



An innovative process improvement approach that integrates ISO 9000 with the Baldrige framework

Robin Mann

Massey University, Palmerston North, New Zealand and

Michael Voss

PYXIS Consulting, Marton, New Zealand

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Abstract *Presents an innovative approach used by one company to integrate its ISO 9000-certified management system with a recognised TQM framework (the Baldrige model). The company concerned developed its ISO 9000 system to address all elements of the Baldrige criteria. Of particular note is its process improvement approach that prioritises improvement projects based on their expected impact on the company's Baldrige score. This approach supported by an online Lotus Notes system helps the company to manage over 200 projects, covering different business units, in a systematic, fact-based way. All projects (with the exception of some strategic projects) pass through this system and therefore this system provides one of the key methods with which the company continuously improves and moves closer to fully satisfying its stakeholders' needs. A detailed description of this process improvement approach is provided including a number of key measures reporting on the effectiveness of the system.*

Introduction

The purpose of this paper is to present an approach, used by one company, to integrate its ISO 9000-certified (ISO, 1994) management system with the Baldrige criteria, thus facilitating a smooth transition from a quality assured company to a TQM company. In particular, it will report on this company's innovative process improvement approach, as it provides a good example of a systematic fact-based approach to improvement and it is where the company gained most benefit from integrating these two quality frameworks.

The paper begins by providing a review of previous research on the links between ISO 9000 and TQM award models. A general overview of the company concerned and the key characteristics of its management system follows. The remainder of the paper focuses on the company's process improvement approach.

ISO 9000 and TQM award models

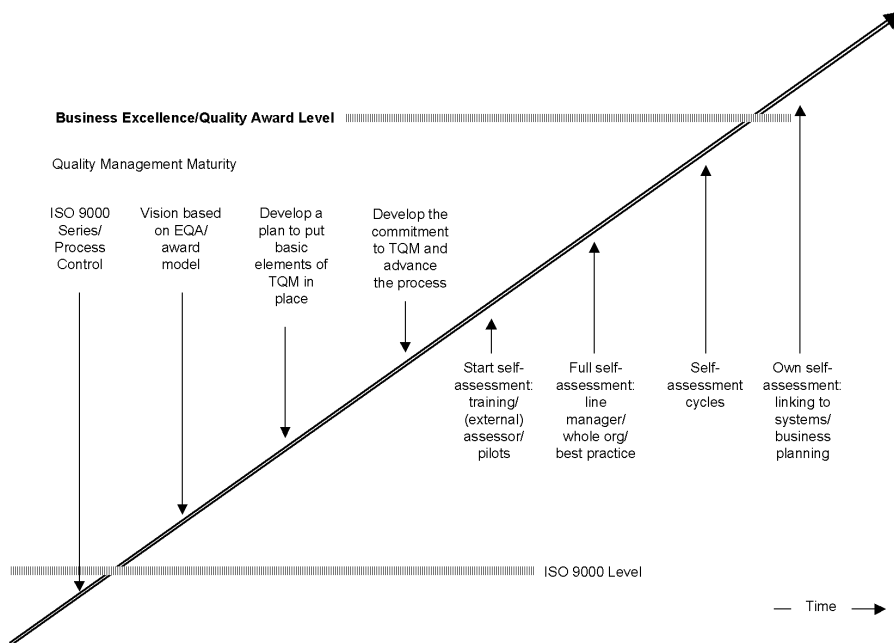
The evolution of quality management from inspection to quality control to quality assurance and through to TQM has been well documented (Garvin, 1988; Hutchins, 1990; Dale, 1994). Progressing through these evolutionary steps presents major challenges to organisations. The final step towards TQM is recognised as the most difficult. This was particularly the case, in the late

1980s and early 1990s, when there was widespread confusion as to the elements of TQM and how it was implemented (Mann and Kehoe, 1994). Whilst research was conducted in this period to identify the common elements of TQM (much of this work is summarised by Martinez-Lorente *et al.* (1998)) there was certainly no widely accepted and recognised TQM framework. In the late 1990s the challenge, in a sense, has become easier as TQM is now more clearly understood through the development and worldwide acceptance of TQM award models such as the Baldrige model, and the European business excellence model.

Work by van der Weile *et al.* (1997) focused on the challenge faced by many companies moving towards TQM. They explained the importance for a company of having a quality assurance system in place before progressing towards TQM and proposed an eight-step plan (see Figure 1) involving first the achievement of ISO 9000 certification (or a comparable system) and then the use of self-assessment against a TQM award model. ISO certification was advocated as the first step as:

continuous improvement only makes sense if an organisation knows what is going on in relation to the processes, which are underlying the things which need to be improved. The ISO 9000 series forces an organisation to describe the key processes and make them more transparent (van der Weile *et al.*, 1997).

