second aspect that needed to be presented to the decision makers.

The installation of the electronic non-conformance control system had:

- improved the perceptions regarding the value of reporting non-conformances;
- provided safety through value checks to prevent internal witch hunts and backbiting; and
- shown the value of investigating what went wrong and how to prevent recurrences.

The organization was, however, slow to make, or to record having made, changes that were results of recommendations. This, together with frustration at the slowness of the electronic system and the maintenance involved, resulted in the dwindling of confidence in the effectiveness of the electronic non-conformance control system in spite of a positive (50%) initial improvement.

A review of the electronic non-conformance control system six months after its installation in June 2002 included the following recommendations:

1. The non-conformance control system should be transferred from Microsoft Excel to another software platform that is able to handle cross-functional databases (such as Microsoft Access). This will provide additional functionality, simplified programming and improved speed for users. It will also require less LAN space and minimise maintenance activity.
2. The reporting function should be added once the system is converted to the new software platform so that better analysis can be done. The lack of a relational database has made the creation of reports extremely difficult.

3. The new system should be extended to include customer feedback and complaints, especially as these processes interface closely with the non-conformance control system.
4. The new system should be extended to allow the separate viewing, sorting and analysis of recommendations. The action taken on recommendations is still the slowest part of closing out non-conformances.
5. Only when the system has been moved to the new software platform, should audits and customer feedback be integrated to create a single continuous improvement system.
6. Audits by external parties could also be successfully included in this single system.

These recommendations hint at, but do not spell out, one inherent problem with the old system – the current software was not appropriate given the requirements and constraints of the system. The result was that the system was unable to fulfil all the requirements set out in the original scope, was clumsy and expensive to run in terms of time and space. This led the project team to perceive choice of software platform as critical to the success of the new system.

6.1.3 Ideas for a Solution

Once the a need for change was established, the third aspect of the paper presented to decision makers was the proposed solution to the shortcomings of the current system and additional benefits arising from new ideas. The proposed solution was to create a new electronic system that would incorporate matters relating to all continuous improvement activities, not just to non-conformance control. It would include audits (internal and external, scheduled and spontaneous), non-conformance control, customer complaints and customer feedback. The new system would need to be based on a cross functional database, or on a workflow system (that incorporates cross functionality), so that it could manage the interrelationships between various processes, manage different phases and produce intelligible data for analysis.

The integrated electronic system would be easy to use and be available electronically to all colleagues at speeds that enabled even remote colleagues to use the tool effectively. It would also provide reminders to colleagues whose action was awaited. The system would include the logging, assessment and action stages so that

continuous improvements initiatives would not fail part way through the process. The solution would enable electronic record keeping so that reports could be effectively generated and trends could be analysed, with further learning conveyed to other parts of the organization. The system would require far less maintenance and setup time for the administrator, and the planned automation features would speed up other parts of the process.

6.1.4 SWOT Analysis

The following strengths, weaknesses, opportunities and threats were defined at this stage.

Strengths

Speed for users
Easy to use and maintain
One place for all continuous improvement activity
Prompts to keep the system moving
Ability to do analysis

Weaknesses

Requires investment of time
Requires investment of money
Requires buy-in of organization

Opportunities

Eliminate cost of rework
Reduce repetitive errors
Save money
Software purchased will be useful for the whole organization
Organizational learning

Threats

Competition for investment
Projects will be marginalised, as it does not directly affect customers

6.1.5 Other Requirements

The paper that was presented to decision makers did not have a section on other requirements. It is worth noting that there are always unspoken, intuitive requirements (such as documentation) which are often missed because involved parties assume that they are included. In addition to these requirements, there were also software and interface requirements that were only discovered as the project progressed. Finally, there was the requirement for approval to spend a budget of time and money to progress the project to the next stage, that is, to complete the Preliminary Analysis of the opportunity presented.

A copy of the paper that was finally presented is attached as Appendix A.

6.2 Phase 2: The Preliminary Analysis

Having received support to investigate the idea further, the next step was to complete a preliminary analysis of the proposed system in adequate detail to establish if the benefit will justify the cost to the organization. Essentially, this is an extension of the Idea Conception phase where proof of concept for the project is tested. In this phase, the model is described, some detail provided, and feasibility is considered. The preliminary analysis phase is completed with a recommendation and a request for conditional approval of, and funding for, the project.

6.2.1 The conceptual model

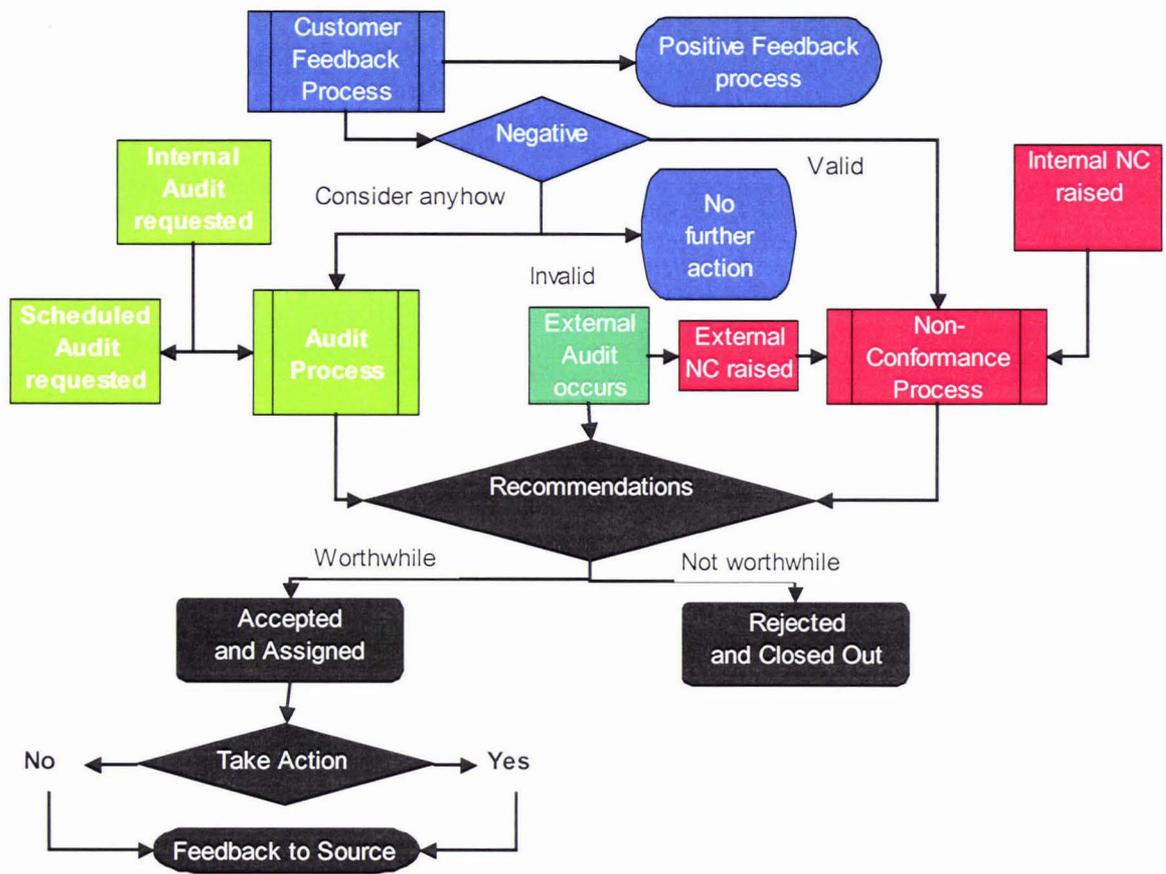


Figure 5: Flowchart of the conceptual model for continuous improvement in the organization.

The flowchart in figure 5 provides a high-level model indicating how the various continuous improvement processes in the organization will be combined into a single system. The shapes used at each stage in this flowchart, and in other figures, in this thesis have defined meanings to programmers. A legend is provided as Appendix B. The flowchart also shows the complexity of the interrelationships between parts processes. Four different colours have been used to highlight the different processes, which are discussed in further detail below.

6.2.1.1 Customer Feedback (Blue)

This process consists of both positive and negative feedback. Although positive feedback may have little value in terms of helping the organization continuously improve, it is worth including it in the system because:

- It illustrates how the organization can delight customers
- It allows all customer feedback to be recorded together for future analysis
- It provides balance to the continuous improvement system by providing some “good news” along with the bad news (where improvement is needed).

Negative feedback requires a rapid and appropriate response from sales as well as further investigation within the organization (the latter takes place through the non-conformance control process). By considering each customer complaint as a possible non-conformance, the organization can learn if their process can improve, even in case of failing to deliver contractually.

6.2.1.2 Internal Audits (Light Green)

Internal Audits may be initiated spontaneously or as regular checks. For example, a manager might awake at 3am due to concerns that some aspect of the business is not occurring, as it should. The next morning, the manager requests an audit to check that good processes are being followed. This is what we refer to as a spontaneous audit. In contrast, regular audits should be done on key processes or items in the manager’s area. Regular audits that occur at defined intervals are thus referred to as scheduled audits. Maintaining a schedule of (regular) audits is one of the requirements of ISO 9001.

Audits must be perceived as a system of checking to ensure that things are going right, and not emphasize finding where things are going wrong. To gain the full benefit, an audit should do more than merely state the results; it should also consider alternative methods, remark on areas of weakness, and be used to discover and suggest improvements to process.

6.2.1.3 External Audits (Dark Green)

External audits are conducted by third parties checking the organization’s performance to regulations such as Health and Safety and standards as with ISO 9001 for Quality. They may also be required to check the organization’s financial processes, or its ability to deliver to customer’s requirements.

Any of these audits could result in recommendations being made to the organization, and capturing these in a single continuous improvement system will enable the organization to effectively track their progress and analyse the nature of the requested changes so that maximum learning can be achieved from each suggestion.

6.2.1.4 Non-Conformances (Red)

When a mistake is made, the non-conformance control process is used to investigate the root cause of the problem and recommend corrective and preventative action for the future. Non-conformances need not arise internally; they may be raised by customers (through a customer complaint) or through internal or external audits.

