Case studies

Application of Deming's principles in the management of change – a Hong Kong experience

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Abstract

Describes how a Hong Kong company improves its operations and manages the improvement through the application of Deming's principles. Gives the description in terms of Deming's 14 quality principles. Discusses how the principles are applied within the company, and how they help change management. This case study clearly shows that improving quality can lead to substantial bottom-line business success and growth. However, to achieve this success is a difficult path that must be consistently followed. Suggests and demonstrates practical methods to manage such changes. Such methods are applicable and transferable to other organizations, in particular those operating within a similar cultural environment to that described in the paper.

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Introduction

In the increasingly demanding business world today, every organization is striving for improvement. The key to success is not whether one can improve oneself but that whether one is improving faster than the competitors. Therefore, a good leader is one who can lead his team to manage changes in all aspects of the business, to enhance the performance of the team.

Delavigne and Robertson (1994) say that among the changes going on in our world, three types can be identified. *Evolutionary* change and *revolutionary* change are the two most commonly considered. The third type is *change in the process of evolution* - in other words, change in the process of change itself. This type of change has been studied and recommended for action by Walter Shewhart and later by Dr Edwards Deming.

This paper discusses how Deming's principles for change and improvement have been applied in a Hong Kong computer company.

In the 1950s, Deming taught Japanese top managers the profound changes that concentrated on complexity, variation, and the use of the scientific method as a tool for learning and improvement. He also revealed to them that the systems they ought to improve and serve included elements traditionally considered "outside" the system, such as customers, suppliers, and even competitors. Beginning in the 1980s, Deming taught Western managers and students the axioms comprising unified field theory for whole-system improvement, reflecting his system of profound knowledge. His contribution to the quality movement in Japan is well recognized in both the Eastern and the Western world. Deming's management theory is best summarized by his 14 points.

There are many case reports proving the practical use of the 14 points. Success is reported even in countries where culture is different from the Japanese. In November 1989, Florida Power and Light Co. became the first non-Japanese company to win the prestigious Deming Prize, Japan's top award for TQM in business (Rutledge, 1994). Davis and Fisher (1994) reported the successful implementation of the Deming philosophy in a cast iron pipe manufacturing plant in Sydney, Australia. Employees were satisfied with their work, their supervisors, and with the company. Results supported the notion that a

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top-down approach to implementation could be effective and confirmed that the change to a total quality management culture could be lengthy and time consuming.

Broedling (1996) reported the use of Deming's principle in the TQM and human resources management at McDonnell Douglas Corp., USA. By building in a process of continual improvement, Deming's philosophy helped change the norms in the organization. People who learned how to change their organization in small steps gained the confidence and skill to succeed at larger changes. Nalco Chemical Company (Keiser and Blake, 1996) in the USA began its quality journey in 1986 by adopting parts of several quality philosophies, including the Deming measurement systems and the Juran problem-solving methodology. Changes were particularly needed in its research and development process. The end result was a quality improvement process leading people to "do it the right way the first time". Kingsbury Machine Tool Corp. (Teresko, 1996) in the USA reported successful management of changes to result in a machining cell with 60 per cent improvement in cycle time. An example of process improvement using the Deming's "plan, do, study, act" cycle was reported at the Marshall Space Flight Centre (Watson, 1996) in Alabama, USA. Average processing time was reduced by more than 60 per cent.

It is interesting to note a case of applying the 14 points in a public service environment in Wisconsin, USA. Madison created the nation's first quality and productivity administrator position in a city government (Masterson, 1995). The change process started in 1986.

There is continued interest in comparing TQM and re-engineering, and thus comparing the theories advocated by Deming and Hammer. Allee (1995) sees that TQM that is grounded in the comprehensive profound knowledge perspective of Deming provides a solid foundation in the tools and procedures needed in successful re-engineering efforts. The radical changes addressed in Hammer's re-engineering require a level of mastery in systems thinking and systems tools. Too often re-engineering efforts focus only on the business process and ignore the human aspects of change. One should never dream of undertaking a major re-engineering effort without delving deeply into the culture and underlying assumptions and mental models that have created the existing system. Owen (1996) also emphasizes the need for a working model in which all the pieces fit together, and which puts the technical sides together with the human sides of manufacturing. A good programme has to be both strategic and holistic.