The extent of the gap between ISO 9000 (1994) and TQM was highlighted by Porter and Tanner (1996) when undertaking a detailed analysis of the key



Source: van der Weile *et al.* (1997)

Figure 1.
From ISO 9000 series registration to quality award prize winner

differences between ISO 9000 and the TQM award models. Figure 2 highlights the differences between ISO 9000 and the European business excellence model. This Figure indicates that the main area addressed by ISO 9000 is in the “processes” criterion. Similarly, when considering the Baldrige model and ISO 9000, the main similarity is with the “process management” criterion (Fletcher, 1999). The following explanation by Porter and Tanner (1996) provides a good summary of the key differences between ISO 9000 and TQM award models (these comments relate to the European business excellence model but apply equally to the Baldrige model):

Comparing the concept of both ISO 9000 and the European business excellence model, it is important to recognise that ISO 9000 only covers the organisation’s quality management system while the European business excellence framework addresses the total quality orientation of the whole organisation . . . The ISO 9000 standards primarily address limited areas of the enabler side of the European business excellence framework. The standards give very little weight to areas that directly impact on business or organisational effectiveness. In contrast, the European business excellence framework addresses all areas that are generally recognised as important for the overall success and continuous improvement of the organisation.

The difficulty of progressing from compliance with the ISO 9000 quality management system requirements to TQM has been recognised by the International Organisation for Standardisation (ISO). Its technical committee is currently revising the 1994 version of the ISO 9000 series with the intention of publishing an updated standard in the year 2000. The changes being proposed are in areas that will specifically help organisations to bridge the gap to TQM and introduce more modern management practices.

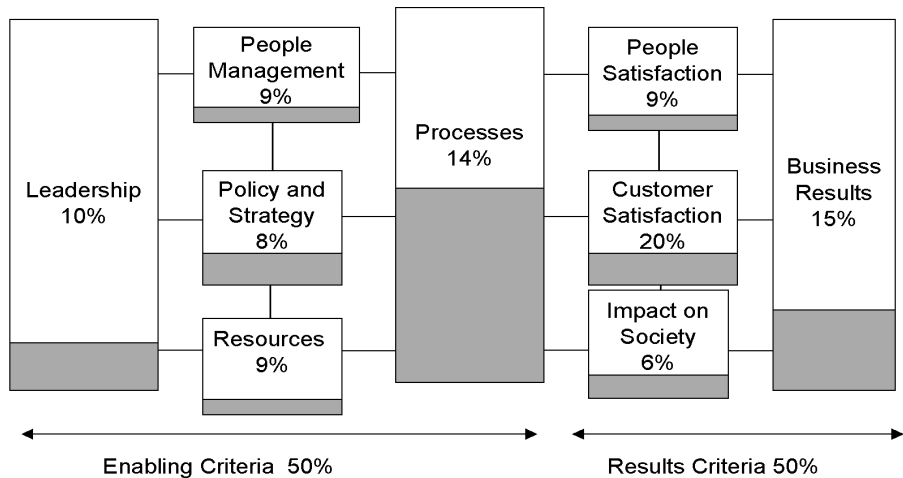


Figure 2.
European business excellence model and ISO 9000 comparison

Source: Porter and Tanner (1996)

The next section will show how one company has already approached this problem and developed a management system that integrates the ISO 9000 and TQM award frameworks.

Overview of PEC (New Zealand) Ltd and its management system

PEC (New Zealand) Limited develops, manufactures, markets and supports innovative business solutions to the oil, security, and retail industries. In particular, its market is in retail fuel dispensing and forecourt points of sale operations, and access control in the security industry. PEC is an international company with its 250 staff organised into three business units (based in New Zealand, Australia and London). Most of its support services including hardware development, manufacturing, finance, human resources and business improvement are provided by the corporate head office and shared by its three business units.

PEC's vision is to build a successful and enduring company whose innovative solutions and products lead their respective markets. To achieve this vision, PEC has developed its management system with the following characteristics:

- (1) *It is designed to address all areas of the business.* All procedures that add value to the organisation are included in the PEC management system. This means that the scope of the documentation is much wider than that for ISO 9001 and addresses all areas of the Baldrige criteria. For instance, procedures are followed for strategic and business planning, recruiting, and selecting staff for new positions. To assist ISO 9001 auditors, the relationship between individual management system procedures and the ISO 9001 standard is detailed using cross-reference tables.
- (2) *It is designed to react quickly to changing business needs.* Through an online process improvement request (PIR) procedure all staff can at any time activate a process or management system review or suggestion for improvement. The PIR procedure ensures that these reviews or suggestions for improvement are addressed in a specific timeframe according to business priorities (based on the Baldrige criteria). Changes to management system documentation are immediately transmitted online, in electronic form, to personnel at all locations.
- (3) *It is designed to satisfy the requirements of ISO 9001.* ISO 9001 certification was achieved in December 1992. Although the management system has been designed to satisfy the requirements of ISO 9001 its main emphasis is on meeting the needs of PEC. To help to ensure this, all procedures within the management system have a process owner and a cross-functional review team (from the three business units) with the responsibility for ensuring that each procedure continues to meet the needs of the company.

An example of the organisation's approach to ISO 9000 is demonstrated by the way that audits are scheduled. Audits need to be undertaken when a PIR is submitted. If a process is not audited as a result of a PIR during a

12-month period then the PIR system automatically advises the process owner that there is a requirement for the procedure to be audited. This audit system ensures that processes are audited by business needs rather than through adhering to a scheduled rota system normally employed to satisfy ISO 9001 requirements. It also identifies which processes/procedures may not be of value to the organisation as a process/procedure not included in a PIR during a 12-month period may not be of value to the business.