The non-conformance control process can be initiated by anyone within the organization. To prevent the system being misused by those wishing to get back at other colleagues, all suggested instances of non-conformance must be assessed by a general manager (of the area who is perceived to be at fault), and the results of the process be made available to any colleague in the organization. This provides a safety net to ensure that the system is not used as a weapon to cause division, and that the issue at the centre of the non-conformance is worthy of investigation. The General Manager's decision on whether or not to proceed is based on a risk assessment, which considers impact to reputation, risk, profitability and legal issues. If the General Manager considers that an investigation is worthwhile, s/he selects a suitable investigator who submits their resulting report to the General Manager for approval before it is made available to the rest of the organization. This provides a second safety net to ensure the process is used the right way. The General Manager is also responsible for considering all recommendations arising from a non-conformance investigation. These can be accepted and assigned to be actioned, or rejected, as s/he sees fit.

6.2.1.5 Recommendations (Black)

Recommendations for change can arise from any audit or non-conformance. It was proposed that all recommendations should be handled through the continuous improvement system so that:

- they can be easily found by colleagues required to take action,
- their relevance to other areas of the business can be considered, and

- they can be used to identify trends and more widespread issues that needed addressing.

The manager receiving a report containing recommendations may reject them (with explanation) or accept them (and assign them to an individual to carry out). If a recommendation made by an external party is rejected, the degree of explanation required is far greater and is sometimes disallowed.

6.2.2 System Considerations

There were three aspects to be considered in this section:

What alternative systems were available?

How would such a system fit into the organization? and

What was required of these systems to provide the functionality needed for the project?

6.2.2.1 Alternative Systems

Research done on the internet and within the local market revealed that there were no systems that dealt specifically with continuous improvement in an intuitive way. Some software (eTQM)⁷⁷ existed for use in applying Total Quality Management systems, but seemed to focus on a manufacturing environment and thus did not provide a viable alternative. It was also based on ISO 9001:1994, which is less continuous improvement focused and is out of date as the most recent version of ISO 9001 is the 2000 edition. Other software was based on the Remedy system, which is built on an Oracle platform. This had possibilities as the organization runs its financial systems on Oracle. Similarly, workflow software was found that could be based on Novell's GroupWise product, the basis of the organization's operating system at the time. Finally, a business process management system called xSol⁷⁸ was found and its functionality seemed to fit superbly both with the system the Quality Team was trying to implement, and with another profit centre in the organization that was looking for a similar product. xSol's system also worked like a workflow system, in fact, there seems to be little difference between workflow systems and business process management systems.

6.2.2.2 Organizational Fit

Of the products investigated, three products showed promise in terms of organizational fit. They were Novell, xSol and Remedy products. The quality improvement project team thus arranged to meet three vendors of these products to assess the suitability of their product as a solution to the problem being resolved.

6.2.2.3 Evaluation Criteria

Creating the evaluation criteria originally required a simple check sheet. At this stage, this grew to be a 20-page document with five categories. The criteria were divided into the following categories:-

⁷⁷ See www.etq.com for further information on this product

⁷⁸ See www.xsol.com for further information on this product

Cost – 11 requirements including setup, training and documentation costs as well as purchase, support, maintenance and annual software charges.

Functionality – 21 requirements including workflow, notification, and reporting requirements as well as administration and user requirements.

Interfacing – 6 requirements including the systems with which the Quality Improvement System would have to interface, such as email, Microsoft Office applications, and other work management systems within the organization as well as the online Quality manual.

Technical – 10 requirements including considerations such as platform, licensing, hardware, location, speed and availability as well as future-proofing requirements.

Vendor – 6 requirements including requirements of us as a customer, such as ensuring the organization had local representation, was financially stable, provided ongoing support and has the staff to do so. It also covered aspects such as referee checks and ensuring that we would be obtaining fully tested and released software (i.e. no alpha or beta prototypes).

An example the cost criteria category is attached to this thesis as Appendix C.

6.2.2.4 Scoring Evaluated Vendors

The requirements in these categories were classified as mandatory, desirable or optional on a scale of one to five (where 1 is low). This gave an inherent value to each item against which our perception score could be compared to establish ability and compliance. To provide weighting to mandatory items, each classification grade was multiplied by a different denominator. The score of mandatory items was multiplied by three, desired items by two, and optional items by one.

A very important mandatory item - such as that the vendor's product was accessible to all the organization's offices - would get a score of 5 under mandatory, but in the final calculation would have a value of 15 (5 x 3), while a highly desirable item (scoring 5 under desired) would have a score of 10 (5 x 2) in the final calculation. This meant that

we could calculate a “perfect” score against which to evaluate the performance of a vendor’s proposed solution.

An example the cost criteria category assessment sheet is attached to this thesis as Appendix D.

6.2.2.5 The Evaluation Process

Each of the short listed vendors were provided with a copy of the evaluation criteria (they had already been given an overview of what was required), and were given a couple of weeks to prepare a presentation to demonstrate how their product would deliver on the requirements listed. All three Quality Improvement Team members attended the first two vendor evaluations.

The first vendor interviewed supported the Remedy (Oracle-based) product. Their presentation demonstrated that what was desired was possible, but the GUI (General User Interface – that is, the screen users would see) was poor. The result risked looking unprofessional, raising concern within the quality improvement project team that this would undermine the new system before it had a chance to prove itself. It also required the purchase of Crystal Reports (not a cheap requirement), and programming costs would drive the price above \$40,000. This is significantly more than the quality improvement project team hoped the new system would cost.

The second vendor to be evaluated represented a product which could be based on Novell (the product on which the company’s IS architecture was built at that time). They presented an extremely slick presentation, and proved that their solution was more than capable of delivering an effective system that met, or exceeded, requirements. It was also intuitive, easy-to-use and could be adapted to many different uses throughout the organization. Their cost was also about \$40,000.

The third vendor was based in Auckland, as was the candidate who had been earmarked as the project’s system architect and programmer of the new continuous improvement system. The criteria and results were therefore forwarded to him to approach the third vendor and complete the evaluation. Indications were that this third product was at least equal to the second product evaluated, and that it would cost less.

Once this was complete, a recommendation could be made as to which vendor was preferred.

At this stage, a few significant events occurred:

- The regular quarterly quality team meeting took place. The quality improvement project team's findings to date were presented to the quality team, and approval to proceed was again received from the quality team and from the project sponsor (the Executive Representative for Quality).
- It became evident that a Capital Expenditure Request would need to be processed promptly if the project was to be given clearance to proceed in the next financial year. Budget was earmarked for the project, and applicable forms were thus prepared for submission. See Appendix E for further detail.
- Before the Capital Expenditure Request was submitted to the management team, discussion with the enterprise architect revealed that there was another area in the organization that was also eager to implement a work management system. This team was a profit centre instead of a cost centre, so money channelled to them could possibly be recouped, rather than remain an unrecoverable overhead cost to the organization.

This led the quality improvement project team to delay the submission of a separate request for funding although the amount involved had already been signalled to the company accountant. It was decided that it would be better to produce a single, combined business case for the workflow software both teams required rather than two weaker business cases. The other team (SMC) undertook to follow up and submit the business case as soon as practicable. The draft prepared by the quality improvement team was used with the documentation the quality improvement project team had prepared in their final request document.

With the software decision out of the hands of the Quality Improvement Team, attention was diverted to the next stage of system development – the design of the System Architecture.

6.3 Phase 3: The System Architecture Phase

The purpose of the system architecture phase is to define the overall functioning of the system, as well as the rules and standards that will govern development and operation. During the system architecture phase, issues concerning the system are clarified and eliminated where possible. This phase includes completing the data and process model(s), defining the functional and physical configuration required, and documenting the architecture guidelines. At the end of this phase, a final cost/benefit check is conducted before the project is handed over to a system developer for construction.

The process model defines the actions required to achieve the desired result. The data model describes the information “bytes” that need to be collected as part of the actions described in the process model. The functional configuration describes how the system must be built to achieve the functions desired by the business (how it will look and work for the user). The physical configuration is the detailed technical design of the ‘nuts and bolts’ of the system.

The architecture guidelines are documented by an enterprise architect or a systems architect - someone who fully understands the company’s technical infrastructure and how the system should operate to achieve optimum performance.

6.3.1 The Process Model

The process model maps each part of the conceptual model in greater detail. It is not only a flowchart, but has documents that sit behind the flowchart to explain the role and connections of each part of the process. To complete this phase, detailed flowcharts were completed for each part of the continuous improvement process (i.e. for audits, customer feedback, non-conformances and recommendations). The flow charts were then explained in greater detail through the provision of written material describing each step in detail.

Figure 6 is an example of the audit set-up as part of the continuous improvement process that has been described in a detailed flowchart.

