



The application and use of the PAF quality costing model within a footwear company

PAF within a
footwear
company

265

David R. Bamford
Manchester Business School, Manchester, UK, and
Nicola Land
Airwair International, Wollaston, UK

Received November 2003
Revised September 2004

Abstract

Purpose – The purpose of this paper is to describe an investigation into collection and measurement of cost of quality, explaining how this information was presented and used for business improvement in a footwear company.

Design/methodology/approach – An action research methodology was adopted. The research involved: review of available COQ literature; identification of cost categories; adoption and trial of cost collection systems.

Findings – Quality costing can only be used as a management tool if the data presented is both accurate and valid. This is limited by availability of required information and necessary expertise and resources to gather and analyse such information. Careful development of the cost model and a transparent, agreed methodology for employing it is essential.

Research limitations/implications – The methodology applied was appropriate, generating data to facilitate discussion and draw specific conclusions from. A perceived limitation is the single case approach; however, this can be enough to add to the body of knowledge.

Practical implications – Guidelines for quality cost collection and analysis are presented. The methodology developed is being used elsewhere within the same corporate group.

Originality/value – The paper describes how one company effectively used COQ to produce focused data for decision making. It demonstrates that COQ can focus efforts to improve business performance.

Keywords Quality costs, Business improvement, Footwear industry, United Kingdom

Paper type Research paper

Introduction

There has been a consistent effort by a relatively small number of companies to use and apply cost of quality (COQ) tools and techniques. An even smaller group of researchers (such as Dale and Wan, 2002; Roden and Dale, 2001; Campanella, 1999; Dale and Plunkett, 1999; Goulden and Rawlins, 1997; Bottorff, 1997; Bamford, 1995) report various attempts and efforts to establish COQ and allude to a variety of success factors and pitfalls to avoid. This paper will add to the body of knowledge by sharing the experiences of a major UK based footwear manufacturer, a sector in which there is little available quality costing literature at this time.

So what are quality-related costs? They are the money spent attempting to achieve a quality level of 100 per cent, plus the money wasted through failure. Establishing the COQ may be useful at a number of different levels within any business, to compare and



International Journal of Quality &
Reliability Management
Vol. 23 No. 3, 2006
pp. 265-278

© Emerald Group Publishing Limited
0265-671X
DOI 10.1108/02656710610648224

transfer successful techniques and ideas from one business unit to another. In being able to monitor trends in COQ valuable information, rather than mere data, is created and can be used as a basis for decision making. It allows for: more accurate setting of future budgets; the setting of realistic improvement targets and goals; and focused investment in prevention techniques to produce quantifiable savings (Bamford, 2004). According to Dale and Wan (2002) COQ helps companies to reduce manufacturing costs by identifying excessive cost, waste and non-value adding activities.

Proposed initially by Feigenbaum (1956), quality related costs comprise both the voluntary costs of achieving a desired level of quality, and the involuntary costs of failing to achieve it. These are respectively called the costs of conformance, and of non-conformance (Crosby, 1979). According to Musgrove and Fox (1990) sometimes also "cost of quality" and "cost of un-quality". Since its proposition by Feigenbaum, the Prevention (cost of any action taken to investigate, prevent or reduce defects and failures), Appraisal (cost of assessing the quality achieved), Failure (internal = costs arising within the manufacturing organisation of the failure to achieve the quality specified; external = costs arising outside the manufacturing organisation of the failure to achieve the quality specified) (PAF) model has been the principal method for quality costing. This model was the only one used by the British Standards Institute until 1992. From this date, the Process model was recognised and included (see BSI, 1990, 1991, 1992) note that these are currently out of print but have been incorporated within Campanella, 1999). Dale and Wan (2002) summarise two further methods: a less formal scheme based on collecting quality costs by department (outlined in Dale and Plunkett, 1999) and a team approach where the aim is to identify the costs associated with things which have gone wrong within a process (described by Robison, 1997). This paper focuses upon the implementation, application and use of the PAF model.