- (4) *It is designed to ensure the continual improvement of product and processes.* An overview of how this is achieved is shown by the “production overview” procedure (refer to Figure 3). The production overview procedure outlines the interaction between the product-related procedures (product concession, product recall/rework, non-conforming goods change request and product change) and the process related procedures (corrective and preventive action, management system document process and issuing). The corrective and preventive action procedure (that encompasses the PIR system) provides the key means of improving processes and also products based on audit requests, customer complaints and suggestions, staff member suggestions, supplier suggestions and local community inputs.
- (5) *It is designed to be a practical management system that is understood and used by all staff.* To achieve this the PEC management system documentation has been developed to be as concise as possible. The documentation inclusive of policy and procedures is just 100 pages long. Procedures contain both flowcharts and tables to enable the process to be clearly understood by the diverse range of backgrounds and education of staff members at PEC. In addition, work instructions are used sparingly in order to avoid the creation of too rigid a system that allows little freedom for flexibility and stifles innovation. All staff members have access to PEC’s management system either as a manual (in loose-leaf, pocket-book size for user-friendliness) or in electronic form. All manual holders are responsible for updating documents and destroying the superseded pages.
- (6) *It is continuously reviewed for effectiveness.* Reviews of the system are undertaken by the PEC management team, business improvement team, and via input from staff and customers (through surveys and the PIR system).

The remainder of the paper will focus on PEC’s innovative online PIR system and show how it links to the Baldrige criteria.

PEC’s PIR system

PEC’s PIR system, along with the company’s strategic planning process, is designed to provide a systematic, fact-based approach for improving all of its

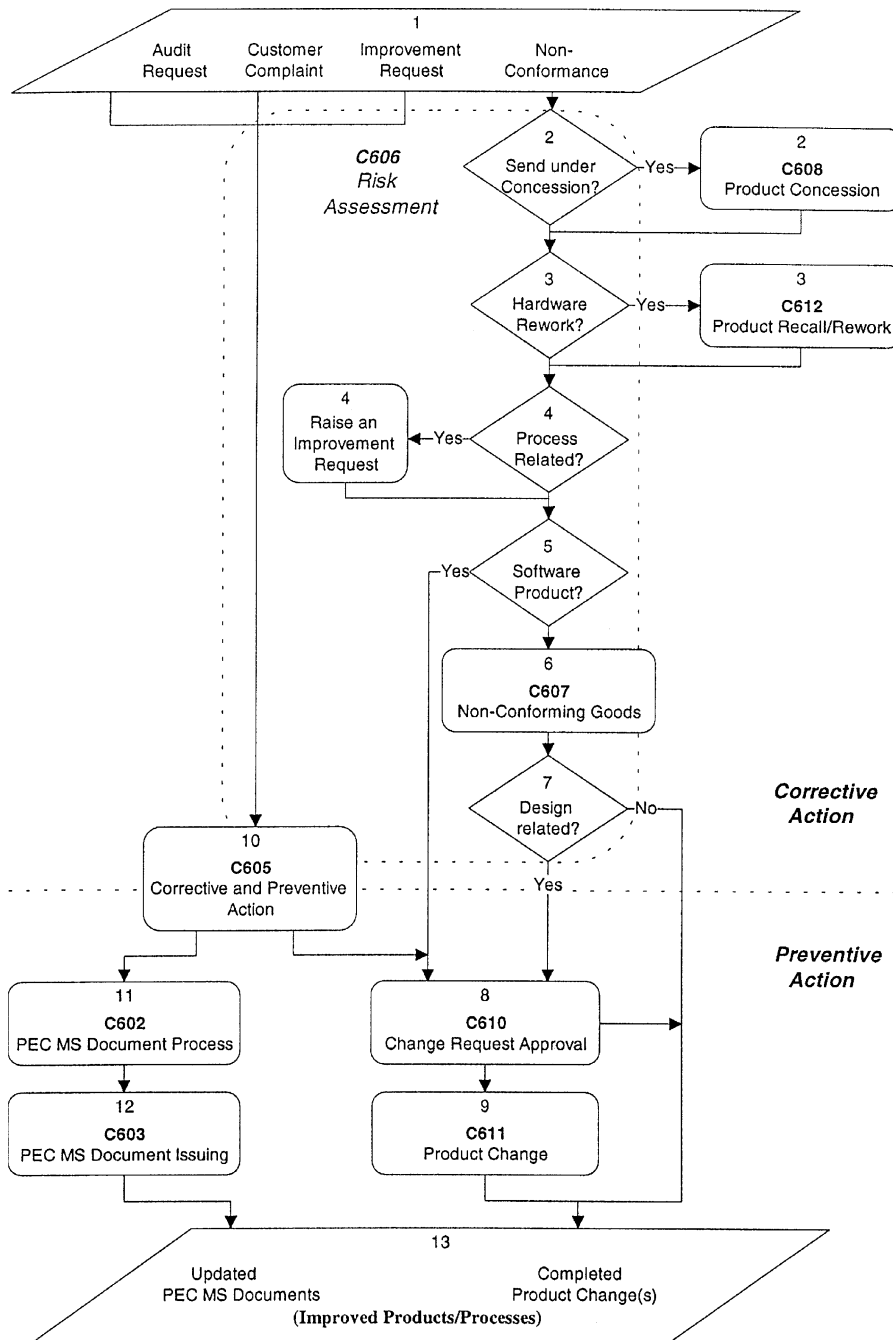


Figure 3. Production overview of the PEC procedures that ensure continual improvement of product and service (Procedure C601)

processes as well as its products and services. The company's strategic planning process identifies areas of greatest need for improvement through a Baldrige self-assessment process and regular management reviews. The PIR system manages the improvement projects that result from the strategic plans (top-down projects) and are put forward from its staff on a daily basis (bottom-up projects). Through the PIR system process improvement, projects are channelled and monitored to ensure resources are being devoted to areas of greatest need. To achieve this, projects are prioritised based on the organisation's relative performance against the Baldrige model and its strategic goals.