Phase 1 - Setup/Create Audit

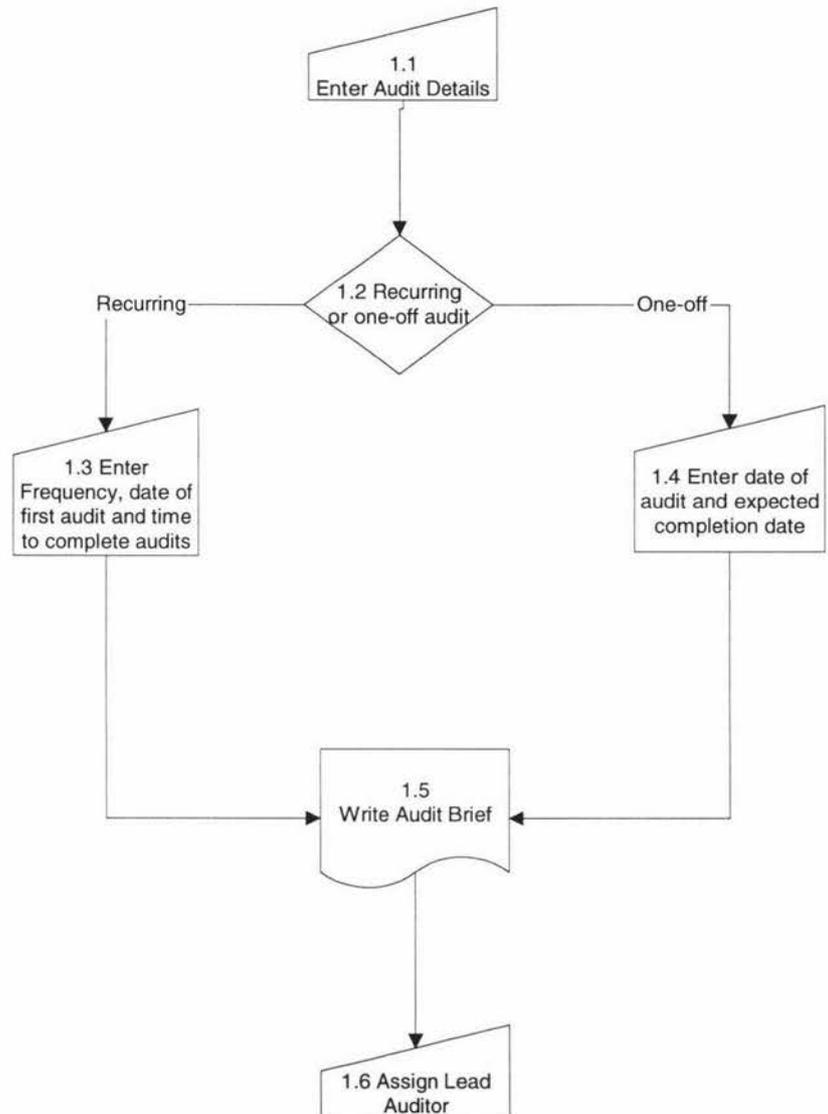


Figure 6: Flowchart of Audit setup phase of continuous improvement process

6.3.2 The Data Model

Although the diagram above may look detailed, in that there are five steps involved in setting up an audit, the development of the data model requires the addition of further detail. Below, I have included the associated documentation for each step described in the above flowchart.

Audit Setup Process Details

1.1 Enter Audit Details

Actor(s)	Initiator
Inputs	Audit Details
Outputs	Notification of audit setup
Outcome	The details of an audit are captured in the system.
Reason	A reminder can be sent out when it is required to be done. In addition the system will have information required to complete the audit

Steps

The following fields will be entered during this phase of the audit:

- Initiator
- Name of Audit
- Area to be audited
- Date audit to start
- How long audit should take to complete
- Lead Auditor (optional – see extensions/exceptions)
- Proposed audit team (optional)
- Draft Scope and Methodology

Extensions/Exceptions

The initiator field should default to the person that is entering the audit details, though the field can be changed to be someone else.

After the details have been entered into the system, the audit will appear in the audit index. The initiator and system administrator will be able to change details of the audit until the audit has been started.

The audit can be deleted. If the audit is deleted before the process commences, it will not become part of any reporting statistics unless the administrator chooses to report it.

The initiator may enter the details of a period of time. If the auditor is not entered at the time it is setup, then the initiator(s) will be prompted to enter this at a set period before the start date of the audit.

Each new audit requires a unique identification number by which it will usually be referred to. The number used must be identifiable as an audit number so that there is not any confusion between this and other improvement system numbers (e.g. non-conformance numbers).

1.1.1 Check when entering details

Audit Value check

1. Who Requested the Audit:	[Name of requester]
2. What areas/people does the audit have an effect on?	[Who does the audit affect]
3. (a) Do the above areas come under the control of the Requester?	[Yes/No]
3. (b) If not, has the Manager who has actual control agreed to follow up the audit?	[Yes/No]
4. Who has the manager/requester arranged to follow-up on audit recommendations:	[Person doing follow-up]
5. Given the answers to the above, is the audit worth doing?	[Yes/No]

1.1.2 Audit details required

Audit Title:

Incidence:

Start Date:

Completion Date: Anticipated completion date only applies to non-scheduled audits and investigations

Audit Requested by: Manager's name

Audit Contact: Who are auditors to contact for further information

1.1.3 Scope:

The scope quantifies what is included in the audit. This describes what the audit covers in terms of period, people, groups, locations and numbers (of files, sites, projects etc.) and similar quantifying attributes of the audit.

For non-conformance control, the scope will highlight areas raised in the documentation received so far, as well as other attributes (such as those mentioned for audits) which the General Manager believes should be covered.

1.1.4 Purpose/Objective:

The purpose describes the intent of the audit.

Examples may include:

- An audit to establish compliance with the requirements of a process (e.g. non-conformance control process)
- An audit to establish compliance with the requirements of a standard (e.g. ISO 9001:2000)
- To discover the root cause of a non-conformance.

The objective of an audit/investigation is to establish whether purpose is being fulfilled.

1.1.5 Desired Outcomes:

Particularly relevant to non-conformance investigations

1.1.6 Appendix 1

This may include previously developed checklists or comments from auditors (on process, tips, things to check etc.) from previous audits. The owner of the audit (i.e. the requestor) should include these as deemed necessary.

1.2 Audit Type Decision

Actor(s)	Initiator
Inputs	Audit Type
Outputs	Dates for audits to be completed
Outcome	The system knows whether the audit is to be a recurring audit or a one-off, and can prompt for the appropriate information
Reason	This is where the initiator decides whether the audit will be a one-off or recurring. By setting it up properly, the system will be able to start the audit process at the required time.

Steps

- Decide whether one-off or recurring audit
- Recurring Audit
- Decide when the first audit will be completed
- Decide how long the audit should take to complete
- Decide on the frequency of the audit
- One-off Audit
- Decide when the audit will be completed by

Extensions/Exceptions

A one-off audit may be changed to a recurring audit at a later date. As part of the close out process, the system may prompt the initiator as to either schedule a one-off audit or set up another recurring audit. The system will use the start date and frequency to set up the following audits, and possibly an end date. The system will use the length of the audit to calculate the schedule completion dates. The start dates will be start date plus frequency. The frequency of the audit will be a limited list e.g. annual, six monthly, quarterly or x times per year. See 1.3.1 Frequencies.

1.3 Recurring audit information

Actor(s)	Initiator
Inputs	Recurring information details
Outputs	
Outcome	The system will be able to schedule the audits so that those concerned are reminded when an audit is due
Reason	The quality system needs to be able to accommodate scheduled audits so that a person in the company can schedule something to be audited at a regular frequency

Steps

Having determined that the audit is going to happen regularly, the initiator will be prompted by the system to enter the following information:

- Date of first audit
- Frequency of audits
- Amount of time required to complete audit
- End date of audits/number of instances

Extensions/Exceptions

The start date of the second audit, and following audits, will be the date of the first audit plus the frequency. The expected completion date of an audit will be the start date and the time required to complete the audit.

Note: Audits are not scheduled from the completion date of the previous audits.

1.3.1. Frequencies

The following are the frequencies that the initiator(s) can chose when setting up a recurring audit:

- Monthly
- Bi-monthly
- Quarterly
- Six-monthly
- Annually
- Bi-annually
- x times per year (only applicable where initiator commits to e.g. 10 per year, cannot estimate when they will fall).

1.4 Completion date of one-off audit

Actor(s)	Initiator
Inputs	Expected completion date
Outputs	N/a
Outcome	The system will record when the audit is expected to be completed
Reason	The system must know how long the audit is expected to take so reminders can be generated if it is running late. Audits vary as to how long they take to complete so standard reminders cannot be set up from the start date

Steps

Having determined that the audit is a one-off audit, the initiator now enters the date by which the audit is expected to be completed.

Extensions/Exceptions

To determine whether this will be entered as “as soon as possible”, “one month” etc, a specific date must be selected. It would probably be easier to have a selected date rather than cite an estimate.

1.5 Write the Audit Brief

Actor(s)	Initiator
Inputs	Audit information
Outputs	Audit Brief Document
Outcome	Clear directions for the auditor(s)
Reason	The audit brief ... <i>(we need to put in here what the audit brief is/does)</i>

Steps

- The audit brief is the document that contains additional information not already captured in the details of the audit.
- The audit brief is the document that contains additional information, specifically tailored to provide additional information to the auditor that will assist in completing the document. It will have any supplementary information the initiator thinks is required for a successful audit

Extensions/Exceptions

The initiator may not wish to supply any additional information to the auditor. The system will combine the audit brief with other information entered in the system to the auditor for review. The other information includes the purpose/objective, the scope of the audit and reference documents (attachments etc.).

1.5.1. The Audit Brief

To: [Auditor/Investigator]
Copies: [Who is the Brief being copied to]
From: [Who is sending the brief]
Date: [Date audit brief is written]
Subject: Audit Brief

Key Points and Suggestions:

- Things the auditor/investigator should pay special attention to.
- Things the requester wants the auditor/investigator to specifically report back on.
- Who should be interviewed?
- What (in particular) should be checked?

* Remember: the purpose of the audit is to check whether a planned arrangement has been complied with.

A planned arrangement is a process or a standard or any other requirement for a particular work. The auditor is to check against this planned arrangement thus the report should point out the details of the planned arrangement, the processes, procedures or standards involved and specific information about the matter to be investigated.

1.6 Assign Auditor

Actor(s)	Initiator
Inputs	Lead Auditor
Outputs	
Outcome	Lead Auditor has been assigned
Reason	This is the point where the auditor chooses a person to be responsible for the completion of the audit

Steps

- Select the Lead Auditor from the pick list

Extensions/Exceptions

- The lead auditor is usually a trained auditor.
- The system should be able to provide the initiator with a list of trained auditors.
- The initiator should be asked to confirm the selection of a person that is not a trained auditor.
- The pick list itself should contain names of all colleagues within the company, as there may be reasons for picking a lead auditor who has not been trained as an auditor.
- The system should notify the lead auditor that they have been appointed as for this audit.
- The notification should include a link through to the system so that the lead auditor can review the information that has been put in the system.
- If the audit brief has not been created, then the system should prompt the initiator(s) asking whether they want to write the audit brief before assigning the auditor.

The Architectural Guidelines

These could not be completed with any degree of accuracy until an electronic workflow system product had been chosen.

7. What Happened Next

While the Quality Improvement Team completed all the preparatory work it could, the workflow system, at time of writing had still not been selected. There are a number of reasons for this. These are outlined below.

7.1 Change of Ownership

At the beginning of 2004, the organization was made a subsidiary of a new company that was completely separate from its previous owners. This change required many system separations to occur in the year before the organization became part of the new holding company. Examples include separating Payroll, Superannuation, Assets and the companies' IT systems, including email, websites and LANs. The cost and effort involved in these separations were all additional to a "normal year's" costs. In addition, the new company was keen to show its value to its shareholders by maximising its earnings.

