

## First Steps on the Quality Journey

Tony O'Connor, Dominion Hydrographer, and Sean Hinds, Project Authority for ISO 9000 Implementation, Canadian Hydrographic Service, Canada

The Canadian Hydrographic Service (CHS) prides itself on its paramount attention to quality. CHS hydrographers and cartographers have long held the banner of 'quality' as the 'flagship of service'. The dramatic revolution in technology, client demands and organisational culture has shaken the historic pillars of quality assurance in CHS. In response, CHS is moving to reinforce this foundation of quality with a new business model anchored by the culture of a Quality Management System. This paper will reflect on the changed environment that faces CHS and the quality lessons in the global marketplace that can be applied to a hydrographic organisation. It will explore the first steps that CHS has taken on this journey as it moves toward the goal of becoming an ISO 9000 certified 'quality-organisation'.

### A Quality Decision

When starting out on a quality initiative it is hard not to ask the basic question of just what do we mean by quality. The word 'quality' has been woven into the hydrographic vocabulary forever but are we able to categorically define what it is? Society has embraced the 'quality' phrase and applies it in everything including automobiles, education and health services. If asked to define it very few would be able to but most would admit to knowing it when they see it. Often quality is taken for granted and is most noted when there is an absence of quality. The starkest examples in recent times have been the U.S. Presidential election ballot question and the drinking water crisis in small-town Canada.

Even the gurus in the quality field have a spectrum of explanations for the term with two fairly distinct paradigms of quality coming out in each of the definitions.

- The first of these is that quality is a simple matter of producing products or delivering services whose measurable characteristics satisfy a fixed set of specifications
- The second is independent of measurable characteristics, and defines quality products and services as those that simply satisfy customer expectations for their use and consumption

The first implies that quality can be defined by the organisation that sets the specifications while the second places the decision of quality on the customer. The ISO 9000 Standard covers both of these concepts with a broad brush as it defines quality as 'the degree to which a set of inherent characteristics fulfils requirements'. The term 'requirement' extends from product or regulatory requirements,



to quality requirements (specification) and customer requirements. Kaoru Ishikawa expressed another definition of quality in his book *What is Total Quality Control? – The Japanese Way*. In this book he states, 'quality means quality of work, quality of service, quality of information, quality of process, quality of division, quality of people, including workers, engineers, managers and executives, quality of company, quality of objectives.'

Apparently, there is unanimous support for the breadth of these definitions of quality but if one is to take these definitions to heart one places 'quality' on a very high plateau within the organisational mission. Quality cannot be looked upon as a function but rather as a basic value system that permeates the entire organisation. The revolution in hydrographic technology and the strain on resources within hydrographic offices puts a huge amount of responsibility for quality at the feet of an organisation. In days gone by risk from poor quality was fairly small as hydrographers had tools that surpassed the capability of the end-user. Not so today as the technology deployed by the mariner and the expectation of hydrographic data pushes the envelope for quality to new heights.

Very and ultra large crude carriers (VLCC, ULCC), product tankers, high-speed commuter vessels, congested waterways, cargoes of dangerous goods and increased cruise-line traffic combined with reduced shipboard crews, conjure up visions of increased risk to marine transportation. GPS, ECDIS, aids reductions, *minimal keel clearance, sailing in marginal weather* all threaten to push the data and the products to their limits. As the world moves toward data-sharing and linked data-bases the threat of poor data increases as the management of the data moves from the hands of the hydrographer who knows the data limitations, into the hands of the operator who may assume the data as absolute.

All of these factors culminate into a question of operational excellence and due diligence on behalf of the Hydrographic Office (HO) to take 'quality' out of the risk equation and place it into the overall business management for the organisation. The Hydrographic Office is a component of the maritime safety chain that covers everything from ship management to operations at sea. The marine industry has implemented the ISM Code as its assurance model for safety at sea. The ISO 9000 International Standard is an ideal quality assurance system that compliments and fortifies this safety chain via the provision of certified services for marine information. The Canadian Hydrographic Service (CHS) is committed to the task of implementing and maintaining a Quality Management System as the benchmark principle and tool in its search for excellence.

## **Background on the Quality Movement**

To understand our current quality control practices one needs to see how quality has evolved through history. Quality has always played a predominant role in the marketplace but it was accomplished and respected in many different ways. In early time the craftsman monitored their own quality as they oversaw the entire production process from design through to the final customer. A simple but effective quality loop.