The definitions of the four kinds of cost incorporated within PAF can be taken from British Standard 6143: Costs of Prevention: any action taken to investigate, prevent or reduce defects and failures (e.g. the cost of planning, setting up and maintaining the quality system); Costs of Appraisal: assessing the quality achieved (e.g. the cost of inspecting, testing etc., carried out during and on completion of manufacture); Failure Costs – Internal: the failure to achieve the quality specified (e.g. scrap, re-work and re-inspection, and consequential losses within the organisation); Failure Costs – External: costs arising outside the organisation from failure to achieve quality specified (e.g. claims against warranty, replacement and consequential losses of custom and goodwill) (Campanella, 1999). Typical figures given in the literature for COQ range from Crosby's (1979) view of 25 to 30 per cent of turnover to Dale and Plunkett's (1999) 5 to 25 per cent. The PAF split is reported in an analysis by Abed and Dale (1987) of the quantitative data contained in the quality costing literature to be $P = 5$ per cent, $A = 28$ per cent, and $F = 67$ per cent.

Writing on the subject of the PAF model, Dale and Plunkett (1999) detail the perceived advantages and disadvantages stating that it may prompt a rational approach to collecting costs and can add orderliness and uniformity to ensuing reports. Among the advantages they outline are:

- apparent universal acceptance;
- promotion of desirability of different kinds of expenditure; and
- provides keyword criteria to aid categorisation.

Among its limitations are:

- quality elements defined do not match well with common accounting systems;
- many quality-related activities in grey areas where it is unclear to which category they belong; and
- COQ of interest only to quality department personnel.

Research methodology

Research aim

The aims of the research described in this paper were firstly to investigate the practical aspects of data collection and measurement of COQ within a footwear company; and secondly to examine the manner in which the resulting information is used as an integral part of business improvement.

Research design

An action research methodology was adopted (Remenyi *et al.*, 1998). Action research was developed during the 1960s and has proven particularly useful in the area of managing change (Remenyi *et al.*, 1998). Moore (1983, p. 57) states that to be properly regarded as action research, a project must contain a continuous thread of objective evaluation and a mechanism whereby the results of the evaluation and the lessons learned during the project can be fed back into the process so that it becomes something which is dynamic and constantly modified in the light of experience. The main advantage of action research is that it is done in real-time; produces a concrete result and everyone in the organisation can see what is going on. This can have its disadvantages as well – mistakes made are very public, but on the whole it makes for research which has the support and backing of people who might otherwise have shown little commitment to the idea. Its distinguishing feature is that it integrates something of real, practical worth into an organisation. This has to be the case, otherwise the research would never have been sanctioned – firms do not have resources to spare and would not waste their own time and resources on a futile project. As detailed above, one potential weakness of the adopted research methodology might be its very public nature. If the project did not produce tangible real-time results, those supporting it may lose interest and bias any future initiatives. The applied methodology needed to be systematic so that it fitted with the basic aims of the research. Informal interviews, observation and company documentation were all used.

Gaining access to an organisation for this type of research can be the result of good luck, strategic planning and hard work (Bryman, 1988). For this research it was a combination of all three elements. One of the authors had recently completed a Management Degree at UMIST and was aware of the institutions active COQ knowledge base and research interest. Once employed by the company she was tasked with initiating and facilitating the COQ programme and contacted UMIST for advice and support. This led to sanctioned academic research and support within the footwear sector.

The research involved a review of the available COQ literature, the identification of cost categories and the adoption and trial of cost collection systems within a host company. The literature review was undertaken in order to identify existing quality measurement systems and established means of assessing COQ. The gathering of information started with key quality costing sources, such as relevant British

Standards and American Society for Quality Control (ASQC, 1974, 1977, 1987) publications, and then broadened to include the references discovered through a targeted research paper search. Once access was established key measurables and cost categories were identified through a detailed examination of company processes, informal discussion with company personnel, and formal interviews with various employees. This process, over a period of time, allowed the identification of sources of errors within the host company's systems.

Company background

The host organisation (hereafter called the "Company") started in 1901 as a UK-based manufacturer of footwear. In 1960 it sealed an agreement giving it rights to produce under a now famous brand name. It enjoyed rapid growth in the eighties through to the late nineties with sales peaking at over 10 million pairs per year equating to £200 million in turnover. Sales then began to fall. The economic downturn following September 11 2001 also contributed to the Company's problems as 60 per cent of its sales had been in the USA. The year 2002 saw continued low sales and lack of profitability, the Company closed all its UK manufacturing sites and began sourcing finished footwear from abroad, primarily South East Asia. The Company has since undergone major restructuring as it transformed itself from a manufacturing to a sourcing company over a six-month period. The Company now consists of a head office in the UK with owned distribution networks in Europe, the USA and Far East.