7.2 Payroll as Competition

The separation from the old parent organization required the separation of the Payroll systems of the two organizations. This had a double effect on the Continuous Improvement Project.

- Investment in Payroll was considered more important than the continuous improvement system.
- The project sponsor, who was the Executive representative for Quality, had to focus his energy on payroll issues, and therefore not on the installation of the proposed continuous improvement system.
- The sponsor was not the only one affected. His whole team needed to focus on Payroll to ensure a smooth changeover of the system.

7.3 Sales as a Competitor

The staff resource in the Applications Development area of the organization was limited and at the same time the Quality Improvement Team was seeking to develop and implement the Continuous Improvement System, the Sales department also decide to improve their systems by making them electronic. This took energy, focus and resources away from the Quality Improvement Project as work required by the Sales department was considered to be more critical to the company. The Quality Improvement Team found it hard to justify the value of their proposed system when compared with the potential value added by the Sales department's project. This was partly because the cost of (poor) quality to the organization had not been measured.

7.4 Changes in Information Technology section

Separation from the old parent organization also required division in the company's IT system infrastructure, including its LAN (local area network), email system, internet, intranet, firewalls and other systems. This not only required a large amount of investment, but also involved much of the IT team's time and spurred a rethink on a number of areas relating to IT. This had an automatic follow-on effect for all projects using IT systems. There was a reluctance to invest in any system that might become unnecessary or defunct under the new regime when fully defined. There was also a change in the management of IT. Basically, their involvement in the Quality Improvement Project was minimal because of other, more pressing, priorities.

7.5 Cost Cutting

The organization was broadening its focus to include other markets in an effort to secure a viable future. Breaking into a new market is expensive and therefore there were ongoing cost-cutting measures. This meant that unnecessary investments were put off until "brighter days". This further strengthened the case of the Sales team. Some cost cutting measures resulted in systems that were seen to bring continuous improvement, although not from a pure quality perspective. Their existence meant that the proposed system was not required to maintain the organization's ISO 9001

certification as alternatives were available.

7.6 Control Centre Did Not Grow as Expected

The other section that was keen to get a workflow system was a control centre in the organization. This was a relatively new start-up in the company servicing its nascent telecommunications business. Unfortunately, the uptake of services in this area was slow and the control centre made less of a profit than was anticipated. This meant it also had less powers of persuasion and could not justify, even with the support of the Quality Team, the purchase of a workflow system with which to run continuous improvement and their own initiatives.

7.7 Lack of Experience

As previously reflected in this paper, the non-conformance control system, which was to be replaced, by the continuous improvement system was not stable. This was due in part to the lack of experience of the quality improvement project team that prepared it. While much experience was gained through the implementation of that project, inadequate skill did not ensure the successful selling and implementation of the proposed new system.

7.8 Loss of Personnel

When the selection of the software required for implementation of the project was taken outside the quality improvement team, the systems analyst who had been earmarked to program most of the new continuous improvement system (when the software tool had been selected) decided to move to another organization. In addition, the skills of the system architect were required for sales initiatives and also for the payroll system changeover.

7.9 Management Priorities

The many issues facing the organization due to change in owner, change in market focus, as well as the need to cut costs, meant that management felt that the cost of the

proposed investment in the continuous improvement system was not warranted at the time. Some management did not wholeheartedly support ISO 9001 certification, and were thus not supportive of further investment into systems that were perceived to be supporting it. Management also expressed some concerns that it might heighten bureaucracy (rather than diminish it), and failed to see the value that a good system could provide.

In summary, in spite of the development of a system, which appeared good on paper and that would save the organization money, time and reputation; the system did not go ahead due to the harsh realities of a business environment. This left the Quality Team with the unstable, disparate existing system that needed to be replaced if the company's quality initiative was not to flounder and continuous improvement was to be maintained.

8. The KISS - Keep it Seriously Simple - Solution

8.1 Providing a Viable Alternative

When it became apparent that the project was not going to be implemented, the quality improvement project team disbanded. However, it was still necessary to change the current non-conformance control system as the software was not stable. It was also very time-consuming, frustrating to maintain and difficult to use. The writer therefore decided to “dumb-down” the existing system. This was done by:

- Removing almost all programming that automated the sending of emails etc. This made the system stable but manual.
- Transferring all the data from the separated system into the central quality system so that it could be accessed just like any quality process.
- Altering the templates to simplify the system for users.
- Creating a separate file for recommendations so that they could all be accessed from one central place.
- Removing the tracking system that enabled administrators to automatically see activity on each file.
- Applying the same model to audits and learning moments, so that all continuous improvement systems had the same look and feel.

The benefits of this change were that:

- The system was stable
- The system was easier to maintain
- The system was easier to access
- There was a consistent approach to audits, non-conformance control and other continuous improvement functions
- These functions were more easily searched

The downsides to this change were that:

- The system was less intuitive
- The system did not automatically prompt “players” when it was their turn to act
- The system felt clunky to those who had experienced what could be achieved with programming (when it worked right)
- Fewer statistics were collected so less analysis could be done
- The systems were not integrated into a single continuous improvement function.
- Participants had to learn a new, but not improved, system of handling such files
- Progress on recommendations has not improved

In retrospect, the writer is not certain that the “dumbing down” of the system was the right thing to do in spite of problems had with the old system. The current system is tolerated more than it is accepted and adopted, and only satisfied two of the criteria of the desired outcome - the system is stable and all continuous improvement activities are centralized.

9. Findings and Discussion

While the project that was subject of this thesis has not yet been implemented, much learning has occurred in the process of researching, designing and attempting to implement it. The writer has used the five primary metaphorical filters – mechanistic, organic, cultural, political and cybernetic (by Flood⁷⁹, 1993) - to group and discuss these findings below.

9.1 Mechanistic

Using a mechanistic filter enables the observer to consider the failings of the system as a mechanical process and how these failings might be fixed.

What needed to change?

From the quality improvement team's perspective, there were three key mechanistic problems with the existing non-conformance control system that needed to be overcome in the implementation of a new quality improvement system:

- a) The programming of the non-conformance control system was not robust and was therefore creating many software errors, which made it irritating to use and time consuming to maintain.
- b) Recommendations were not being acted on, and if they were acted on, it was not happening quickly enough or was not being recorded in the system.
- c) There was no way of analysing the data collected to find consistent issues.

The quality improvement project team used these three criteria as primary drivers in the definition of the new system. They did not consult users widely enough to detect other existing issues. For example:

- users found the non-conformance control system and the recommendations in them, hard to find;
- continuous improvement initiatives were accessed through the same user interface (screen) as other quality documentation, however the link took users to a separate system which had little transparency or ability to search. Users therefore had to drill through a number of levels to try to find information that

⁷⁹ Flood, R.L. (1993) *Beyond TQM*, John Wiley & Sons: Chichester, England.

related to them (or what action, if any, was required of them), making them feel less comfortable using these systems.

- users could not see the value in recording action taken, or even in supporting the continuous improvement initiatives; and
- users were not rewarded (and in some cases were punished) for their involvement in continuous improvement, or in quality generally because it was seen as an overhead (although this may be more a cultural issue than a mechanical one).

These examples highlight that user desires for the new system, and their problems with the old system, were not clearly defined enough in the early stages of designing the new system. There can be no doubt that this would have decreased the likelihood of user buy-in as the project progressed.

In designing the new machine – that is, the new Quality Improvement System, about forty categories were defined to enable the effective evaluation of suppliers, and the importance of each category was assessed on a scale of desirable (1) to non-negotiable (5). The categories were only considered from the perspective of requirements for a software product. It would have been equally useful, and may have saved many hours, if the same type of robust assessment had been applied to requirements for the system for a general needs/desires perspective. For example, if the quality improvement project team had evaluated the importance of general factors, one of the key requirements would have been control of the system. As you cannot control the system (because you do not own the software), the system is at far greater risk of failure.

Workflow systems – a tool to manage continuous improvement

To improve the continuous improvement mechanism, the team intended to harness the power of software to make the follow-up on recommendations easier by providing prompts and to enable effective reporting on continuous improvement systems. It was anticipated that the software required would be a relational database product (such as Microsoft Access). A standard database system (such as Microsoft Excel) enables designers to store information on different worksheets but cannot draw data from the various sheets to produce another "product" without complicated macros (programming). A relational database product has functionality that enables this to happen but still requires macros (programs) to deliver items such as notifications by email or to create reports. A survey of the market found that there were software

products that seemed far more effective than the original candidate – Microsoft Access. Workflow or Business Process Management (BPM) software and enables system designers to describe the steps of a process and henceforth create an electronic process that can be edited by the designer at the press of a button. The system also has the functionality to create emails or reports based on defined requirements.

For example, if you were to create a new workflow process for the library regarding the return of a book that has a waiting list, the process would include the following steps:

1. The borrower is sent a notification that the book is due^{*80}
2. The borrower locates the book
3. The borrower takes the book back to the library returns desk (or slot)
4. A library assistant checks the book back in
5. A prompt email or text message is sent to the next person on the waiting list noting that the book has been returned*
6. A prompt is sent to the library assistant (probably on the check-in system) that the book is to go into the books awaiting collection area (not for ordinary shelving) and possibly also confirms that the next borrower on the waiting list has been notified.*
7. Library assistant shelves the book in the right place, ready for reissue.

To build this example, the workflow software would produce a flowchart and create three sub processes that would enable the system to automatically prompt the right people as to what action is required from them. The workflow system could also be edited, for example, to add another step to send a reminder to the person the book is being held for, if the book has not been collected within a couple of days. This would be as simple as describing the extra step and the software would do the rest (including creating the appropriate sub process). The software also had the capacity to design processes to measure anything from how long it took the library assistant to check the book back in, to how long it took between notification and pick up by the next borrower.