The marketplace changed in the Middle Ages and guilds were formed to unite craftsman and protect market share. Specifications and standards for the quality of work were established to protect the status of the guild. In order to monitor this quality the guilds introduced the concept of inspection to the workforce and this was the precursor to the quality department. A rigorous training regime from apprentice, through journeyman and ultimately to master craftsman was considered the structure required to maintain the quality of work.

With the Industrial Revolution came the factory system and the concept of mass production. The factory system broke the production into a number of smaller steps and developed production tools to aid less skilled workers in repeating these production steps with greater consistency. This factory system was successful at delivering vast quantities of goods at a relatively low cost. The negative impact on quality result-

ed from few employees seeing more than their particular piece of the work. This put greater emphasis on specifications and inspection by members of the quality department. With time, inter-factory collaboration developed and parts were shipped and assembled far from the production factory. With this greater dependence on quality products there was a notable rise in the value placed on the inspection activity and the inspection office. Through all of this, the inspection office was focused on its task of making sure only good quality products went out the door and was not really concerned with the processes that caused the re-work or the costs associated this activity.

It was not until the twentieth century that quality tools such as statistical process control and quality management were understood and applied. With the rise in consumerism and the competition from companies abroad it became necessary for industry to pay closer attention to refining processes. It was the unprecedented turn-around of the Japanese economy during the 1950's to 1980's that woke the western-world to the need for quality management.

The United States had started to use these quality tools earlier in the century but had let the tools and the principles fall by the wayside. It was because the U.S. products were in such demand in the post-war economy that management did not see the need for this effort and focus on quality. As western companies started to lose the competitive edge, they looked to Japan and found that attention to quality did indeed pay dividends in the marketplace. *This candid realisation moved quality to centre stage in many corporate boardrooms.* Today quality management is recognised as an essential ingredient to a successful enterprise

## Drivers for Change

Real change is most often driven by crisis and seldom is crisis borne from a single event but rather from a series of events. CHS has experienced a series of events over the past ten years that culminated in the decision to embrace a quality management system.

CHS experienced significant changes in capacity triggered by a 30% reduction in resources as a result of the Canadian federal government workforce adjustment initiative called Program Review. *Workforce reduction should ideally be accompanied by a similar reduction in workload but this is not always the case.* CHS found itself in this situation as 30% of its staff departed at a time when normal production requirements were increased by the addition of vector and raster format digital charts to the CHS product line. The majority of the workforce adjustment came at the expense of losing some of the senior staff that took with them a vast amount of intellectual capital.

With the loss of the experienced staff came an influx of less experienced temporary staff. The lack of documentation for the digital production processes resulted in greater reliance on the end-of-line inspection process. This end-of-line Quality Control (QC) was essentially a 3rd party review of the entire production process. This is an overhead that CHS realised was not sustainable over the long term.

To compound the loss of resources CHS was still in the midst of a digital revolution that saw all of CHS production shift from principally manual production to fully digital production. This expansion of digital technology in the workplace upset the traditional production sequences that had been proven over time to deliver quality. A lack of documentation and a lack of long-standing experience with digital production raised the risk of errors and increased reliance on software.

Through all of this digital revolution and increase in product lines CHS had no formal system for process improvement but instead put a heavier reliance on end-of-line inspection – the quality control office. It is an accepted principle in industry that organisations with no system for process improvement activities have 10-30% of wasted effort in their production. This is the factory mentality where re-work is accepted as the norm and aggressive attempts at process improvement are not engaged.

The impact of all these changes and pressures had a compounding effect on the morale and health of the workplace. Job satisfaction, teamwork, communication, feedback, purpose, visibility and recognition are all key elements that work together to produce the right attitude and the right environment (win-win culture). Today's business environment is plagued with a revolving door of deadlines and an endless list of pressures, driven by the need to survive in an increasingly competitive world. In this fast pace environment it takes a strong commitment to quality and a systemic feedback process to ensure that the fragile human factors of job satisfaction, communication, and recognition are not overlooked or undervalued.