Figure 4 illustrates how the PIR system is used in PEC to continually move the organisation forward. Improvement opportunities are systematically addressed using a "plan-do-check-action" approach (Stages 1-11 of the corrective and preventive action procedure are shown in Figure 5) that through considering the Baldrige criteria ensures that the organisation focuses on issues that are most relevant. These improvements are then fed back into the management system so that it continually develops and moves the organisation closer to fulfilling total stakeholder satisfaction.

As PEC's PIR system primarily focuses on improving processes (as defined by the Baldrige criteria[1]) it is useful to revisit the work undertaken by Porter and Tanner (1996) on the typical links between ISO 9000 and the "process

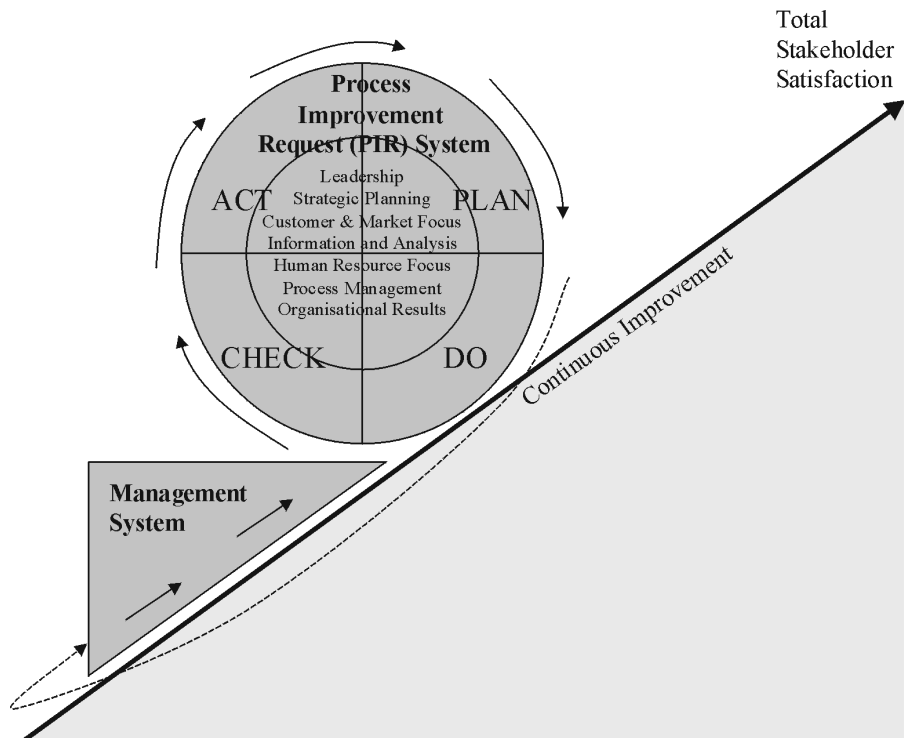


Figure 4.
PEC's journey of
continuous
improvement

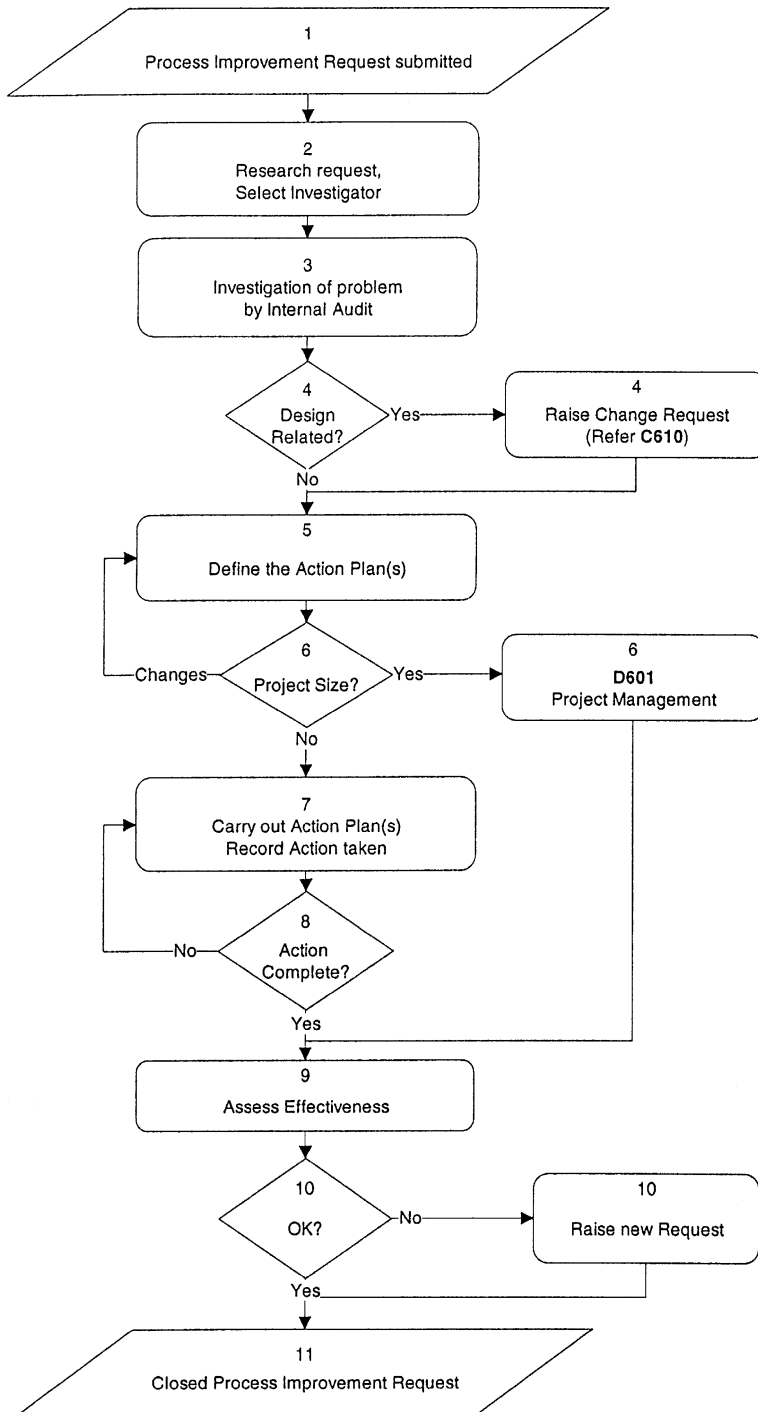


Figure 5.
Corrective and preventive action
(Procedure C605)

management” TQM award criterion. Their work identified that the following elements of the ISO 9000 series were addressed in the European business excellence model element processes:

- contract review;
- design control;
- purchasing;
- purchaser supplier products;
- product identification and traceability process control;
- handling, storage and packaging; and
- delivery servicing.

They then went on to describe the key differences between the standard and the European business excellence model for these criteria as:

While the standard only aims at identifying and describing these processes, the European Business Excellence framework goes a step further and addresses also:

- how these processes are identified and systematically managed;
- how measurements are used along with all relevant feedback to review the processes and to set targets for improvement;
- how the organisation stimulates innovation in process improvement; and
- how the organisation implements process changes and evaluates the benefits.

It is believed that the approach used by PEC addresses all these elements and enables the company to satisfy a similar key requirement of the Baldrige criteria that they have “a fact-based, systematic evaluation and improvement process” (NIST, 1999).

The 11 stages of the corrective and preventive action procedure that encompasses the PIR system will now be described.

Stage 1. Process improvement request submitted