At a Deming conference in the USA, the participants accepted change as an undeniable necessity and they eagerly sought it. It was also apparent that these engineers and managers were frustrated in not knowing where to start or how to make the transformation happen.

About the company

Computer Products Asia-Pacific Limited, trading as Power Conversion Asia-Pacific (PCAP), was established in Hong Kong in 1981. The company is located in Shatin, occupying a seven-storey industrial complex with a total area of 140,000 square feet. In 1996, about 800 employees were employed in Hong Kong, plus another 1,300 in Zhongshan City in southern China. PCAP is the Asia-Pacific regional headquarters of Computer Products, Inc., a listed company based in Florida, USA. Founded in 1968, Computer Products, Inc. is a leading company in three business lines: power conversion products for commercial and industrial use, microcomputers for industry, and process automation hardware and software for process control, simulation, and other industries.

Major products manufactured by PCAP are standard and custom AC/DC switching power supplies and DC/DC converters. PCAP now produces 5 million units of power conversion products a year. These core electronics are the backbone of many industries that are vital to everyday life.

In July 1991, Computer Products Asia-Pacific Ltd became the first company to be certified ISO 9001 by the Hong Kong Quality Assurance Agency. Its China branch factory in Zhongshan was certified ISO 9002 in May 1993, the first ISO 9000 factory in that city. In 1992, PCAP won two grand prizes of the Hong Kong Governor's Award of Industry – the Productivity Award and Quality Award. All these achievements are good proof of the high standard of quality and productivity management of PCAP. The reputation of the company is greatly enhanced.

Through these years, PCAP has been striving for continuous improvement in all

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areas of its operations. A lot of these efforts and movements are in line with Deming's 14 principles of management. The following sections will give a brief account of how such principles are applied in PCAP.

How Deming's principles are applied in the company

Deming's 14 principles are:

(1) Create constancy of purpose towards improvement of product and service.
(2) Adopt the new philosophy.
(3) Cease dependence on mass inspection.
(4) Cease award of business on price tag alone.
(5) Improve constantly and forever the system of production and service.
(6) Institute training.
(7) Adopt and institute leadership.
(8) Drive out fear.
(9) Break down the barriers between departments.
(10) Eliminate slogans, exhortations and targets for the work force.
(11) Eliminate numerical quotes for the workforce and numerical goals for management.
(12) Remove barriers that deny people pride of workmanship.
(13) Institute a vigorous programme of education and self-improvement.
(14) Take action to accomplish the transformation.

The author's experience in the use of Deming's principles shows that all 14 principles are applicable. Among them, there are seven principles (2, 4, 5, 6, 9, 12 and 13) which are more important to the change of the fundamental management philosophy of PCAP, and to the motivation of the people so that they accept and support the change. These six principles and the practical ways to apply them are discussed below.

Adopt the new philosophy

PCAP's experience in promoting quality shows that having the right company culture that reflects the new quality philosophy is the key to successful TQM.

The success of TQM relies on the participation of all employees. If the TQM activities are incompatible with the company culture, implementation will be difficult. Hence the management team has to change the company culture, to enable employees to contribute to the TQM programme and to provide an environment where involvement in problem solving as well as decision making is the norm. Any group norm contradicting this principle should be changed.

When PCAP progressed towards the end of the 1980s, the framework of its management system had well been established. PCAP management team was proud of its team of hardworking and dedicated employees. However, most of the employees were constrained by the system and hesitated to suggest changes.

In mid-1988, the author joined PCAP as its managing director. This was a year when the company was at the cross-roads. In the USA, Computer Products, Inc. went through a major reorganization that year, and its Hong Kong subsidiary did not seem to be able to cope with the new management style and the business was unsatisfactory. In order to upgrade the company and meet the needs of the ever-changing electronics market, the author decided that he should rally the employees around a common vision; the concept of "3C":

- Charge.
- Challenge.
- Change.