### **A Quality Management Solution**

Quality and management are not thrown together by chance. Quality and excellence can only be achieved when they are managed and when the system is embraced throughout an organisation. This is clearly supported by the numerous criteria for quality systems that exist in the marketplace. Some of the most recognised definitions of a high performance quality management system are the criteria for the Malcolm Baldrige National Quality Award (United States), the Canada Awards for Excellence, the Deming Prize (Japan) and the ISO 9000 International Standard. All of these models describe the same founding principles of leadership, planning, client/market focus, employee focus, process management, supplier/partnering relationships and performance measurement/results.

When CHS realised it had to address the quality issue with a quality system it looked at all of these systems. *Though the Awards criteria are excellent business models they lacked the necessary documentation for guidance, inspection and maintenance that CHS needed at the early stage on this journey.* On the other-hand the ISO 9000 Standard had a long track record having been established in 1987 with a revision in 1994 and a further revision in 2000. It defined a logical and comprehensive approach to organisational processes. It was applied in over 150 countries totaling 400,000 certifications. It embodied a formal audit process that would ensure short and long-term maintenance. There was an accredited registration process that would aid in *maintaining focus and bring best-practice guidance from a wide range of organisations.*

CHS has had positive experience with the ISO 9000 (1994) International Standard with CHS Laurentian Region (located in province of Quebec, it is one of five CHS Regional offices) being certified to ISO 9002 in 1998 as a pilot project. Numerous benefits were identified by Laurentian staff as a result of this initiative and were highlighted in a report to CHS management (S. Labonte 1999). These are as follows:

- The absorption of the quality control officers' workload into the production-line process
- The establishment of a more rigorous management framework
- The streamlining of processes to eliminate duplication and standardise procedures
- The managing of non-conformities using root-cause analysis which resulted in improvements to productivity and quality
- Improvement of strategic planning through audits that identify strengths and weaknesses
- Documentation and uniform procedures facilitated training and rotation of employees
- Improved customer interface in terms of response time and analysis of non-conformities
- Increase in the level of pride and confidence of quality and work amongst employees

### **The CHS Quality Journey**

CHS Senior Management authorised a national project for a Quality Management System in June 1999 with a target date for ISO 9001 certification in June 2001, which has slipped to October 2001. Each of the four Regional offices across Canada, and CHS Headquarters in Ottawa, will be certified to the ISO 9001:2000 standard. The scope of the certification will cover all of the aspects of operation from administration to production to distribution. Internal links within the organisation will be reinforced, especially those between Headquarters and Regions, where dependencies are critical to optimising quality and effi-

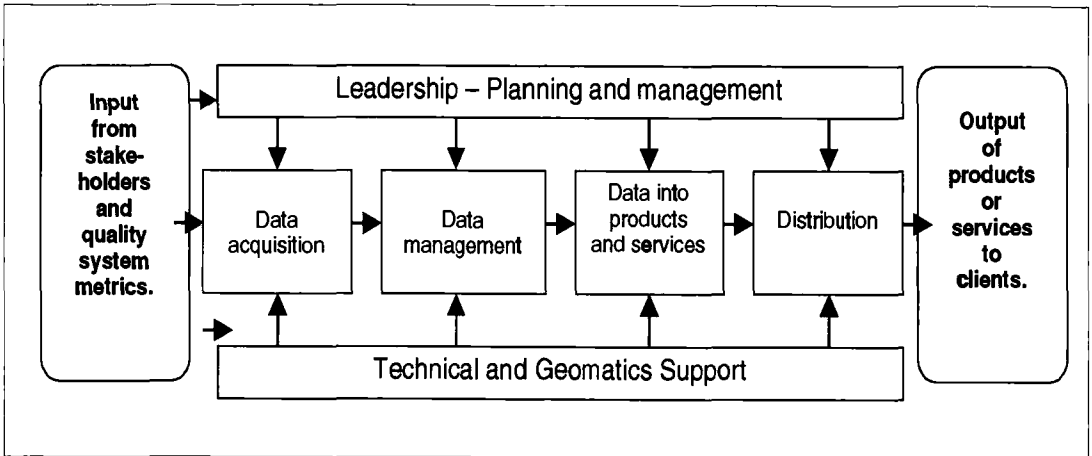


Figure 1: CHS basic process model

ciency. External links to agencies, with which CHS has moderate dependencies and yet limited influence, will be reinforced to the best level possible. These links will be a combination of communication protocols and service standards.