PIRs can arise from many different sources such as suppliers, customers, local community, staff and internal or external audits. Any member of staff can register a PIR on the company’s Lotus Notes-based PIR system. The PIRs are categorised as one of the following:

- customer complaint (an issue raised by an external customer for investigation);
- corrective action request (records a problem with the operation or content of a management system document);
- internal customer complaint (an issue raised by an internal customer for investigation);
- major improvement opportunity (a major process problem or improvement opportunity);
- improvement suggestion (a minor process problem or improvement opportunity); and

- internal audit request (a request for a special audit raised by a management team member in order to investigate a process).

Once a request is submitted it is sent electronically to the business improvement department for a business improvement potential assessment. It is at this stage that the Baldrige framework is used to assess the importance of the problem to the business.

The key stages involved in prioritising the request are shown below:

- (1) *An assessment of the improvement potential.* The request is assessed in terms of the impact it has on each item of the Baldrige model. A request can score zero, low or high. A zero rating is given when the request would have no effect on a Baldrige item. A high rating is given when the request would have a significant effect on one of the items or sub-items of the Baldrige model.
- (2) *An assessment of the organisation's needs.* Results from the latest organisational self-assessment (using the Baldrige model) are used to prioritise, in terms of importance, the areas of the business that need to be improved. This is achieved by multiplying the Baldrige points value for each sub-item by PEC's gap against the item. For instance, the points value for Item 1.1 (organisational leadership) is 85 points. If PEC at their last self-assessment assessed Item 1.1 at 0.3 of this total and their goal is 0.7 then the gap would be 0.4. In this case, the 85 points would be multiplied by 0.4 to identify a gap of 34 points for Item 1.1. By considering the size of the gaps for each item the company can ensure that it focuses on the areas that are likely to bring the greatest benefits.
- (3) *Combining the improvement potential with the organisation's needs.* The third stage is to combine the improvement potential rating with the organisation's needs rating. This is achieved through multiplying these figures together. The resultant "improvement factor" then helps the company to prioritise the process improvement request.