In order to achieve top-quality products and superior performance, PCAP encourages all its employees to "charge" themselves to acquire further knowledge and skills. Employees are expected to accept "challenge" with responsibility and courage, and to have the ability to manage "change" in order to improve.

The "3C" was not just a slogan. To make it part of the company culture, the author encouraged the employees to visit other factories to see how they were managed. Experts were invited from outside to share their professional experience with the employees. A professional training manager was employed to design and organize an integrated employee training and development programme. This series of actions realized the commitment to "charge".

Employees were encouraged to make suggestions for improvement and innovation. In the past, the design centres of the Power Conversion Group were in the USA and Europe. The plant in Hong Kong was merely a manufacturing centre that followed the

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instructions given by the design centres. Ideas for product improvement were raised only when there were serious manufacturing difficulties. Encouraged by the concept of "challenge", employees of PCAP started to challenge themselves with a higher standard of product quality. Not only did they contribute to improvement of production methods, but they also initiated product design changes. PCAP demanded development of products with high manufacturability, high production yield, lower customer return rate, shorter cycle time, and lower production cost. In 1989, the Hong Kong plant was upgraded to a business division and Asia-Pacific headquarters. Its engineering team formed a "concurrent engineering" circle with its counterparts in the USA and Europe to develop products for the global power conversion market. Concurrent engineering was used to improve the productivity and effectiveness of the product development process by means of a cross-functional approach, instead of the traditional sequential approach. As a result, production yield and customer return rate improved, and the development cycle was shortened. PCAP employees were more confident. They were ready to face any challenge and to work out solutions.

The third concept, "change", was also embraced by PCAP employees. They accepted continuous changes and improvement as the way of life. The award of the ISO 9001 certificate highlighted the importance of "change" in the development of the new and complete quality management system.

Cease award of business on price tag alone

In PCAP, purchase decisions are made with full consideration of the "total cost" of an item through out its life cycle, not just simply on its purchase price. PCAP also believes in developing a long-term relationship with suppliers so that it can innovate and develop economy of scale.

The materials manager of PCAP is responsible for the selection and assessment of potential suppliers and subcontractors as well as the control of the procurement activities in the company. He reports directly to the author regarding the performance of these activities.

The procurement team is responsible for ensuring that the technical, quality and commercial details are adequately defined and are in sufficient detail to prevent ambiguity. It is also responsible for selecting the products/vendors to be evaluated.

PCAP exercises a formal component evaluation and vendor selection process. Components should meet the specified requirements of PCAP. Vendors and sub-contractors should have the capacity to provide products and materials which meet the specified requirements of PCAP. All new vendors are assessed through the vendor assessment programme. The approved vendor list is recorded in the manufacturing resources planning system.

Vendors are rated according to their ability to supply products meeting PCAP's specified requirements. Vendor rating methods are detailed in the working instructions of "Vendor quality performance rating method". The record of rating is also captured in the planning system.

A ship-to-stock programme was introduced in order to enable PCAP to minimize its incoming inspection activities. Only suppliers who show consistent good quality history and who are committed to delivering low defect rate components to PCAP will be qualified to the ship-to-stock programme. The programme is discontinued for a supplier if the quality requirements are not met.

Through such vendor quality management systems, PCAP ensured that award of business to the vendors is not based purely on purchase price. At the same time, it managed to reduce the materials price every year by working closely with vendors and building up a partnership spirit. For example, in 1994, an overall reduction of 6.2 per cent was achieved.

Improve constantly and forever the system of production and service

The section before the last describes how PCAP promoted the concept of continuous improvement in the company and quotes some examples of how its people faced "challenge", managed "change", and "charge" themselves through training.

Another means to enforce improvement is the "corrective action" procedure. PCAP has established well documented corrective action procedures which incorporate the following elements :

- Formal investigation of the cause of non-conformity.
- Comprehensive analysis of possible contributory factors.