Workflow systems can therefore provide new mechanisms to simplify the creation (or editing) of processes at all levels of an organization. The prompts they can deliver also eliminate the need for much of the interaction that is currently done by individuals, with the added beauty that tone is much less likely to be an issue. It also means that there is less likelihood of a recommendation being forgotten or “falling off the to-do list”

⁸⁰ Items marked with an asterix (*) would happen through an automatic electronic message without the involvement of the administrator.

before the appropriate action has been taken. Management today is used to being reminded and often have too many items on their to-do lists. The result is that they tend to do the work at the top of the pile – “the urgent things” - while important tasks might be set aside. The reminders provided by a workflow system can assist those involved to keep tasks suggested in continuous improvement initiatives in focus and on track. It is thus unsurprising, particularly from a mechanical perspective, that the Quality Improvement Project Team felt that a workflow system would provide the best solution to the failings presented in the current system. However, most organizations do not currently have a workflow product, as it is not one of the Microsoft Windows suite of products. Thus, the selection of a workflow system by the organisation required additional investment. It is primarily the lack of the required investment that caused this project to stall. It is necessary to reflect critically on whether the cost of the new system would have brought sufficient additional benefit to be selected over Access, a Microsoft Windows product to which all colleagues already had access.

Projects involving information technology are notorious for being difficult to implement. The recent New Zealand Police “Incis” debacle is one example. The major reason for this is that there are so many more design variables in information technology projects, of which any one can go wrong, therefore increasingly the chance of failure. Using this project as an example, it would appear that information technology projects require stronger commitment than other projects to weather the storms of unforeseen consequences arising from the many variables.

Timing is everything

In a factory, supervisors are abundantly aware of exactly how long it takes to assemble a product. The Quality Improvement Project team were not as skilled, nor were they working in a highly skilled environment, so with only a little previous experience gained in the non-conformance control project, the Quality Team expected that the quality improvement project would be completed within a year at most. The reality was far different. The initial costing, which was prepared at the time of idea conception to obtain approval for the project, indicated that the expected timing involved would be:

1 month	Idea Conception (IC)
2 months	Preliminary analysis (PA)
1 month	System Design (SD)
1 month	System Programming (SP)
2 weeks	Testing (TA)
2 weeks	Implementation (I)

At the beginning of the project, it was therefore perceived that the project would take about 6 months from idea conception to implementation. Looking back at the time actually taken (including delays), the true time cost of the project to get to the point where work was stopped was:

2 months	Idea Conception
2 months	Christmas break
1 month	Assessment criteria (PA)
1 month	Vendor assessment (PA)
1 month	Capital expenditure approval (PA)
2 months	Audit & Recommendation process documentation (SD)
<u>1 month</u>	<u>Non-conformance control documentation (SD)</u>

....Project was put on hold indefinitely, but if it had continued....

2 months	System Programming
1 month	Testing
1 month	Implementation

A revised estimation would indicate that even **without** the hiccups that eventually caused work to cease, the project would have taken at least **a year** from idea conception to implementation. This information would have had a significant bearing on the cost benefit analysis of the project and therefore on any decision to proceed.

9.2 Organic

Using an organic filter requires that the observer consider the system as an organism with interrelated and connected processes.

A Single System

Before the Quality Improvement system was proposed, continuous improvement in the organization was seen as a set of disparate activities that somehow worked together to bring improvement to the organization. There are three types of audits conducted in the organization - some audits are done by external auditors, others are done internally on a regular basis and still there were some that are done spontaneously due to management concerns. Each of these audit types were recorded in a different part of the existing quality system. This also applied to non-conformances, which were evaluated as situations of non-conformance arose and investigated where valid and warranted, then filed in another separate system. Most audits and non-conformance investigations are similar in that they produce recommendations for change to bring improvement to the organization. However, in the old system, these recommendations remained attached to their reports and were only sometimes followed through partly because they were not obvious once the report had been neatly filed away.

The fundamental breakthrough that led to the proposal of the new system was in the concept of continuous improvement as a single function, not as multiple activities within the quality framework. This enabled the writer to consider the interrelationships between customer feedback, audit and non-conformance control processes. The writer aimed to develop a system that would allow their integration without losing functionality while enabling maximum organizational learning to occur from each event. All continuous improvement activities would be accessed from a single location. The strength of this is that colleagues would always know where to go to access the information they sought. Recommendations would also be accessed from the central point (regardless of why they were raised) with a number of benefits:

- they would be easily found
- they could be categorised to find themes
- they could be searched for topics
- they would be more visible – to ensure the required action took place, and to encourage discussion amongst colleagues.

With all continuous improvement in a single system, it would be easier to report effectively on activity at an executive level. This would raise the profile of continuous improvement as a development function and hopefully spur on the initiatives. By combining all continuous improvement functions together, the recommendations would not be seen solely as arising from negative sources – a recommendation could as easily come through the suggestion box as from a non-conformance investigation – making the required activity seem less as a “punishment” and any associated negativity could be neutralised.

Other Initiatives

While the Quality Improvement Project was underway, there were two other initiatives which began, that should have been merged with this project if one considers it from an organic view. They are called the *improve* and the *learning moments* systems.

The *improve* initiative was set up as a way to improve the organization’s score in this area for the Baldrige Criteria for Performance⁸¹ and because the organisation faced a number of rounds of cost cutting during the project. A result of this has been the development of an ongoing system to capture bright ideas that could lead to improvement in the way the organization. This system is called *improve* and colleagues can email their suggestions to a system where they are automatically included in the *improve* database. Suggestions are assessed on a monthly basis by a group of colleagues from different areas of the organization. An owner is assigned if a suggestion warrants further investigation or requires implementation. Colleagues are always notified of action taken on their ideas. The suggestions made in the *improve* system are very similar to a Quality Improvement System recommendation – except that they may not arise from a definite incident, audit or investigation but although the *improve* team had as much trouble arranging follow-up on recommendations as any other area in the organization the *improve* team did not wholeheartedly support the ongoing quality initiatives in the organization as was witnessed when scheduled audits were declared a “sacred cow”.

Near the end of the project, a recommendation arising from a non-conformance investigation suggested that the quality system’s continuous improvement activities

⁸¹ Baldrige Criteria for Performance Excellence – www.quality.nist.gov. Retrieved 12 September 2005.

should be extended to capture other situations in which learning had occurred. Examples could arise from project work or near misses, or even out of an audit or non-conformance. The *learning moment* system was thus created. This system is searchable, accessible to all colleagues, and items are circulated to a defined group (mainly managers) so that they can inform their team members who may be affected. The *learning moment* system has removed some of the stigma associated with quality initiatives, such as non-conformances, by emphasising learning rather than compliance or failure.

Once the quality improvement team became aware of the *improve* and *learning moment* systems it hoped to include these initiatives into the proposed quality improvement system.

9.3 Cultural

Viewing an organisation through a cultural filter enables the observer to see how cultures within the company are affecting its systems.

The culture in the organization is to push on with projects, please the customer and plan for future work. If work is not being done directly for a customer, then it is considered to be an overhead; something to fit in if time and budget permits. Even administrative necessities, like completion of timesheets, are seen as a waste of time particularly if there is no overtime to be claimed. Certain areas of the organization are assessed on the rate of their team's utilisation by customers. If a staff member is working on a customer project they were considered utilised, but "administration" work, the category into which Quality related work falls, is not. As a result, managers put staff to work on customer projects wherever possible and avoid having them do administrative work. This occurs even though Quality may improve performance for customers or resolve raised issues by customers. If utilisation rates are low, then this is perceived to be a failure by the manager. The quality team is not seen as a customer and there is no charge or job code for work done to maintain quality. The work is not done unless the management can think of no other task that might be (or become) billable work.

Quality is seen as important because of the accessibility it provides to company processes, and the value certification to ISO 9001 brings in the form of the ability to

tender for work that the company would otherwise not be eligible to do. It should be taken into consideration that continuous improvement activity (such as auditing) is not always seen as an aid to the business, and is sometimes viewed as an unfortunate necessity required to maintain quality standard certification. Continuous improvement driven by quality initiatives is sometimes seen as one of the many corporate driven demands on employees' time that adds little tangible value. Some colleagues feel that continuous improvement activities look more at what is wrong than at what's right, that they "nit-pick" or are "witch hunts". The opinion is that one rarely is praised because of a non-conformance. This has led to negative feeling and lack of willingness to contribute, or to take positive action, on suggestions and recommendations.

The monthly quality report, which is included in the Executive Minutes, highlights the teams that have (or have not) made progress in terms of quality. Lack of adequate progress could cause embarrassment at a senior level, and for members of the quality team, serving to keep them focussed on quality outcomes. However, if the culture of the organisation does not support quality then there will be little embarrassment or incentive to act.

Although the organization wants continuous improvement to happen, it encourages it to occur in an "innovative" way; such as a bright idea that is suggested. Systematic improvement (continuous improvement that is found by deduction and a desire to eliminate errors) are not considered as exciting or worthwhile.

Organizational Buy-In

According to Saraph and Sebastian⁸²(1993), "research suggests that management, not technology is the key to quality improvement". If management does not fully support the implementation of a system, it may still succeed, depending on the nature of the system. For example, if a manager believes that well documented processes will enable his/her team to be more effective, they might create these internally, without other managers' support. However, continuous improvement initiatives may affect multiple areas of an organization. Though one area may raise a recommendation, it may require action by another area. Continuous improvement initiatives often highlight issues that require fundamental changes, sometimes across multiple areas. These require the cooperation of multiple managers and team members to achieve effective results. If some areas do not support the initiative, the chances of failure are high. Thus

⁸² Saraph, J.V and Sebastian, R.J (1993). Developing a Quality Culture. In *Quality Progress*, September, 73-78.

if all management do not support the system, it is doomed to fail as the committed area(s) will soon become disheartened by lack of action. Management also “hold the purse strings” to monetary and time commitment in the organization and continuous improvement, activities usually require both of these to be invested for ultimate gain in the organization. Without management’s support, lack of money or time can put the initiatives at risk of failure. Even if management do support quality, lack of buy-in at lower levels of the organization may result in limited continuous improvement. This is because:

- processes may not be kept up to date;
- instances of non-conformance may not be reported;
- audits may be shammed;
- the non-conformances control process may be being used for the wrong reasons (e.g. retaliation);
- learning moments may not be documented; and
- recommendations may not be implemented promptly.

If a continuous improvement system does not result in continuous improvement, it brings the associated initiatives into disrepute. Interest in the system may wane and cause it to flounder. In the organisation studied, the lack of wholehearted support for the system greatly weakened the ability of the organization to act effectively on recommendations arising from continuous improvement activity.