An example of this assessment process for a PIR is shown in Table I. This particular PIR resulted from a staff member recognising that a key document (functional requirements) within the project management procedures was not completed prior to development work proceeding. The lack of this completed document has a high impact on Item 3.2 (customer satisfaction and relationships) primarily because it provides a key access mechanism to customers (therefore responding to Baldrige Item 3.2a1 – "how do you determine or target customers?"), is used to deploy requirements to staff (therefore responding to Baldrige Item 3.2a2 – "how do you listen and learn to determine key customer requirements?") and is used to help build relationships (therefore responding to Baldrige Item 3.2a4 – "how do you keep your listening and learning methods current with business needs?"). Similarly, a high impact was assessed for Item 6.1 (product and service processes) as the

Table I.
Calculation of PIR
improvement factor^a

Baldrige criteria	Point values	Gap analysis	Organisational needs score	Improvement potential ^b	Improvement factor
1. Leadership	125				
1.1. Organisational leadership	85	0.32		0	
1.2. Public responsibility	40	0.32		0	
2. Strategic planning	85				
2.1. Strategy development	40	0.35		0	
2.2. Strategy deployment	45	0.35		0	
3. Customer and market focus	85				
3.1. Customer and market knowledge	40	0.35		0	
3.2. Customer satisfaction and relationships	45	0.35	15.75	3	47.25
4. Information and analysis	85				
4.1. Measurement of organisational performance	40	0.40		0	
4.2. Analysis of organisational performance	45	0.40		0	
5. Human resource focus	85				
5.1. Work systems	35	0.33		0	
5.2. Employee education, training and development	25	0.33		0	
5.3. Employee wellbeing and satisfaction	25	0.33		0	
6. Process management	85				
6.1. Product and service processes	55	0.37	20.35	3	61.05
6.2. Support processes	15	0.37		0	
6.3. Supplier and partnering processes	15	0.37		0	
7. Organisational results	450				
7.1. Customer-focused results	115	0.37		0	
7.2. Financial and market results	115	0.37		0	
7.3. Human resource results	80	0.37		0	
7.4. Supplier and partner results	25	0.37		0	
7.5. Organisational effectiveness results	115	0.37		0	
Total	2,000				108.3

Notes:

^a This is an example of how improvement factors are calculated for PIRs. The example given is taken from a real PIR investigating a "failed process to generate business functional requirements"

^b Improvement potential can be classified as one of the following: 0 = zero; 1 = low; 3 = high

document plays an important part in ensuring that products and processes are managed effectively. This assessment resulted in a total improvement factor of 108.3.

- (4) *Prioritising the process improvement request.* The Lotus Notes system automatically re-orders and prioritises all PIRs daily based on the improvement factors. The top scoring 5 per cent of PIRs are assigned as critical, with the next 20 per cent as high, 25 per cent as medium with the remaining 50 per cent low. This approach ensures that the organisation is always focusing on the top 5 per cent of issues no matter what the actual improvement factor rating is.

An icon appears in all “Notes Views” of Lotus Notes to indicate the priority of each PIR in the system. This scheme ensures that staff members who have a number of PIRs assigned to them have a clear indication of which PIR is strategically most important to be progressed.

- (5) *System reminders.* To ensure that PIRs keep moving through the process the system automatically sends an e-mail reminder to the staff member assigned to the project if the project is late. The date the reminder e-mail is sent is dependent on the expected completion date and priority of the project. The grace periods given for the different levels of priority are as follows:
- critical – 4 days;
 - high – 11 days;
 - medium – 18 days; and
 - low – 25 days.

Stage 2. Select investigator

Anyone can assign the most appropriate staff member to be the investigator of a request. Typically, though, the investigator is the person who submitted the request unless an independent investigation is necessary or the individual does not have the required expertise. The business improvement department receives an e-mail describing any change that is made to a PIR and so is able to monitor and where necessary change the person assigned. For requests resulting from non-conforming products special investigation teams are formed consisting of the business unit manager, the development or production manager and the business improvement manager.

When the request is passed on to the investigator the status of the request is recorded as “investigate”. This helps the business improvement department to track the progress of the requests. Subsequent changes in status are:

- (1) “action”;
- (2) “effectiveness”; and
- (3) “closed”.

All changes in status are recorded and monitored in the Lotus Notes process improvement database.

Stage 3. Investigation of problem (or improvement opportunity) by internal audit

The PIR is initially investigated by means of an internal audit reviewing any PEC policy statements, procedures and work instructions involved in the process.

Since most processes involve staff members across several business units, the investigator will usually involve the cross-functional review team members in assessing the problem (or improvement opportunity) checking the cause and proposing what action should result. Where the PIR addresses several processes with different process owners and team members, a member of the business improvement team is usually assigned to conduct the investigation. In these instances existing processes are checked against current best practice using a variety of means including accessing best practice sites on the Internet and via the local Baldrige evaluator network.

Stage 4. Is the problem (or opportunity) design-related?

If the request is related to a design enhancement or design problem then this is identified, a change request raised and the PIR request finishes. The change request then follows the change request procedure, which assesses the feasibility of the design change.

Stage 5. Define the action plan

The investigation team plan the corrective actions required to address the improvement opportunity and if it is a specific problem an action plan is put in place that will prevent its recurrence. These action plans are recorded in the PIR directly. Once saved, advice of changes to the PIR are forwarded to the business improvement department.

Stage 6. Review the action plan and assess project size

The business improvement department reviews the proposed action plan. Where changes are required to the action plan the investigation team is consulted. If the action plan is large enough to warrant a project the project management procedure is followed. A project is usually considered when the corrective and preventive action plans involve significant cost, duration, importance or complexity (for example, involving more than one business unit).