To move this project forward a cross-regional National Co-ordination Team was formed that reported to the Dominion Hydrographer and the CHS Senior Management Committee. This national team had one representative from each of five Regional CHS offices and they were responsible for co-ordinating Regional efforts with the national design. A Quality Council was established in each Region to support the national representative and stimulate understanding and support for the quality system. A Management Consulting firm was contracted to provide guidance in the implementation and interpretation of the ISO 9000 Standard. This Consulting Team worked intimately with the National Co-ordination Team and with employees who were the main contributors in building the Quality System from ground up.

It was decided at the outset that this would be a national CHS Quality System and not a collection of five quality systems designed for each of the five CHS offices. This meant that the Quality System would have to accommodate the activities in all CHS offices while remaining flexible so any office could opt out of processes that were not applicable. It was a classic multi-site Quality System that had strength in its breadth with flexibility in its design. Critical to mapping the ISO 9000 Standard onto CHS was presenting the organisation as a process model.

It was important to the design of the quality system that the nature of CHS business was not compromised by the ISO 9000 Standard. To this end, it was necessary to integrate the ISO process model into the CHS process model. The founding process of ISO 9000 is the simple business model of Plan-Do-Check-Act and CHS took this and overlaid the CHS activities onto it. The effect was a Plan-Do-Check-Act model for CHS.

Key to an effective quality system is ownership and usability. The basis for ownership is that all employees needed to be involved at one stage or another. Usability comes from the design and the documentation being logical and intuitive for the CHS user. CHS addressed both of these through heavy involvement of teams in the designing of the system and the development of the documentation. It was crucial that the National Co-ordination Team, responsible for the quality system design, had representation from all CHS offices and worked collaboratively together to ensure the Quality System would reflect all of CHS.

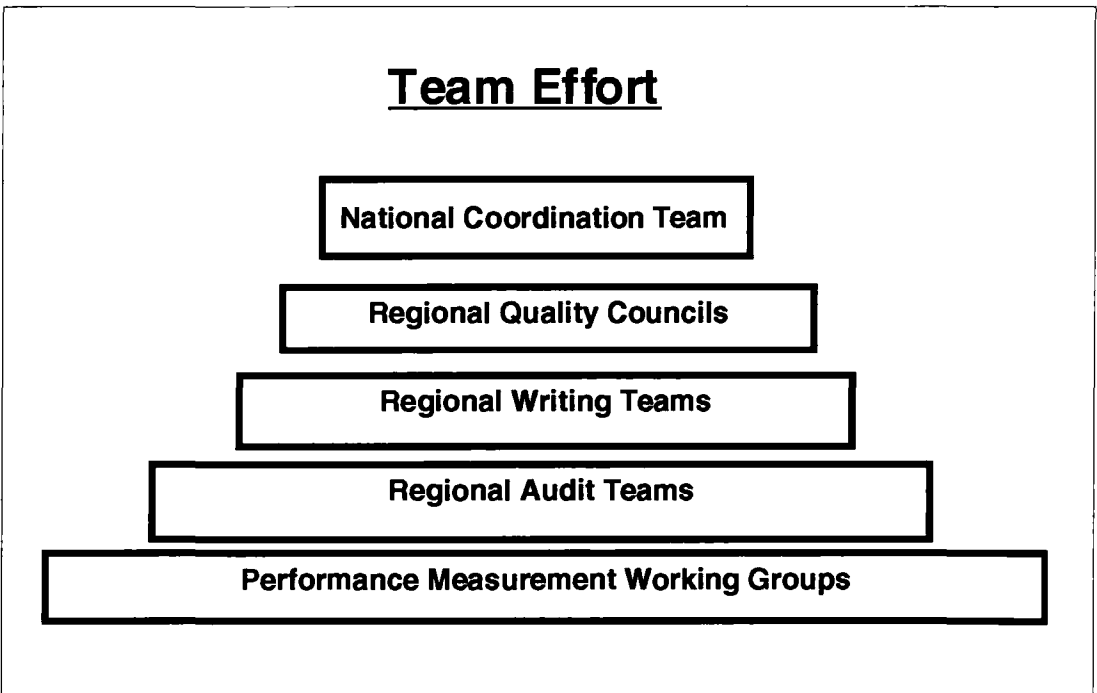
Quality Councils were established in each office early in the process, to stimulate ideas, generate support and start the ripple effect of ISO 9000 understanding and acceptance. Writing teams were assem-

bled and trained in every office for each of the major processes. The writing teams were purposely assembled with varying degrees of expertise to promote learning and development of documentation that would be useable by all staff.