The collection and application of quality costing

Background

The Company has been using quality costs since late 2000 and has recently undergone a second extensive COQ revision. The initial decision to start using the tool was taken for a number of reasons:

- Following continued success and sustained growth in profits the Company's fortunes were beginning to change. Profit margins steadily reduced. New initiatives were needed to improve the Company's performance and make cost savings.
- Reject rates were high and it was felt that cost of quality would highlight the financial significance of this to the business – if it could be measured it could be reduced.
- It was expected to raise the overall level of quality awareness.
- It was felt COQ could be used to measure the financial impact of improvement activities. This measure of improved levels of performance in the factories could focus attention on improvement and act towards boosting morale.

The first COQ report was not based on any recognised model and was narrow in scope. It was intended only to capture quality related costs that were attributable to the manufacturing and quality functions. This approach was adopted partly due to time constraints but also because the main purpose of the report was to drive through improvements in the manufacturing function. The costs captured were: scrap/reject costs and related costs; repair costs; wages (all staff employed within the quality function, wages of final examiners, incoming goods inspectors, and repairers).

Despite the limited scope the report did have a large impact on the Company because it highlighted for the first time the financial impact of poor performance. By the end of 2001 measured quality costs had stabilised at £70-£80,000 a week from a high of £150,000 earlier in the year. Total quality costs for the year amounted to £4.7million. Overall, a slow downward trend in quality costs was emerging, reflecting the improved performance in the factories.

Active collection of COQ

In constructing the revised report informal interviews were carried out with everyone submitting figures for inclusion (production managers/supervisors; quality managers; accountants; etc). This was carried out by means of a questionnaire based on that created by Bamford (1995). The interviews created an understanding of how information was being collected, compiled and rated. It became clear from these interviews that the majority of costs were not readily available from the Company's existing systems; this is consistent with similar findings from Dale and Wan (2002). Costs were then allocated to the relevant category and where necessary the collation methods were amended and new assumptions constructed. BS6143 (Part 1, 1991; and Part 2, 1992) was used as a guide for the structure and content of the new report (Dale and Wan, 2002; Roden and Dale, 2001). Without this guide significant costs would not have been considered; particularly those not obviously visible to the quality department, i.e. concessions. The cost elements identified are summarised in Table I.

The new COQ report was launched in week 7 of 2002 and both new and old versions were sent out simultaneously for a number of weeks for comparison purposes. This was to allow staff to acclimatise to the new report before the old version was completely phased out. The COQ report also served to monitor improvement activities, to establish if they were having a positive effect on costs. The week the new COQ report was launched COQ was £109,439, the old version valued it at £56,322, a clear indication of expansion of the report. It was also viewed as an opportunity to present data on manufacturing performance as well as on quality costs, to prove the link between them. As a further revision a table was added to the COQ report showing reject rates and the gross shortage rate at each site, plus a combined figure for all sites. The COQ values for the previous four weeks were also shown to illustrate any trends. Figure 1 shows quality costs at the Company in 2002.

At first glance it appears that improvements had been made with costs falling from over £100,000 to £80,000 by the end of the year. However, from August onwards production had fallen dramatically; if fewer pairs were being produced, proportionately fewer rejects were made which reduced the COQ. To counteract this, other measures were introduced: COQ per good pair produced and as a percentage of sales. The COQ per good pair is plotted in Figure 2 and demonstrates that performance remained fairly constant throughout the year with an average COQ per pair of £1.22. Note that week 37 had low production and high scrap rates and that this area for investigation was not as obvious in Figure 1. The new report made quite an impact, particularly regarding the costs that had never been captured before. Table II indicates a direct comparison between the results of the COQ report and five other research studies (Dale and Plunkett, 1999, p. 35). The results demonstrate COQ figures for the Company that are analogous with the others.