Rewards

Unfortunately, the organization’s reward system may not always favour quality. Most managers and employees position descriptions do not include quality as one their requirements and there is often no quality objective set. Sales employees are rewarded in accordance with the number of complaints received from their clients. This has led to many complaints not made official, or were categorised as something less serious such as whinges. On occasion, complaints have also been dismissed as unrealistic as they are not within the agreed specification of a job (while this may be a valid position, potential learning is lost through this approach).

9.4 Political

Viewing the organisation using the political filter enables the observer to see what political factions there are within the company and how these might affect the effective functioning of the organisation or the system.

In the findings so far, the writer has already referenced two situations where politics has interfered. These include the improve system (where scheduled audits were considered unnecessary), and the lack of organizational buy-in (which makes it politic for colleagues not to invest themselves too fully in continuous improvement processes).

Cost of Quality

The cost of quality includes the cost:

- to produce and maintain quality processes;
- to maintain the quality system;
- of quality audits;
- of rework required;
- of not delivering in full;
- of not delivering on time;
- of not delivering to specification;
- of not invoicing correctly;
- of business lost due to lack of quality; and that
- not incurred by having a quality system.

There had been several attempts to get the organization to measure the cost of quality but none had been successful. If the cost of quality were measured, it would be possible to show the value of an effective quality improvement programme. To support such a measurement it is necessary to believe that lack of quality imposes costs on the organization. This should not be assumed. Lack of agreement with this perspective is considered a serious risk of such measuring. One of the main reasons cost of quality has not been implemented is the difficulty of measuring the ongoing benefit of quality to offset the cost of maintaining it. The fundamental dilemma here is best described by an example:

If you go shopping as a child with your grandmother and she teaches you to pay a little more for a toaster of superior quality, then if you apply her teaching, is the amount of saving achieved...

- a) The difference in cost of having to purchase a new toaster each year for the next two years and the cost of having to buy one three years after your initial purchase? or
- b) The cost of having to purchase a new toaster approximately every three years for the rest of your life instead of every year?

In the organisation, cost of quality has not been measured because of the risk it would open debate on the value of quality and therefore become a political football and primary area for potential cost saving through the elimination of quality activity. Measuring the cost of quality is perceived as a greater threat than a possible benefit to the quality initiative in the organization.

The Need to Sell Quality

When management first decided the organization needed to get ISO 9001 certification, the project received due attention and there was even a black tie dinner to celebrate achieving the quality standard. However, within two years of achieving ISO 9001 certification, the organization's interest in Quality had waned because management's focus had shifted to other strategies such as business process reengineering⁸³.

When the writer became involved in the revival of quality in 1997, this was done discreetly, almost surreptitiously, with the objective of making the processes and system indispensable. The intention was to win the organization to quality thinking and drive senior management to be quality converts, rather than having the system imposed by management and begrudgingly followed by colleagues. The advantage of this approach was that quality would be far less likely to fail in the future because of the degree of support garnered by colleagues.

The Quality Improvement Team therefore assumed that having a sponsor from the Executive, with approvals to begin and continue the Quality Improvement project, indicated that the idea was accepted. What was needed was seen to be the design and

⁸³ For more information on business process reengineering, see Hammer, M. (1990) Reengineering work: Don't automate, obliterate" in *Harvard Business Review*, (July-August), 104-112. or Davenport, T.H. and Short, J.E. (1990) "The new industrial engineering: Information Technology and Business Process Redesign. In *Sloan Management Review*, (Summer), 11-27.

implementation of the system because colleagues would buy-in when they saw its value, as they had with the quality processes. This perspective was not correct. The key reason for this was due to the requirement for cross-functional and multi-team involvement to carry out and implement continuous improvement actions. As the approval received was not ratified by all interested parties, the project was vulnerable to the opinions of all these parties and susceptible to failure without them. Once the idea was conceived, and preliminary analysis phases of the project had been completed, the focus of the quality improvement team should have shifted to convincing the decision makers that the project was worth the investment before further work was done. If the cost-benefit analysis conducted in the preliminary analysis phase had been more rigorous, it is possible that the problem would have been noticed in time to rectify the situation. The decision makers could have been convinced through actions such as:

- developing a sales pitch;
- drafting a white paper on the proposed project;
- accumulating cost (and benefit) of quality data; and
- illustrating the value of the proposed system.

Competition

In the 1980s and early 1990s, Quality was very fashionable. There was significant kudos to management who could show that they were supporting quality initiatives. This is no longer the case. Quality is seen as a required tool (along with a bunch of others, like double entry bookkeeping) but no longer has the romance of a new idea. Since TQM, there have been a rush of fads: business process reengineering⁸⁴, Six Sigma⁸⁵, Kaplan and Norton's Balanced Scorecard⁸⁶, and the Baldrige Criteria for Performance Excellence⁸⁷, to name but a few, and with every new business title, there's a new competitor for attention. This is not to say that any of the above has no value. If an organization tries to focus on too many such systems then the effectiveness of each is diluted, as only a handful at most can be kept in focus. This is

⁸⁴ For more information on business process reengineering, see Hammer, M. (1990) Reengineering work: Don't automate, obliterate" in *Harvard Business Review*, (July-August), 104–112. or Davenport, T.H. and Short, J.E. (1990) "The new industrial engineering: Information Technology and Business Process Redesign. In *Sloan Management Review*, (Summer), 11-27.

⁸⁵ Six Sigma was originally invented by Bill Smith at Motorola. For more information, see <http://www.motorola.com/motorolauniversity/> or www.isixsigma.com. Retrieved 12 September 2005.

⁸⁶ Kaplan, R.S. and Norton, D.P (1996). *The Balanced Scorecard*. Harvard Business School Press: Boston, Massachusetts.

⁸⁷ For more information on the Baldrige Criteria for Performance Excellence – see www.quality.nist.gov. Retrieved 12 September 2005.

consistent with the findings of total systems intervention as presented in the literature review section.

Today, Quality is hardly the flavour of the month. Some organizations are even laying it aside, and suppliers seem less particular about certification because it is assumed that the quality ethic will have permeated the organization sufficiently to provide assurance of a quality product. The writer considers this a particularly dangerous assumption. During this project, the organization was focussing on the Baldrige Criteria for Performance Excellence, the Balanced Scorecard and eTOM⁸⁸ at the same time as trying to follow a Quality framework. As previously noted, some other big projects were deemed to need more urgent attention. For example:

- The payroll system had to be shifted from one supplier to another.
- A comprehensive sales management system needed to be developed to ensure effective billing occurred.
- The financial system had to be upgraded, as the version that was being used was no longer going to be supported.
- The separation of the organization from its previous parent company meant that new work needed to be done to the organization's website and intranet.
- The separation of the organization from its original owner also required new IT infrastructure, such as a firewall and other IT systems.
- There was a drive to reduce costs, which resulted in resources being channelled away from new projects to focus on eliminating current costs. Ironically, it could be argued that the implementation of the proposed Quality Improvement System would have enabled greater cost savings by eliminating rework, but this was not well understood by the organization.

All of the projects described above could be seen as critical to the organization's ongoing viability. For example, a single breach of the firewall by a software virus could put the organization at extreme risk by corrupting information and records within the organization. This would stop the organization from being able to use its IS network for a period (hence loss of person-hours), and possibly lead to failure in delivering on customer requirements.

The Quality Improvement Project was also not seen as high priority was because the organization believed its Quality system to be excellent. In relation to the (electronic)

⁸⁸ eTOM – Enhanced Telecom Operations Map, retrieved 11 July 2005. See <http://www.tmforum.org/browse.asp?catID=1648> for an overview of this product.

quality manual, this was true, as external auditors had consistently commended the system for a number of years. Unfortunately, the distinction between this system and the quality improvement system was either unclear to the organization, or the value of the additional system was not perceived by decision makers in the organization.

9.5 Cybernetic

The cybernetic filter encourages the observer to consider the organisation as flows of information translated by intelligence, like a brain.

Realistic Assessment

Through a cybernetic filter, it is apparent that the Quality Improvement project team did not fully comprehend the increased risk to the project. This was caused by allowing the choice of software to be made by another area of the organization. For example, the quality improvement project team did not know the strengths and weaknesses, opportunities and threats facing that area when the choice was handed over to them. This highlights that the team should have been more critical in its analysis of the strengths, weaknesses, opportunities and threats facing the project as this would have shown that the weaknesses and threats outweighed the opportunities and strengths. It would have been more effective to find solutions to the weaknesses and threats at an early stage as it would have required less wasted investment on the part of the quality improvement project team. The desire to succeed coloured the vision of this team, and they did not accurately assess the SWOT criteria. Similarly, a general cost benefit analysis was completed, it failed to consider important issues such as measurement of the cost of quality, and more importantly, measurement of the gains experienced by implementing good quality (through the continuous improvement process). It did not consider the value of a workflow system, either from a quality perspective alone or for the whole organization, nor did it consider the risk of losing control of the decision making process. The cost to the organization in terms of the time required to implement the project was also significantly underestimated. In summary, not enough attention was paid to achieving an accurate understanding the costs and benefits of implementing the quality improvement system. This made it increasingly difficult to justify the project as time passed.

Use of the other methodologies

From a cybernetic perspective, we can also assess the importance of PDCA, Learning Organisations, and Total System Intervention as tools to drive change in the organisation. Sources read for the literature review highlighted problems in implementation experienced by many continuous improvement practitioners. A long list of issues appears in the literature review section of this document. The writer has considered whether the system may have succeeded if greater attention had been paid to finding solutions to these probable sources of failure before the project proceeded, as this project suffered similar issues. As Crosby says, "People, who have put improvement programs of any kind into their company, always feel that others are not for it".⁸⁹ This perspective may be a reflection of the paranoia inherent in attempts to implement an initiative of this kind. This paranoia is likely to exist not only in continuous improvement initiatives, but also in any initiative where the driver is more passionate about their implementation than those around them are.

The models presented as alternatives to, or extensions of, the Plan-Do-Check-Act cycle have relevance not so much for this project (as the action area is almost always defined simply as Action) but for wider application of quality processes in the organization. The Total Systems Intervention model provides a guide to how continuous improvement could be driven in the organization. The Learning Organizations information highlights the importance of transferring knowledge within the organization.