At the outset, writing teams were coached by the regional representative on the National Co-ordination Team. As expertise in documentation was developed the writing teams turned to supporting themselves and cross-team dynamics took over. This was a critical turning point in the initiative as the ownership factor began to take hold and colleague-to-colleague discussion and collaboration began to take root.

At the implementation stage further teams were brought on line. The Auditor Team became a primary catalyst for encouraging support of the quality system through interviewing and coaching small work units on the documented procedures and how they fit into the larger system. Each CHS office also established a Performance Measurement Team that gathered input from all levels of the organisation to aid in the assembly of a comprehensive Performance Measurement plan for each office.

The impact of teamwork and the involvement of many persons from all areas of the organisation has been critical to the success of this initiative.



*Figure 2: Teams identified in the CHS Quality Management System*

One of the starting steps in the design of a quality system is a 'gap assessment'. This 'gap assessment' is an in-depth look at all of the activities within an organisation to ascertain what processes are in place and which processes are lacking. In a thorough assessment of CHS it was noted that many of the technical functions of data collection, data management, production and distribution were well entrenched and could be documented as is. The greater gaps were in the less technical areas of the organisation that included planning, customer focus and performance measurement. These processes were based more on the personal management style of the Regional Management Team than on any national guidelines or standards like the production processes. As a result there were widely differing business practices across the Regional Office.

One of the principles of the National Co-ordination Team was to leverage existing processes and use them, as is, to develop the necessary documentation. For this reason each Region documented the production processes to replicate what was traditional practice in that Region. The writing teams were provided contact with their counterparts in other Regions and collaboration was encouraged but optional. A future goal will be to benchmark and encourage adoption of best practice across the organisation. On the other hand, the processes that were less entrenched, less traditional, and in some cases non-existent, were targeted for enhancement and documented as national processes which would be learned and deployed in all sites. These national processes included planning, client satisfaction, internal auditing and other business type procedures. This provided a quality system design that was a combination of region-specific technical processes and national business processes.

### The New ISO 9000:2000 Standard

CHS will use the ISO 9000:2000 International Standard as the core of its Quality Management System. ISO 9000 is a common-sense process management model that defines a business environment. The new version of the ISO 9000 Standard that was released in December 2000 has eliminated the earlier ISO 9002 and ISO 9003 options for registration. It now requires all organisations to focus only on the ISO 9001 Standard. The ISO 9001 Standard is considered to be more encompassing as it requires all functions of an organisation to come under the umbrella of the Quality Management System. An example of this flexibility was the previous Laurentian Region ISO 9002 Registration that focused on the nautical product functions and excluded the survey operations from the registration. This is no longer an option with ISO 9001:2000 and CHS is prepared to register the full scope of its operations in all offices.

Though the 2000 version of the Standard was not released until December 2000 CHS proceeded to design its Quality Management System based on the draft versions. Very little fine-tuning was necessary when the final version was released. The 2000 version came at an opportune time for CHS as it represents a more modern approach to quality management and responds better to the demands of the service and public sectors. The most important improvements are the re-organisation of the Standard to follow the Plan-Do-Check-Act loop that supports process management and continuous improvement. It also promotes a greater emphasis on employee awareness and involvement and incorporates the requirement for enhanced customer input into the quality system.

ISO 9000 encourages organisations to harmonise the delicate balance between people and

### Eight Quality Management Principles

- **Customer-focused organization** – organizations depend on their customers and therefore should understand current and future customer needs, meet customer requirements and strive to exceed customer expectations.
- **Leadership** – leaders establish unity of purpose, direction, and the internal environment of the organization. They create the environment in which people can become fully involved in achieving the organization's objectives.
- **Involvement of people** – people at all levels are the essence of an organization and their full involvement enables their abilities to be used for the maximum benefit.
- **Process approach** – a desired result is achieved more efficiently when related resources and activities are managed as a process.
- **System approach to management** – identifying, understanding and managing a system of interrelated processes for a given objective contributes to the effectiveness and efficiency of the organization.
- **Continual improvement** – continual improvement is a permanent objective of the organization
- **Factual approach to decision making** – effective decisions are based on logical and intuitive analysis of data and information
- **Mutually beneficial supplier relationships** – mutual beneficial relationships between the organization and its supplier enhance the ability of both organizations to create value.