Table I.
Summary of quality costs
elements in BS6143: Part
2 checklist

Cost categories	Cost element as per BS 6143: Part 2	Quantified	Identified only	Not identified
<i>Prevention</i>	Quality planning	× (only in the form of wages of the quality dept)		×
	Design and development of quality measurement and test equipment			
	Quality review and verification of design	× (only in the form of wages of the quality dept)		×
	Calibration and maintenance of quality measurement and test equipment			×
	Calibration and maintenance of production equipment used to evaluate quality		× ×	
	Supplier assurance			
	Quality training			
	Quality auditing	× (only in the form of wages of the quality dept)		×
	Acquisition analysis and reporting of quality data	× (only in the form of wages of the quality dept)		×
	Quality improvement programmes			
<i>Appraisal</i>	Pre-production verification	×		
	Receiving inspection			
	Laboratory and acceptance testing	×		
	Inspection and testing	×		
	Inspection and test equipment	× (some)		
	Materials consumed during inspection and testing			
	Analysis and reporting of tests and inspections results			
	Field performance testing	×		
	Approvals and endorsements			
	Stock evaluation			
<i>Internal failure</i>	Record storage			
	Scrap	×		×
	Replacement, rework and repair	×		×
	Troubleshooting or defect/failure analysis			
	Reinspection and retesting	×		×
	Fault of subcontractor			
	Modification permits and concessions			
	Downgrading			
	Downtime			
<i>External failure</i>	Complaints			
	Warranty claims			
	Products rejected and returned	×		×
	Concessions	×		×
	Loss of sales			
	Recall costs			
	Product liability			

PAF within a footwear company

271

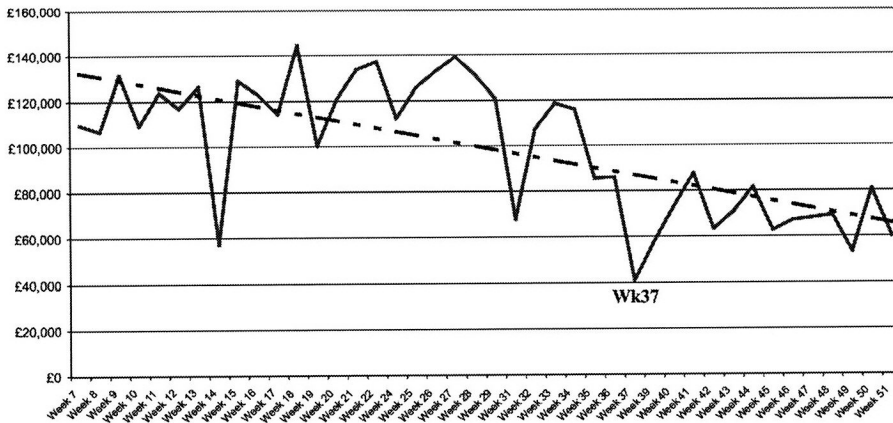


Figure 1.
Cost of quality 2002 at the Company

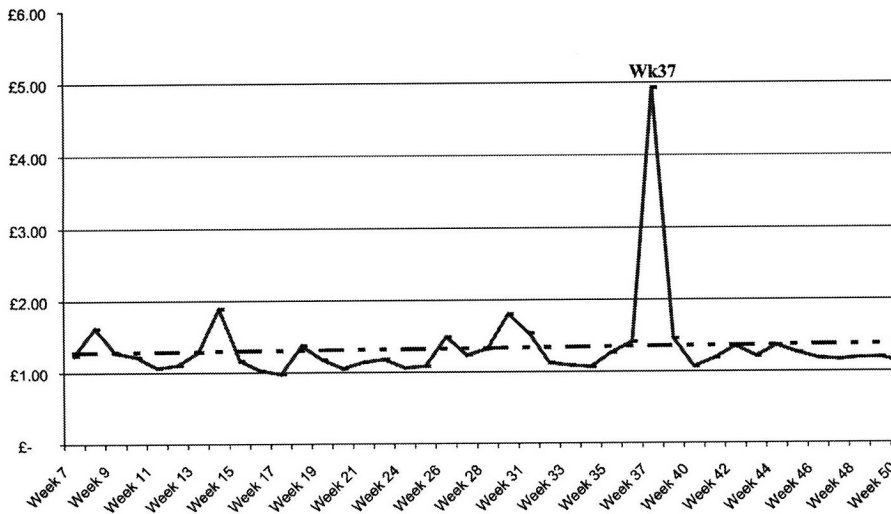


Figure 2.
Cost of quality per pair at the Company

	Footwear company (%)	General industry (%)	Meat industry (%)	Machine tool industry (%)	Steel foundry (%)	BA dynamics division (%)
P	12	10	10	3.3	6	22
A	19	25	25	40.3	14	30
F	69	65	65	56.3	80	48
% sales	5	10	6	5	38	11