The readings on reward systems helped to clarify the importance of having drivers that encourage, rather than hinder, continuous improvement, and were useful in diagnosing where some of the organization's problems lie.

The PDCA cycle is good in principle and, as noted earlier, it can be used to describe any process, which involves change. You plan, then you do what you planned, you assess the outcome of the plan, and the next time, you change some aspect of the plan in order to get a better result. Realistically though, often you decide that the plan will be changed the next time, but this does not occur immediately in spite of the best intentions. In time, the point gets lost and the intended change is forgotten. The six models described as variations on the PDCA cycle in the Literature Review, all appear

⁸⁹ Crosby, P.B. (1979) *Quality is free: the art of making quality certain*, Penguin Books: Auckland.

weakest in this area. Perhaps the PDCA model has the order wrong – after all, there is usually a hiatus between thinking and doing. It could be argued that the Act phase should be at the beginning of a new cycle rather than at the end of the current cycle. What would then happen to the results of checking? This is a problem that is at the core of this project. When we decide to start something new, we naturally plan before we implement. However, where we are not driven to change, there is no need to plan and no need to act. Impetus is essential to ensure that change occurs, and to find this, we need to question where and when learning occurs.

The organization has not yet adopted the philosophy associated with learning organizations, however the literature review highlighted that this philosophy was consistent with what we were trying to achieve in the project described. We were not interested only in adaptive learning – where processes were improved as a result of problems found, we were also interested in generative learning – which requires deliberate analysis of processes to find where learning could occur and processes be improved. This can be achieved using TSI.

At the time the project began, the organization's greatest weakness in the area of quality was the failure to transition from Checking to Action. In other words, recommendations were not being implemented. This reflected that the Plan-Do-Check-Act cycle was not operating successfully in the organization. The result of the failure to act was that errors were recurring because the organization was not learning from its experiences. Audits did reflect some intentional checking on systems and processes, but the lack of action on recommendations meant that learning was limited. Following a learning organization model could provide the impetus to complete the learning cycle in the organization. Total system intervention did not drive the project. It did show, however, how further continuous improvement could be achieved by looking at the organization from a different perspective.

Total System Intervention (TSI) suggests that improvement can be made by considering a company through a defined filter or metaphor that may be political, cultural, mechanistic etc. Its aim is to ensure that issues are fixed in good time, by diagnosing problems early with the help of different filters. Effectively, TSI is another method for defining where continuous improvement can, and should, occur in the organization. However, TSI is not used within the organization. While it presents possibilities for finding new opportunities for continuous improvement, there may be little point in implementing it for this purpose until the organization has found an

effective way of dealing with the recommendations made through existing continuous improvement activities.

Regardless of whether changes occur to the Quality Improvement system, these findings highlight that there is an abundance of work, which could have been undertaken to attempt to overcome the apparent failings.

10. Conclusion

This research found that ISO 9004:2000 supported the type of integrated continuous improvement system that was proposed as the subject of this thesis, while ISO 9001:2000 requires that some system for continuous improvement exists in certified organizations. The literature indicates that continuous improvement is a route towards profits and away from failure. However, the implementation of such a system was not as simple as initially thought – a fact evidenced by this project being discontinued.

The vision for this thesis was “To describe the creation of a robust, effective electronic system, which allows continuous improvement efforts (including outcomes), to: -

- * be visible from a central place
- * be intuitive to use
- * have facilities to report progress – at different levels and within different groups
- * create effective reporting to interested parties
- * enable analysis and evaluation of nature and status of suggested improvements.”

No such system has been implemented in the organization although all continuous improvement activities can now be found in the same place. Many reasons can be considered as partial causes of this, including the focus of the organization on innovation at the expense of continuous improvement initiatives, other more pressing needs, lack of management and organizational buy-in, existing reward systems, and the lack of effective definition and planning by the project team.

The suggested solution was to use a workflow, or other similar business process management software tool, to design an effective, intuitive process to handle all continuous improvement functions in the organization. The possible application of such software to quality initiatives was not discussed in any of the literature reviewed, but is considered by the writer to have exciting possibilities for streamlining processes and making quality initiatives more intuitive. The solution appears to be effective and may still be implemented in the future, though this cannot occur without widespread organizational support. All continuous improvement initiatives require a taking of that extra step – not doing business as usual – and without organization-wide support, the actions will simply not occur especially if the organization has a flat organizational structure with little pressure from above. This is one of the greatest problems faced by

continuous improvement initiatives, and why the writer believes so many are doomed to fail.

It may be an area in which more recent business initiatives, such as the Balanced Scorecard⁹⁰ or the Baldrige Criteria for Performance Excellence⁹¹, have a competitive edge over traditional quality initiatives. They allow organizations to focus on a limited number of predefined areas that appear to be less intangible and more achievable. Their weakness is that they may miss the best improvement opportunities for the organization as they only consider selected areas.

One of the more exciting findings of this research were the possible connections between viable system intervention, Bucklers' six-step model for learning⁹² and the Plan-Do-Check-Act cycle in terms of the relationship between improvement, learning and managing information. This topic does not appear to have previously been considered in the body of knowledge, and may present opportunities for further study and understanding of business methodology in the future.

In spite of the fact that the project at the heart of this thesis was not implemented, a great deal of learning has occurred, been documented and will be made available to the academic community when this thesis is published. Taking this into account, this thesis can still be considered a success and a useful addition to the body of knowledge on the nature of continuous improvement systems.

⁹⁰ Kaplan, R.S. and Norton, D.P (1996). *The Balanced Scorecard*. Harvard Business School Press: Boston, Massachusetts.

⁹¹ For more information on the Baldrige Criteria for Performance Excellence, visit www.quality.nist.gov. Retrieved 12 September 2005.

⁹² Buckler, B. (1998). Practical steps towards a learning organisation: applying academic knowledge to improvement and innovation in business processes. In *The Learning Organisation* 5, 1, 15-23.

Appendices

Appendix A: Idea Conception Paper

Background

■ uses the ISO Quality system to help the company improve the way we do business. ■ is ISO certified which gives suppliers and customers' the assurance that we follow certain procedures and policies.

The QIS is made up of several areas including:

- * Document Control System
- * Audits
- * Non-conformances
- * Customer Feedback

The entire company uses QIS and KPI reports are included in the monthly Executive report. Serious improvement comes from the audit and non-conformance control systems ■ runs as part of its ISO 9001 program. ■ has missed opportunities for improvement due to a combination of day-to-day business getting in the road and the labour intensive nature of the current system. These lost opportunities for improvement are the main reason mistakes either continue to be made or are repeatedly made.

Within the current system the Non-conformance control process has been improved to include some automation but no other areas of Quality were included and the improvements were only of a limited nature. The improvement to the Non-conformance control system has resulted in increased close out of tasks and better understanding of requirements. It has also highlighted the need for a fully automated and integrated system by highlighting what can be achieved by system improvements.

Current situation

Currently ■ is under enormous financial and learning pressure while we enter the Telecommunications market. With re-sizing and other staffing changes many of the people required to complete work in the QIS have less time for these tasks and they are taking longer than desired delaying the improvements resulting from the QIS.

From a user aspect, the current system is:

- * Labour intensive/time consuming
- * Reluctance to use
- * Difficult to understand
- * Documentation not captured within current system

Advantages of a new system

The new system will

- * Reduced administration overhead time for users
- * Capture all documentation within one system
- * Lead by example – The company will be able to adopt the methods used in the new system throughout the company providing more efficiencies etc
- * Eliminate missed opportunities for improvement
- * Reduce errors
- * Eliminate repetition of errors

Goal

The aim of the Quality Improvement system is to

- * Improve the way we do business
- * Learn from experience
- * Continual Improvement
- * Achieve DIFOTIS on all our deliverables/projects
- * Share knowledge
- * Reduce costs
- * Improve internal and external reporting

We want to achieve these goals using a Quality system that is user friendly and facilitates the completion of required work.

Risks and Constraints

The system will need to operate on the existing company IT infrastructure. Any new system that is purchased or developed may need to be changed in future to reflect any changes to ISO9000:2001 so that [REDACTED] will continue to be ISO accredited. Changes to ISO standards only occur every five to six years and usually take the form of enhancements therefore it is unlikely that any change would impact greatly on this new system or could not be incorporated through system changes. If the new system was an off the shelf product then new versions would need to be purchased to incorporate the ISO changes.

Requirements

An electronic Quality Control System that provides an integrated method of:

- * Work Flow Management
- * Reminders
- * Search all areas of QIS for user tasks/requirements
- * Growth – the ability to incorporate other facets e.g. knowledge management
- * Reporting: KPI and one-off reports for internal and external use

[REDACTED] Colleagues will use the system from any computer connected to the LAN. Any new system will need to be available so that the business areas that operate 24/7 have access outside normal business hours.

Documentation of the low level system requirements will be done by selected representatives of three categories of users, System, Administrator and ISO9001:2000. These users will also be involved in testing the system prior to deployment and signoff on all requests and changes. Marketing will approve all branding (i.e. use of [REDACTED] logo, screen colours etc) requirements of the new system.

Roll Out of New System

The method of roll out will depend on whether we purchase an off the shelf product or build our own system. If an off the shelf product is purchased then a “big bang” roll out will be used whereas if we build our own system the roll out will be in phases. The roll out will include seminar’s; training and user guides and the release will ideally be accompanied with a road show introducing the new system to the company.

Financial/Budget (rough estimate only)

The new system will not increase or decrease [redacted] staff numbers but will significantly reduce the time required by users to complete required work providing more time for [redacted] business including chargeable work. There is the lost opportunity cost of [redacted] working on HR systems but the GM HR considers that of all the projects for the Systems Analyst, this is the most important because it affects so many people and is impeding performance of [redacted] serious improvement system.