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- Recommendation of realistic corrective actions to deal with the problems.
- Formal review of corrective action, after a suitable period, to verify implementation effectiveness.
- Recording and implementation of changes in procedures resulting from corrective action.

Corrective action reviews are performed by suitable personnel and verified regularly by internal auditors.

A formal review of corrective actions is generally performed by the functional head(s). The results, if significant, are submitted to the quality management review meeting via the quality system manager for re-examination.

Institute training

The management team of PCAP believes that everyone involved in its products and services must understand the customers' requirements and be trained so that he/she understands the standard required and how he/she may achieve that standard.

It is the policy of PCAP that the people employed must have appropriate experience or qualifications for the tasks they are required to perform. The human resources manager is responsible for the operation of this policy. He/she ensures that training records are updated.

Departmental managers are responsible for the training of the members of their respective departments. For example, the quality and manufacturing managers are responsible for the training of their inspectors and auditors in the use of the quality system, testing procedures and working instructions. The manufacturing manager further ensures that the shop floor operatives are aware of the requirements of the quality system as applied to them.

The human resources manager, in conjunction with other senior managers, identifies the training needs of all personnel and ensures that the policy of continual development of people is adhered to.

For instance, all newly recruited operators have to attend a two or three-day full-time training in the in-house training room. Besides providing basic orientation to the new operators, the training supervisor teaches them how to:

- recognize various electrical components;
- understand the company's policy on quality, SPC (statistical process control), industrial safety and ESD (electrostatic discharge) precaution;
- understand PCAP's workmanship standards; and
- apply total quality management concept in their work.

Such basic training is an essential investment, since an untrained operator on an assembly line would possibly make a lot of expensive mistakes.

In line with the company's commitment to high quality standards, there are several specialized skills training workshops for critical operations such as incoming quality control inspection and testing operations. Only workers who read and passed these internal courses successfully are allowed to take up the corresponding jobs.

Break down the barriers between departments

PCAP is organized into functional departments. In order to avoid the common problem of sub-optimization, joint projects among departments are encouraged. On top of the formal hierarchical organization, the management team of PCAP always reorganizes its peers into cross-functional task forces to tackle special problems.

It is a management axiom that crabgrass grows in the cracks between departments. For example, purchasing buys parts cheap, but engineering wants them to be high grade, and manufacturing needs them strong. Shipping moves goods in bulk, but sales promises the customers fast delivery. A cross-functional dispute where nobody has total control over the whole process will adversely affect the company operation and the level of service to the customers.

Cross-functional teams are formed to consider the overall optimization rather than suboptimization. Old-line manufacturing departments tend to be measured on unit costs, an intradepartmental number that can lead to excessive production runs and stacks of unsold goods. In contrast, an integrated manufacturing-shipping process might be rated by how often it turns over its inventory and a processwide measurement that reveals how all are working together to keep costs down. People with different skills are grouped to accomplish a complete piece of work

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simultaneously, not in series. Information moves straight to where it is needed, unfiltered by a hierarchy.

In 1988, having established the 3Cs, the author started to use cross-departmental task forces to tackle specific operations issues. Different process management teams were formed with team members from related departments. In the initial stage, four working teams were formed:

- asset management;
- cost reduction;
- SIOP (sales, inventory, and operations planning);
- quality improvement.

A steering committee was formed to oversee the running of these teams. Every month the team leaders reported their progress to the steering committee.

The results turned out to be very successful and consequently the same organizational approach was used in the ISO 9001 project. The scope of ISO 9001 covered all the functional departments within the organization. Therefore, it was a natural choice to use the cross-functional team approach.

PCAP's senior managers meet regularly with their key customers to gather their feedback on the services and products, their future needs, and what they expect of PCAP. Within the company, there is a joint task force working on value engineering. Market information collected by salesmen, distributors, and agents is digested by the value engineering work team. The results of the value analysis will be used as milestones to set up the new target costs, new features, forms, fits, and functions for the next generation of products.