Source: Dale and Plunkett (1999, p. 35)

Table II.
Company quality costs vs. other industry figures

How useful are these figures? According to Roden and Dale (2000) there is some debate in the literature about the "typical" scale of quality costs. Crosby (1979) has the view that 25 to 30 per cent of turnover may be COQ; Schonbeger (1986) stated 15 to 30 per cent; Dale and Plunkett (1999) claim 5 to 25 per cent based on a number of studies conducted in a variety of organisations. Roden and Dale (2000, p. 184) state:

It is very difficult to make comparisons between companies, even those in similar circumstances . . . A lack of a common definition of what constitutes a quality cost and the proliferation of measurement bases used in reporting (e.g. percentage of total cost, sales revenue, staff time) makes it difficult to accurately make substantive judgements. However, as long as these "caveats" are considered, then these quality cost ratios serve as a useful benchmark.

In October 2002 senior management announced that all UK manufacturing would cease at the end of March 2003. As manufacturing came to an end so did UK based COQ, principally because it had been so intrinsically linked to the manufacturing function. In late 2003 it was decided by the Managing Director to once again formally review COQ. This time the scope was to cover all functions in the Company's offices. As before, BS6143: part 2 was used to identify costs that needed to be captured. However, the standard was perhaps less useful this time as the Company was no longer manufacturing; it now contracted out its footwear manufacturing to a number of other companies. As before, the research approach consisted of informal interviews, some in person but many via telephone and email as the respondents were now based world-wide. The Company was also now physically smaller, in terms of number of employees, and was operating fewer computer systems. It became clear that a number of significant values, previously assumption based, could now be taken directly from the Company's main accounting system. As a consequence of the change of the Company's operation, and the full review of COQ, the PAF categories became: $P = 6.3$ per cent; $A = 0.7$ per cent; F (internal) = 47.7 per cent; and F (external) = 45.3 per cent. The main costs incurred with the first two COQ systems were rejects, now no longer a feature as the Company sources its footwear through others. However, overall quality costs actually increased, due to the report being expanded from the quality and manufacturing departments to the whole business. This is consistent with a similar study undertaken by Dale and Wan (2002) where one department was targeted initially.

How was the COQ data used?

According to Dale and Cooper (1992), Western organisations and their management are judged over relatively short periods of time. This is confirmed in research by Bamford and Forrester (2003) which highlighted the extremely short-term focus on financial targets and figures within a UK-based manufacturing company. Committing large amounts of money to improvement initiatives without some measure of cost effectiveness is often considered to be nothing more than a blind act of faith. Furthermore, it is contrary to the way in which western businesses operate. This is central to the use to which COQ has been applied within this Company.

Within the Company COQ was used as an indicator to reduce the main cause of footwear failure – sealing splits. The trigger for this was the high proportion of costs attributable to failure in this area. This "welted" construction involves the upper being attached to the sole by passing a heated blade between the rubber sole and the rubber

welt attached to the upper. The two surfaces melt and are permanently bonded. When this process works the bond between the surfaces is extremely strong, however if not done correctly it is prone to failure. In 2001 a total of 21,322 pairs of footwear were returned in the UK, 2,596 of these were for sealing splits (12 per cent of all returns). This amounted to a value of £61,000. Unfortunately, the true cost was actually much higher for the following reasons:

- (1) In 2001 only 17 per cent of sales were in the UK, assuming an equivalent returns rate was experienced globally the true costs exceed £350,000.
- (2) These values are ex-manufacturing cost only, they do not include distribution and shipping costs, the costs incurred processing the returns or loss of profit.

This trend continued in 2002 with a total of 18,875 returns in the UK, of which 3,118 were sealing splits (16.5 per cent).

From the information provided on the COQ report senior management decided something needed to be done. Upon investigation it was discovered that a basic test on the strength of the bond could be conducted in the factory by the heat sealing operative. Indeed, according to standard operating procedure (SOP) a small percentage were already supposed to be tested. In reality, this rarely happened as the employees were on a piece-rate payment system (the more made, the more paid) and it increased the length of the operation. It was decided to use the Company's own engineering department to develop a machine to test for seals that were likely to fail. Such a machine was developed but not in time to be used in the Company's own manufacturing sites, it is now being successfully used in the supplier's factories. It is anticipated that future significant reductions in the number and cost of returns for sealing splits will be realised as a direct result of the focused intervention driven by COQ.