Excerpt from ISO9000:2000 Quality management systems- Fundamentals and vocabulary

process recognising that quality is a result of both these components working together. The founding eight quality principles of the ISO 9000 Standard (see sidebar) are evidence of this balance expected in a functional quality management system.

The basic business processes prescribed by the ISO 9000 system are:

*Say what you do.* An organisation must document its processes that impact on quality.

*Do what you say.* Following procedures reduces variability, prevents known problems, and promotes the benefits of using proven techniques and procedures.

*Record what you did.* This is the key to managing the business based on facts. Without adequate records an organisation is not likely to be able to assess the level of quality effectively and is thus less likely to be able to analyse performance and identify potential problems.

*Check on the results.* Results are analysed and checked against specifications and other criteria for quality.

*Act on the difference.* If an organisation does not take action when results are unsatisfactory or problems are indicated, consistent quality is difficult to maintain and quality cannot be improved.

### A Process Management Approach

Though the concept of process management is relatively easy to grasp it is harder to implement. The requirement to manage processes across traditional functional or vertically managed silos requires highly co-ordinated communication and planning. Though it is a utopian model it nevertheless has some sound business lessons that can reap big rewards if applied in principle. From the Quality System design per-

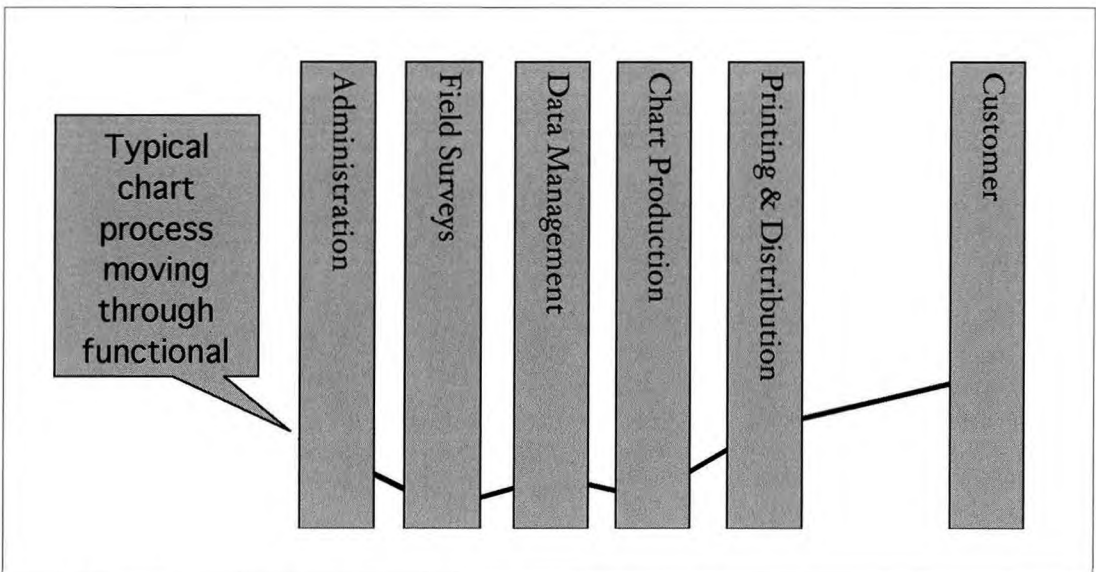


Figure 3: Managing process through silo domains

spective it is essential to view the organisation as a system of processes that can only be optimised when upstream and downstream activities are understood and valued. This systems-thinking approach is a key to the design of an effective quality system that reaps the most value from a finite amount of resources. CHS is moving in this direction as it encourages project teams to carry surveys through to products. In the current organisational structure the hand-off zones between the silos provides the biggest oppor-



tunity for gains in production. These are the zones where people and processes most often fail due to either poor communication or mismatched expectations. In the ISO process model it is imperative to document the links between process and manage the expectations of each and every hand-off. It is through this rigorous system that improvements are made organisation wide and employees see themselves as part of a bigger picture.

### **Performance Measurement**

CHS chose to be proactive in the area of Performance Measurement and go beyond the requirement of the ISO 9000 Standard and implement a balanced measurement approach that was linked to the Vision, Strategy and Quality Principles of the Canadian Hydrographic Service.