The people expected to be involved in the project are:

- Project Sponsor: Executive Representative for Quality
- Systems Analyst: 1 person
- Technical Specialist: 1 person
- System Administrator: 1 person
- Users: 3 people
- Other: 1 person representing ISO requirements

To complete the Preliminary Analysis for this project the estimated cost is:

Business Analyst	8 days @ 8hrs/day@ \$65/hr	\$4,160
Technical Specialist	2 days @ 8hrs/day@ \$65/hr	\$1,040
		—————
		\$5,200

Approved: _____

Date: //

Project Sponsor:

Appendix B: Legend explaining Flowchart Symbols

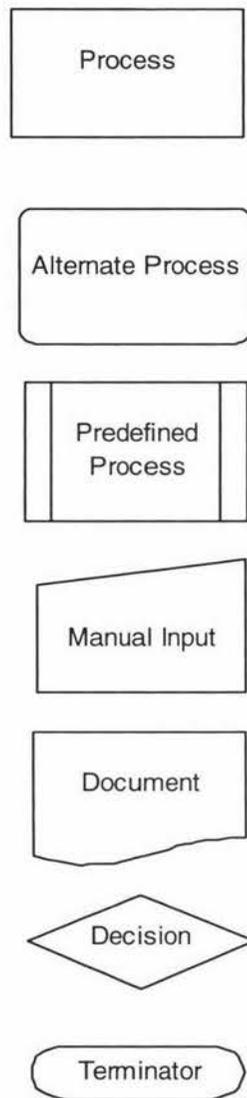


Figure 7: Flowchart Symbols

Appendix C: Example of Assessment Criteria for Vendors - Cost Category

Ongoing Support & Maintenance

1. In-house skills transfer of maintenance skills/requirements

We do not want to rely on external contractors for support & maintenance; we want to be able to do this in house

2. Minimal system support cost

This relates to the support of the system, not supporting the Quality Procedures. Minimal support is for such things as

1. Fixing mistakes
2. Making changes to items
3. User logon maintenance (if logon is required.)

3. Reduced Administrative Support

The amount of time required by the Quality Administrator to maintain the system is reduced e.g. having a system that can setup a non-conformance control file automatically will eliminate the need for an administrator to set up the Excel spreadsheet.

Annual software charges

No additional software charges for software that is not used in other areas of the organization.

Setup Costs

This refers to the costs that will need to be paid to a third party for the rights to use the software that the system runs on.

1. Requires Intangible costs rather than tangible costs i.e. use in-house resources not bringing in contractors
2. Payment of tangible costs needs as much deferred to FY2004/05 as possible

Training

1. User training

Some for of user training is required. There are various options available:

- Individual training (highly unlikely)
- User Guides (likely/ would be published in Quality Document System)
- “Guru” training i.e. several “Guru’s” are trained so they can help people in their area when required.

Phone support i.e. the user would contact the administrator for assistance when required

2. Administrator Training

What training the system administrator will receive, options include

- Training course provided
- Manuals/guides

The administrator requires user training and administrator training and additional training on how to assist the users if phone support is provided.

Documentation

3. User Manual

- A user manual must be available in electronic format, available by hyperlink from the system and through Quality Document System

4. Administrator Manual

- The administrator manual will be available in electronic format. It will not be published in Quality Document System.

5. System Manual

Appendix D: Evaluation Criteria Scoring Spreadsheet Example – Cost Category

Evaluation Criteria - Quality Improvement System

Criteria	Cost							
Criteria Ref	C							
Category Ref	Category Name	Sub Category Reference	Sub Category Name	Expectation	Classification 5 = High, 1 = Low			Assessment
					Mandatory	Desired	Optional	
OSM	Ongoing Support & Maintenance	OSM1	Inhouse Skill Transfer	That skills will be inhouse or transferred inhouse and not rely on contractors.		5		
OSM	Ongoing Support & Maintenance	OSM2	Minimal system support	The system will require minimal support from IG		3		
OSM	Ongoing Support & Maintenance	OSM3	Reduced Administrative Support	This refers to the time required by the Quality Administrator to maintain the system e.g. updating organisation chart	4			
ASC	Annual Software Charges	ASC1	No additional software charges	No additional software charges for software that is not used in other areas of xxx. Additional licenses may be required for existing software used	3			
SC	Setup Costs	SC1	Intangible rather than Tangible Costs	That we use inhouse skills rather than bringing in Contractors to set up the new system		4		
SC	Setup Costs	SC2	Defer Costs	Defer tangible costs until the next financial year i.e. FY2004/05		4		
T	Training	T1	User Training	User training is included with the system or does not require additional expenditure		3		
T	Training	T2	Administrator Training	Administrator Training is included with the system and does not require additional expenditure		3		
D	Documentation	D1	User Manual	is included with the system in electronic format so that it can be published in Quality Document System		5		
D	Documentation	D2	Administrator Manual	is included with the system, is in electronic format but will not be published in Quality Document System		3		
D	Documentation	D3	System Manual	Same as for the Administrators Manual	4			

Appendix E: Capital Expenditure Approval Request

1. Proposal

That the General Manager approves capital expenditure of \$40,000 to permit the development of the automated, integrated Quality Improvement System.

2. Background

■■■■ has been certified to ISO 9001 for 10 years. We require certification to do work for large organisations such as ■■■■■■■■■■, and to demonstrate our ability to deliver on tenders.

Quality documentation required to maintain this certification is currently held in Quest.

An updated version of ISO 9001 was released in 2000, and the new standard places emphasis on the need for effective continuous improvement initiatives within certified organisations. All ISO 9001 certified organisations are now required to comply with the new standard. Continuous improvement is a requirement of ISO 9001:2000 and lack of an appropriate and effective system may cause us to lose our certification.

In ■■■■, continuous improvement is currently managed through

- the audits spreadsheet,
- the recommendations spreadsheet, and
- the non-conformance control system.

These are all difficult to use, time consuming to follow, to manage, and report on. Management of the system currently requires about 40 hours a month, and usage of the system by managers and others is estimated at 45 hours a month. The dollar cost of this to the organisation is about \$11,500 per year.

Another, equally important cost is in reduced efficiency, and increased frustration endured by users of the present system.

The current system is drastically under-utilised, with the result that recommendations are often not followed through as they are deemed to be too difficult to find, thus the continuous improvement objective is often defeated.

In 2002, the non-conformance control system was automated as a trial, and within six months usage of this system increased 100%. However, this system is not stable and thus usage of it has again dropped off. It is also expensive to administer. While this system is not optimal, it has been invaluable in demonstrating the value of an improved, easy to use system.

The advent, over the last two years, of electronic Business Process Modelling (BPM) software have provided us with an effective application type that will enable us to overcome the restraints of the 2002 non-conformance control system prototype.

3. Risks

The system will need to operate on the existing company IT infrastructure. Any new system that is purchased or developed may need to be changed in future to reflect any changes to ISO 9001 so that [REDACTED] can maintain its certification to the standard.

Changes to ISO standards occur as required but usually take the form of enhancements therefore it is unlikely that any change would impact greatly on this new system or could not be incorporated through system changes. If the new system was an off the shelf product then new versions would need to be purchased to incorporate the ISO changes.

The interest of other areas of [REDACTED] (such as SMC) in BPM has reduced the risks originally perceived in designing in a software type not widely accepted in the organisation.

It is difficult to quantify the cost savings that would result from this system (the cost of rework and internal failures are not currently monitored by [REDACTED] - as far as we are aware). However, Lewis J. Ireland (p. IV-3, *Quality Management for Projects and Programs*, Project Management Institute, Pennsylvania, 1991) indicates, "that the cost of non-quality is in the range of 12 to 20 percent as compared with to a should-cost of 3 to 5 percent of sales. This general comparison of quality versus non-quality costs shows a difference of approximately 10 percent".

The prototype automation of the non-conformance control system may have halved the cost of sales to [REDACTED], but even a saving of 2% on [REDACTED]* would be worth [REDACTED]. *([REDACTED]'s budgeted sales revenue for the financial year ending June 2004, as reported in [REDACTED]'s Consolidated Profit and Loss – January 2004, p.5.)

Although the FTE count is unlikely to change as a result of the proposed new system, administration time should be significantly reduced, enabling the administrators to use this time more effectively elsewhere.

Managers and other affected colleagues will be able to find items that are outstanding to them or their team members quickly and effectively, saving time at every level of the organisation.

The proposed system will be useful as an index of issues, their fixes and learning moments so that similar problems can be solved more cost-effectively in future.

Increased visibility of the system will assist management in ensuring that issues are effectively dealt with. In addition, it will be possible to provide accurate reports to senior management on the status of the continuous improvement system, so they can demonstrate accountability to shareholders.

BPM software has the capacity to radically improve the effectiveness of [REDACTED] business processes. The QIS system is almost ready to prototype, and is a good size to run an effective trial of this software and its value to the organisation.

5. Timing

Jan. 2004 – Feb. 2004	Idea Conception	Idea Conception report completed
Mar. 2004	Preliminary Analysis	Evaluation Criteria defined and suppliers assessed
Apr. 2004 – May 2004	Preliminary Analysis	Draft Functional Model designed
Early Jun.2004	System Architecture Functional Design	System Architecture and Functional Design documented
Jun. 2004 – Jul. 2004	System Construction	Prototype designed using xSol
Aug. 2004	System Construction	Prototype testing
Sep. 2004 onwards	Final software choice	Await ■■■ decision which will govern further development

The Quality Team has decided that as only one type of software for Business Process Modelling (BPM) is required by ■■■, and ■■■ is already in the process of selecting this, that it will use whatever software is chosen by ■■■. The Quality Improvement System project timeline from this point on will therefore be governed by the SMC's choice of BPM software.

The table below provides two indicative timelines for the completion of the project with the choice of software governing which timeline should be applied.

Sep. 2004	XSol chosen as final BPM software	e-Work or another product chosen as final software
Oct. 2004 – Nov. 2004	Feedback on system & resultant tweaking	System Construction
Dec. 2004	Implementation	Prototype testing
Jan. 2005 – Feb. 2005	<i>(end of project)</i>	Feedback on system & resultant tweaking
Mar. 2005		Implementation

The CAPEX requested in this proposal is to cover costs up to the prototype stage of the Quality Improvement project.

6. Financials

Item	Detail	Cost
Software	Will use BPM product chosen by [REDACTED]	nil
Systems Analyst	60 days @ 8 hrs/day @ \$65/hr	\$31,200
Systems Administrator	60 days @ 2.5 hrs/day @ \$59/hr	\$8,850

7. Recommendation

That CAPEX of \$40,050 is approved.

Approved:

Executive Representative for Quality

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