COQ was also used for more radical decision making. When the Company first embarked on cost of quality in 2000, one of the main cost areas identified were wages. Being reliant on manual labour for the production process, it was acknowledged this would be a large cost. An analysis was conducted on those people whose job descriptions stated they were involved in "quality related" activities. It was discovered that more people had jobs related to quality than expected. The exercise led to the number being reduced by 100, through re-assignment and a process of voluntary redundancy. Senior management believed this reduction could be sustained and achieved without adversely effecting quality, principally as the Company was going through a process of consolidating its manufacturing into fewer sites over a smaller geographical area. They deemed that one person could be responsible for an area of quality at more than one site. This is similar to findings by Richardson (1983) from the engineering industry (cited in Dale and Plunkett, 1999, p. 45) "...success was achieved by applying the quality assurance managers joke, "we can reduce our quality costs tomorrow – just sack the inspectors and checkers".

The COQ reports also identified specific areas where the Company could make real cost savings by improving efficiency (Campanella, 1999; Dale and Plunkett, 1999). For example, it was identified that Shorts (where the upper is missing for some reason and the shoe cannot then be produced) cost the Company £1.7 million in 2001 but there was no real understanding of what was contributing to this. The COQ report also had particular impact during weeks when quality costs were higher than average; the

managers responsible were often contacted to explain why the costs of their site or factory were so high. The report also acted as a stimulus to solve problems and launch improvement activities, this matches findings made by Bottorff (1997) who identified several tangible benefits to having a quality costing system.

At the Company it was found that management information systems were always the best source of quality cost information. Such systems are generally easier to use, quicker and more flexible than other methods of data collection, if set up properly. However, the Company's systems were not always able to provide the required data and, as explained within this paper, it was necessary to work through a number of assumptions. Although not always 100 per cent accurate these assumptions were considered acceptable because they were consistent. Any improvement in the completeness of the data captured would have led to an un-proportionate increase in effort. For example, a common assumption used was that every pair of footwear manufactured was the Company's top selling style. This assumption was used to value rejects, returned pairs and other scrapped components. It was considered both reasonable as 30 per cent of all footwear was produced in this style and robust as the style is produced every season regardless of changes in fashion. An extensive analysis of the Company's products could have been conducted to reach an average value but it would have been extremely time-consuming; it was felt that the end result in terms of value would have been approximately the same. The Company insisted on a sensible balance between the level of accuracy required and the time taken to collate the data; this was also found by Bamford (1995).

Although the eventual aim was to make the COQ report company-wide, it did prove useful to begin by looking at just one function before expanding the scope of the report to take in the entire organisation (Dale and Wan, 2002). The first report concentrated solely on costs relating to the manufacturing and quality functions and as each revision was conducted its scope was extended. By concentrating on a smaller part the skills required were developed in-house which made it easier to look at the rest of the organisation objectively. At the Company it was found useful to link COQ to other measures, such as reject and shortage rates; COQ per pair; and COQ as a percentage of sales. This increased the perceived relevance and importance of COQ by linking it to data already used and understood (Bamford, 1995). COQ for the previous four weeks was also shown so that trends could be monitored and simple graphs were created projecting trends and values to the end of the year. The layout of the COQ report was also extremely important. Initially, the main body of the report was over 100 lines long and published on a weekly basis. It was discovered that not many people actually read it! A headlines page was therefore added which highlighted key information such as total costs, cost breakdown, COQ as percentage of sales, COQ per pair, trend information and reject rates. This theme gels with findings made by Dale and Wan (2002, p. 115) who asserted that it was important for employees to realise COQ was not an end in itself, rather a means to an end – focusing on areas to be improved.