Financial figures have typically been the foundation for measuring an organisation's performance while new thinking is to have it on an equal footing with market focus, innovation, productivity, public responsibility, and employee satisfaction. More often than not these measures have been observed but they have been for one small enclave of the organisation such as strategic planning being interested in market focus data or the engineering department monitoring innovation. Rarely were these broad-based measures brought to the general management table and utilised for decision making.

For years many organisations relied upon this one financial measure as the sole indicator of performance and this is being seen as possibly more harmful than good. The danger of relying on only one measure of performance is that this one measure may be optimised at the expense of the long-term health and vitality of your organisation. For example, optimising the financial bottom line has a danger of hiding the impact on client satisfaction. On the other hand the numbers in the financial system often fail to clearly support the investments in new technologies and innovation that are essential for successful performance and growth. One of the main drivers for this is the short-sightedness of organisations, as stakeholders tend to support and encourage dividends in the short run rather than the long.

The CHS balanced approach provides an overall view of organisational performance by combining financial measures with other key performance indicators including client satisfaction, employee growth, workplace health, product quality, effectiveness of internal teams and external partnerships, and the organisation's ability to stimulate innovation. As the cornerstone to the CHS quality management system these performance indicators will provide the information for fact-based decisions that guide the organisation and optimise production.

In a rudimentary fashion, CHS has begun to collect and report on a spectrum of performance measures and is working to promote this mind-set through the organisation to encourage performance measurement as a natural step in all processes. It is by integrating these steps into procedures that regular performance metrics will be available as leading indicators for all employees to judge the effectiveness of processes as they unfold.

### **Quality and the Bottom Line**

Traditionally, recommendations were made to management that a choice had to be made between quality and cost, the so-called trade-off decision because better quality would somehow cost more and make production difficult. Experience throughout the world has shown and management is beginning to see that this is not true. (Campanella 1999) Good quality leads to increased productivity, and reduced quality costs, and eventually to increased sales, market penetration, and profits.

The focus of a quality management program is more about saving money and increasing operating capacity than it is about spending money on a quality program. The costs of poor quality are truly significant in

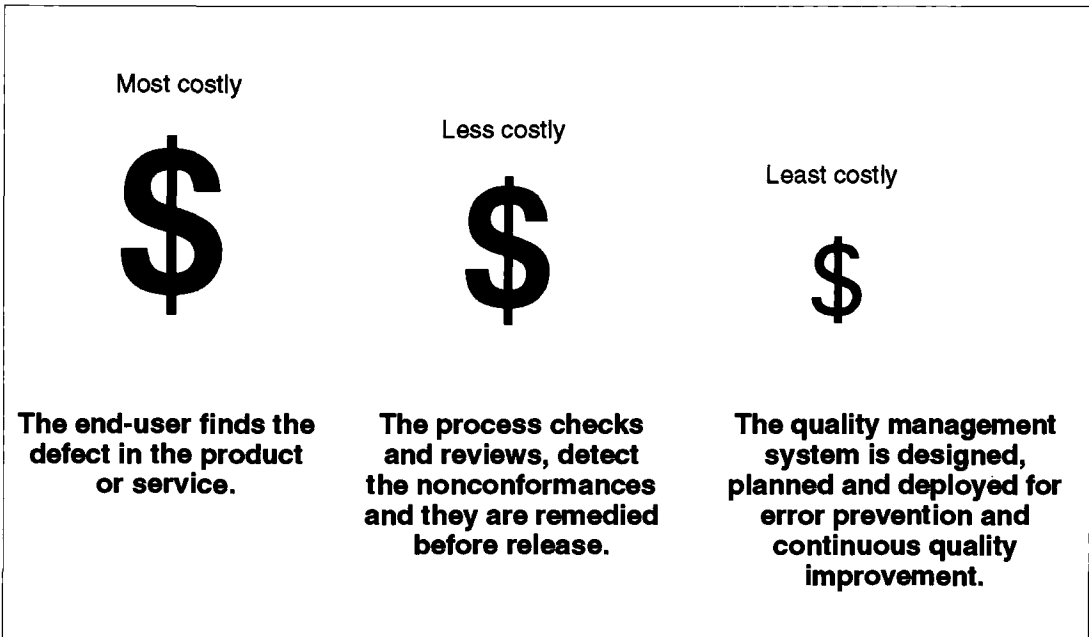


Figure 4: Comparative costs of quality. Adapted from 'Principles of Quality Costs' by Jack Campanella

both the manufacturing and the service environment. Some of these costs are really obvious like the cost of re-work, cost of redundant quality control checks, cost of after sales service or updates for poor quality products or services. But some poor quality costs are hidden from view such as the cost of poor planning, the cost of poor training, cost of a dissatisfied employee and the costs of losing a customer. If all of these seemingly small but significant costs were tracked and tallied they would be certainly be substantial.