Stage 7. Progress action plan

Once the action plan has been approved, the business improvement department may reassign the PIR to the most appropriate person for the action plan to be carried out and the request status is changed to "action". The PIR database allows multiple action tasks to be created and assigned to individual staff

members with separate target dates. The same reminder system is used to ensure that the staff member responsible for the PIR can keep track of all action plans. Upon completion, the PIR owner records the actions taken.

Stage 8. Review if actions have been completed

The business improvement department verifies that the action taken has properly addressed the request. If the action is incomplete then it is returned to Stage 7.

Stage 9. Change status to effectiveness

When the business improvement department has assessed that the action plan has been completed, the PIR is reassigned to an auditor and a target review date is set for the audit and the request status is changed to “effectiveness”. The audit date is usually set for three to six months in the future to ensure that the modified procedure has been used within the business. In some instances a longer period may be required.

Stage 10. Actions are reviewed for effectiveness

On the review date, the request is audited for effectiveness. The purpose of this audit is to examine whether the actions taken have been effective in taking advantage of the improvement opportunity and/or correcting the problem and preventing a recurrence. Details of the results are reported to the appropriate managers and a summary of all actioned requests is forwarded to the PEC management team each month. If the action taken has not been effective, then a new request is created to re-address the problem. The auditor also makes an assessment of how smoothly the PIR progressed. A graphical display shows the number of PIRs that have progressed as excellent, good or unsatisfactory. This information is used by the management team to improve the PIR system.

Stage 11. Closed process improvement request

After the appropriate action has been taken based on the effectiveness audit the request status of the PIR changes to “closed”.

The effectiveness of the PIR system

The Lotus Notes-based PIR system has enabled PEC to efficiently implement a workable process for evaluating and improving processes. The PIR system has helped change the culture of the organisation from one that passes on quality problems and opportunities to quality staff to one that gives individuals the responsibility and tools to solve and prevent problems, and take advantage of opportunities. The success of the PIR system can be judged by the fact that over 3,500 improvement projects have been successfully completed since the system was introduced in January 1996.

Furthermore, prior to the PIR system implementation, PEC’s corrective action system involved one full-time person who could effectively manage up to 12 simultaneous improvement projects. The Lotus Notes-based PIR system

currently employs 50 per cent of a person’s time managing the 220 improvement projects currently under way, representing a 37 times productivity increase.

Figures 6-9 are part of PEC’s management reporting system. The first graph, Figure 6, shows the number of PIRs by month and reports on their progress status. As shown, there are presently over 200 PIRs most of which are in the investigative stage. It can be seen that the total number of PIRs has remained relatively static and the number of new requests is reducing. This indicates that the average cycle time involved to complete a PIR has been increasing.

To monitor cycle time of PIRs an “average time to effectiveness” measure is regularly reviewed by the senior management team (see Figure 7). This Figure shows that the average time to effective action for PIRs relating to the three business units (pumps, retail and cardax) and for general corporate activities has been increasing. In addition an “age of PIRs” measure has revealed that currently around 50 per cent of the PIRs in the system have not changed in status over the past six-month period. The main reason for these trends is

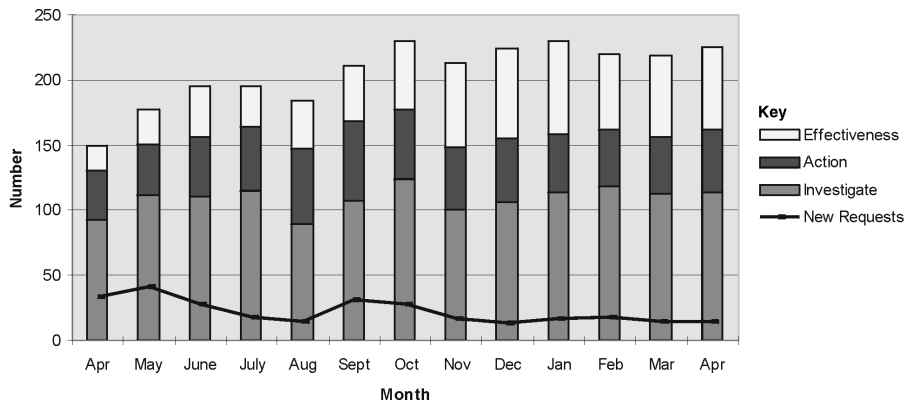


Figure 6.
Process improvement requests (all types)