Guidelines

As business and management research is essentially a field of applied studies it is appropriate that research of this type should convert at least some of its findings into a series of practical management guidelines (Remenyi *et al.*, 1998). Therefore, although it is not our main purpose to present prescriptions, the following maybe useful for

practitioners. The key lessons presented below offer straightforward advice to managers who have already or will be shortly embarking upon some form of COQ exercise:

- (1) Senior management commitment is vital to the success of the COQ project and must be in place before it begins. It is possible to produce a report that accurately captures relevant costs without this commitment, but there will be no impetus for people to react to it. Ultimately, no improvements will be made.
- (2) Evidence = areas for improvement had been previously identified from the COQ report but, prior to having the Managing Directors focus, were not always fully investigated.
- (3) Use existing systems where possible: this is quicker, easier, cheaper and more flexible than trying to invent new methods for cost collection. People also have less ground to dispute the accuracy of the information presented. Evidence = data compiled from the Company's manufacturing software was accepted more readily than manually collected data. Data from the system also proved more reliable, consistent and less open to manipulation.
- (4) If something is not easy to cost, make an assumption: the Company found they were accepted if there was no other way to measure a cost; providing there was reasonable detail to back them up. Evidence = rejects were recorded in the manufacturing software but this system did not hold any costs. It was therefore decided to use an average value per pair for rejects. An "exact" average could have been reached but proved extremely time consuming. It was decided to assume that every pair of footwear was the company's best selling style. This had a number of advantages:
 - robustness;
 - not subject to seasonal variations; and
 - instant calculation. Investigations later proved the difference between an "exact" analysis and the assumption was reasonably insignificant.
- (5) Link COQ to other measures: it gives it more relevance and impact. Evidence = having reject rates, rather than just quantity of rejects, reported in conjunction with COQ proved to be powerful.
- (6) Continually improve the COQ report: this does not mean regular extensive reviews, rather setting aside time each quarter to devise capture methods for costs known to be missing. Evidence = the Company COQ report began with a manufacturing focus. This enabled the application of COQ whilst the Company learnt how to use it, starting with significant "headline" costs such as rejects, and to moving onto others on a continual basis.
- (7) Application of common sense: in an ideal world every cost would be available to the nearest penny. Is there benefit in committing time "chasing" such a numbers? Evidence = the Company now assumes a certain proportion of courier costs are quality related. To calculate the exact costs incurred is both extremely time consuming and not significant enough to warrant. Closely linked to points 3 and 5 this would be constantly under review.

These guidelines are by no means exhaustive; rather they reflect key learning from this research. They do tally with similar recommendations, guidelines, and quality costing dos and don'ts presented by Dale and Wan (2002), Roden and Dale (2001, 2000), Dale and Plunkett (1999), and Goulden and Rawlins (1997).

Conclusions

The aims of this research were to investigate the practical aspects of data collection and measurement of COQ within a footwear company; and to examine the manner in which the resulting information was used as part of business improvement. The PAF model provided information that could be used to add the strategic decision making process for the Company. During the research, the data collected was presented to the senior management team with other information collated by the quality department. This information was used to identify areas for improvement and to monitor the success of improvement activities. The PAF model is therefore highly suitable for the collection of costs for this Company. The structure of the model enabled senior management to distinguish how much money was spent on doing things wrong, and therefore how much value could be added to the bottom line by getting them right.

Quality costing can only be used as a management tool if the data put forward is accepted as accurate. It is therefore limited by two factors:

- (1) the availability of required information; and
- (2) necessary expertise and resources to gather and analyse such information completely; these fit with similar findings by Crosby (1979), Eldgride and Dale (1989) and Roden and Dale (2001).

Availability of information was a major hurdle at the Company. Some information was not available on systems, which meant assumptions had to be made. This was not ideal but without adopting this approach there would not have been a COQ report present. The costs of quality are most effective when the relationship between people is such that both successes and difficulties in cost control can be discussed openly without fear of chastisement. Where relationships are defensive, to advocate analysis of the cost of quality is nonsense. It appears to be a facet of human nature to manipulate figures, tell half-truths and play intellectual games to catch one another out. This ultimately results in the cost of quality being a total fabrication and of little value.

The methodology applied for collection of the research data was wholly appropriate and consistent with the perceived outcomes required. It generated ample data, which facilitated discussion and the drawing of specific conclusions. A perceived limitation is the adoption of a single case approach; however, Remenyi (1998) argues that this can be enough to add to the body of knowledge.

This research has provided a foundation for future work. An interesting area for further investigation would be to investigate the relationship between the management information systems in place, the COQ models used, and the Company approach to business (proactive, reactive, etc). It is anticipated that progression would not be linear, i.e. they may exist and develop independently of each other.

References

- Abed, M.H. and Dale, B.G. (1987), "An attempt to identify quality-related costs in textile manufacturing", *Quality Assurance*, Vol. 13 No. 2, pp. 41-5.