In a practical sense, real quality costs can be measured and then reduced through the proper analysis of cause and effect. As non conformance or inefficiencies are revealed through customer feedback, employee observations or process failures, they are examined for root cause and eliminated through corrective action. Elimination of root cause means permanent removal. The further along in the operation process that an error is discovered – that is, the nearer the product is to the customer - the more expensive it is to correct. The optimum point to catch a potential error is in the planning – the cost of poor planning is a significant contributor to the organisations cost of poor quality. Ultimately, if this philosophy and technique of capturing non conformances and eliminating root cause is projected far enough you expect that a reduction in checking will be possible, as the production process is a result of highly efficient planning and execution.

## Challenges

Like herding cats, the transformation of an organisation into a high-performance organisation is a tall order. As mentioned earlier a quality journey is not just about documentation and a system for control of processes. It is a culture that permeates all the corners of the organisation.

A key to success is true leadership by those at the top of the organisation. They must be seen to walk the talk. Management must be visible leading the charge if they expect the employees to follow, as even supportive employees will be hesitant to join in if they feel their Supervisor is less than warm to the new regime. Management may have a difficult time embracing this change, managers generally have been in the organisation for a long time and they must break some of the habits and practices of the past and

learn a new set of procedures and practices. In addition to learning these new practices senior managers must be very outgoing and visible in the whole change initiative. They have to be seen spearheading change and providing reinforcement and encouragement to less senior staff as they struggle to embrace the new laws of the work place. Eventually these new practices will become second nature but the ongoing role of the leader as coach, motivator and communicator goes on, in the spirit of continuous improvement pushing the organisation to even greater heights. Management commitment is one essential ingredient that cannot be delegated.

Quality initiatives need the backing and the participation of employees. Staff need to feel encouragement and take an active role in decisions about the change. Today's workforce is the most skilled and talented in all of history. They need more than daily work instruction and a paycheck at the end of the week. They need involvement and empowerment to stimulate a workplace charged with energy for continuous improvement and stretching for excellence. Employees need to be free from fear of reprisal to fully participate in the non-conformance process. They need to feel connected and involved in reaching the goals of the organisation, they need to know where they fit in the organisational vision. They need a clear understanding and support in their career plan and they need access and involvement in organisational measures and personal performance. More than anything they need effective training and coaching that is often more reliant on peer-to-peer and supervisor guidance than anything formal. Trust and transparency of organisation plans and clearly articulated goals are the pillars upon which to build an effective quality system.

Once the Quality Management System is in place it must be understood and exercised as a management tool to drive continuous improvement. It is an effective system to identify potential improvement areas through the nonconformance process, the internal audit process, the performance measurement regime and the 3rd party Registrar audits that occur on a regular basis over the duration of certification. The quality system is a rigorous management framework that needs to be integrated into the culture and style of the organisation.

The Canadian Hydrographic Service has taken these first steps on the quality journey.

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## **Biographies**

Tony O'Connor is the Dominion Hydrographer and Director General of the Canadian Hydrographic Service (CHS). He is responsible for developing, designing and directing the implementation of national policies, plans and programs related to surveying and charting of all Canadian navigable waters. Mr. O'Connor has extensive experience as a mariner, a hydrographer and a senior manager in both government and the private sector.

Sean Hinds has worked for the Canadian Hydrographic Service for 21 years. He was the national chair of the ISO 9000 Implementation Project and has been the Head of Quality Management in Central & Arctic (C&A) Region since 1998. Sean spent 12 years as a field hydrographer, 4 years Supervising chart production and 2 years as the Manager of the Electronic Charting Division in the C&A Regional office.

E-mail: [OconnorTo@DFO-MPO.GC.CA](mailto:OconnorTo@DFO-MPO.GC.CA)

E-mail: [HindsS@DFO-MPO.GC.CA](mailto:HindsS@DFO-MPO.GC.CA)