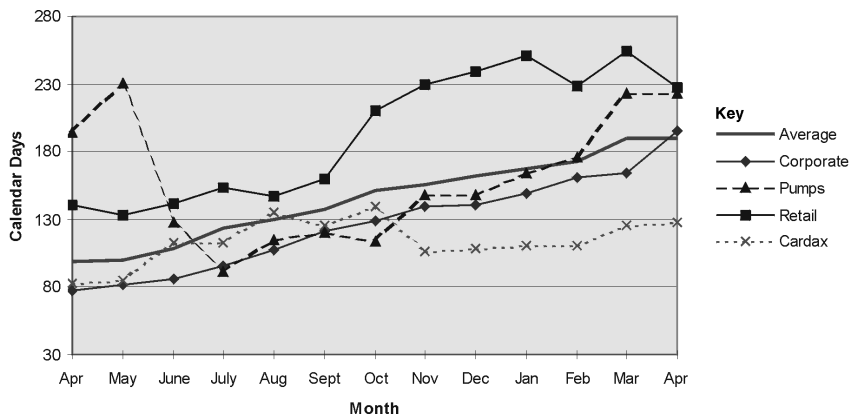


Figure 7.
Average time to effective action: all requests

resources being diverted to prevent the slippage of key Y2K projects and the recent combining of the staff suggestion scheme with the PIR system (this created a backlog of projects that stretched the present resource). Having a PIR system during this period has helped PEC to make fact-based decisions to decide on which projects to tackle, in which order and at what level of resource. The system has ensured that PEC has remained focused on critical projects. For instance, this has meant that resource over this period was not diverted from solving customer complaints with the result that customer complaints have continued to reduce (see Figure 8). This reduction in complaints is also a major reason why the number of new PIR requests as shown in Figure 6 reduced.

Staff involvement in the PIR system is measured in two ways. The first of these is the proportion of total staff members who have been involved in raising a PIR over the past two years (see Figure 9). This graph shows that the

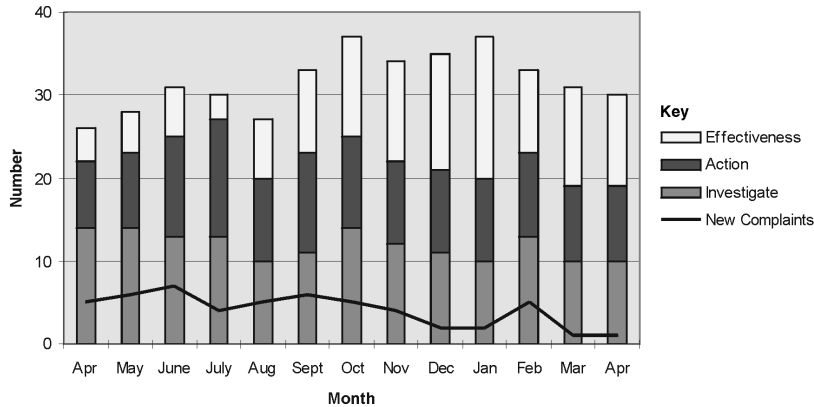


Figure 8.
Current customer complaints

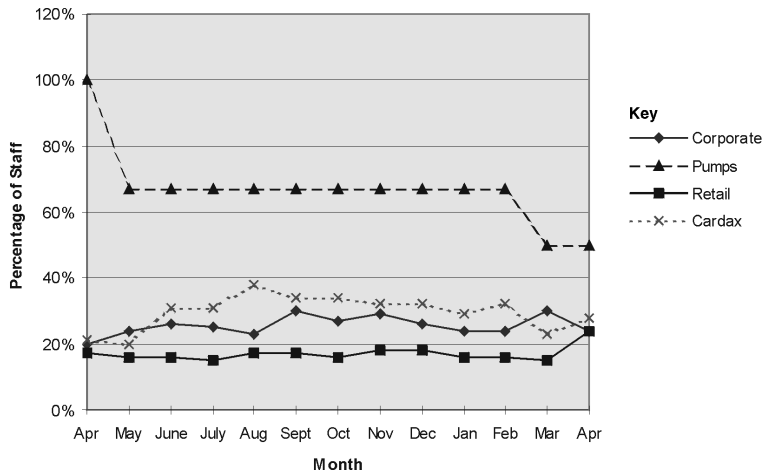


Figure 9.
Staff usage of process improvements database: people raising PIRs by business unit

number of staff raising PIRs over the last two years averages at about 25 per cent for the three business units and at about 65 per cent for corporate head office. Perhaps a more relevant measure to use that has only recently been introduced is the percentage of people involved in editing a PIR over the last two years. This is presently at 45 per cent of staff across the organisation.

Overall, PEC's management team consider the PIR system to be effective at measuring, reporting and managing the PIRs across the entire organisation while still enabling "drill-down" into each work unit within the separate business units. One of the particular strengths of the system is the ease with which improvement opportunities recognised in one particular work unit can also be applied across other work units and business units in the company.

Work, though, is continuing to look at improving the PIR system. Recently effort has been targeted at improving deployment of the system to all areas across the three business units. Another project has been looking at a method that includes a financial analysis of the added value that results from the implementation of a PIR.

Conclusion

PEC's management system provides a good example of how the elements of ISO 9000 and the Baldrige model can be integrated together. In particular, PEC's PIR system has greatly assisted the organisation in bridging the gap from ISO 9001 certification to Baldrige performance excellence. The assignment of procedures to "owners" and the use of cross-functional teams in both the creation and the maintenance of the procedures have been additional key elements in moving the organisation forward.

PEC's process improvement system forms the basis of a sound systematic approach that is fact based with a strong emphasis on improvement rather than on reaction to problems. The system is integrated with other key processes in place and the Lotus Notes environment has eased organisational learning and sharing across geographic boundaries.

As with any system there are areas that need to be continually addressed such as the cycle time of PIRs. In general, though, the PIR system has achieved significant success with over 3,500 improvement projects being completed successfully since January 1996. This has enabled PEC to continually improve as assessed against the Baldrige framework.

Note

1. The Baldrige process management category examines the key aspects of an organisation's process management; including customer-focused design, product and service delivery, support, and supplier and partnering processes involving all work units (NIST,1999).

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