- ASQC (1974), *Quality Costs – What and How*, American Society for Quality Control, Milwaukee, WI.
- ASQC (1977), *Guide for Reducing Quality Costs*, American Society for Quality Control, Milwaukee, WI.
- ASQC (1987), *Guide for Managing Supplier Quality Costs*, American Society for Quality Control, Milwaukee, WI.
- Bamford, D. (1995), “An investigation into the collection, measurement and use of quality costs within a high volume production environment”, Middlesex University, London, unpublished MPhil thesis.
- Bamford, D.R. (2004), *Q7 and M7 Tool Lectures*, 16 February, UMIST, Manchester.
- Bamford, D. and Forrester, P. (2003), “Managing planned and emergent change within an operations management environment”, *International Journal of Operations & Production Management*, Vol. 23 No. 5, pp. 546-64.
- Bottorff, D.L. (1997), “COQ systems: the right stuff”, *Quality Progress*, Vol. 30 No. 3, pp. 33-5.
- Bryman, A. (Ed.) (1988), *Doing Research in Organisations*, Routledge, London.
- BSI (1990), *BS 6143: Parts 2, Guide to the Economics of Quality*, British Standards Institution, London.
- BSI (1991), *BS 6143: Parts 1, Guide to the Economics of Quality*, British Standards Institution, London.
- BSI (1992), *BS 6143: Part 1, Guide to the Economics of Quality: The Process Model*, British Standards Institution, London.
- Campanella, J. (Ed.) (1999), *Principles of Quality Costs: Principles, Implementation and Use*, 3rd ed., ASQC Quality Press, Milwaukee, WI.
- Crosby, P.B. (1979), *Quality is Free*, McGraw Hill, London.
- Dale, B.G. and Cooper, C. (1992), *Quality and Human Resources: An Executive Guide*, Blackwell Publishers, London.
- Dale, B.G. and Plunkett, J.J. (1999), *Quality Costing*, 3rd ed., Gower Press, Aldershot.
- Dale, B.G. and Wan, G. (2002), “Setting up a quality costing system”, *Business Process Management Journal*, Vol. 8 No. 2, pp. 101-16.
- Eldrigde, S. and Dale, B.G. (1989), “Quality costing: the lessons to be learnt from a study carried out in two phases”, *Engineering Costs and Production Economics*, Vol. 13 No. 1, pp. 33-44.
- Feigenbaum, A.V. (1956), “Total quality control”, *Harvard Business Review*, Vol. 34 No. 6, pp. 93-101.
- Goulden, C. and Rawlins, L. (1997), “Quality costing: the application of the process model within a manufacturing environment”, *International Journal of Operations & Production Management*, Vol. 17 No. 2, pp. 199-210.
- Moore, N. (1983), *How to do Research*, Library Association Publishing, London.
- Musgrove, C.L. and Fox, M.J. (1990), *Quality Costs: Their Impact on Company Strategy and Profitability*, TQM Practitioner Series, Nelson Thornes, Tewkesbury.
- Remenyi, D., Williams, B., Money, A. and Swartz, E. (1998), *Doing Research in Business and Management*, Sage Publications, London.
- Richardson, D.W. (1983), “Cost benefits of quality control: a practical example from industry”, *BSI News*, October.
- Robison, J. (1997), “Integrate quality cost concepts into teams problem-solving efforts”, *Quality Progress*, March, pp. 25-30.

- Roden, S. and Dale, B. (2000), "Understanding the language of quality costing", *The TQM Magazine*, Vol. 12 No. 3, pp. 179-85.
- Roden, S. and Dale, B. (2001), "Quality costing in a small engineering company: issues and difficulties", *The TQM Magazine*, Vol. 13 No. 6, pp. 388-99.
- Schonberger, R.J. (1986), *World Class Manufacturing: The Lessons of Simplicity Applied*, Free Press, New York, NY.

Further reading

Feigenbaum, A.V. (1983), *Total Quality Control*, McGraw-Hill, London.

About the authors

David Bamford is a Lecturer in Operations Management at Manchester Business School, Manchester, UK. David Bamford is the corresponding author and can be contacted at: David.Bamford@umist.ac.uk.

Nicola Land is a Project Leader at Airwair International, Wollaston, UK

To purchase reprints of this article please e-mail: reprints@emeraldinsight.com
Or visit our web site for further details: www.emeraldinsight.com/reprints