In order to review the progress, the management use a monthly operation report system to evaluate the performance against the specified goals. For example, some of the short-term plans for 1995 included:

- Asia-Pacific sales increase by 90 per cent;
- continuous cost reduction of 7 per cent a year;
- on-time delivery;
- less than 300PPM defects on outgoing goods.

These short-term plans are supported by seven long-term movements:

- just-in-time implementation;
- flexible manufacturing capacity;
- sales and inventory operation planning activity;
- DOE (design of experiments) technique application;
- vendor management;
- testing facilities upgrade;
- world-class training.

These goals are derived from careful consideration by the whole management team. They are important business drivers.

Remove barriers that deny people pride of workmanship

Computer Products' mission on people management is "to make Computer Products a nice place to work". This is promoted not only by encouraging and helping people to perform in their job, but also by organizing extra-curricular activities for them.

The Employee Recreation Club (ERC) with members elected by employees and ex officio members of the human resources department, organizes monthly functions for the employees. These include sports competitions, picnic, launch, karaoke singing, talent show, etc. also several interest groups were organized : Cantonese Opera Singing Group, Photography Club and Drama Club with membership open to all employees.

Contribution and service to the community are encouraged. The ERC and interest groups often organize functions with other social service organizations. In the past two years, they performed several times for the elderly centres. PCAP also participated in "Walk for Millions" for the Community Chest.

Through these activities not only "teamwork" and "sense of belonging" are promoted, but also natural leaders are identified. Organizing such extra-curricular activities does help the business as well.

Institute a vigorous programme of education and self-improvement

The management of the company recognizes the importance of training and development.

The former chief executive officer of Computer Products, Inc. set a proper direction for facilitating self-development of employees. He said:

> Our growth at Computer Products in influenced by only two factors : the financial health of our company and our desire and ability …so by excelling at our current job while, at the same time, learning new skills, we are fostering an environment that will make it easier for us to move up the corporate ladder.

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These words integrated the value of training with business development as well as career development.

Local management support is strong. The author, being the managing director of the company, exemplifies commitment in training and development through his direct involvement in training design, conducting classes and liaising with various institutions to provide in-house training for his colleagues. Externally, he is very active in the technical educational field, promoting education and training in the local industry.

PCAP is running a generous Training Sponsorship Scheme to encourage staff to take external courses for the growth of the individual and development of the organization. At present, a number of colleagues are taking certificate, diploma, degree, masters degree or even doctorate degree courses in various tertiary educational institutions. PCAP now has four employees who have completed the master programme of the IGDS (Integrated Graduate Development Scheme) organized by the Warwick University and the Hong Kong Polytechnic University.

All the above have fostered PCAP to create a strong foundation for long-term people development. With the outstanding results of both in-house and external training, the company was elected winner of the "Award for Excellence in Training 1991" by the Hong Kong Management Association.

Benefits achieved

The longer-term TQM movements of PCAP are supported by individual departments; the progress is reported and reviewed monthly. The major achievements from 1989 to 1994 are:

- Inventory turns increased from six to nine.
- Work in progress (WIP) reduced from US$700K to US$240K and the throughput time reduced from eight to three days.
- The average order lead time decreased from 12 to 4 weeks.
- The scrap rate reduced from 0.25 to 0.1 per cent of sales.
- Each year, PCAP maintained 5 per cent to 10 per cent cost reduction on the products.
- The labour efficiency kept improving despite the routing hour reduced 4 per cent to 7 per cent per year.
- The overall test yield improved from 92 to 98.4 per cent.
- The warranty return rate dropped from 1.2 to 0.2 per cent.
- The outgoing audits defect rate improved from 5,000 to below 500ppm .
- The repair backlog dropped from 1,800 sets to 100.

In the fiscal year of 1994 which ended just before Christmas, the total business revenue of PCAP increased by more than 30 per cent over 1993, reaching US$53 million. Cost reduction of over US$3 million and productivity improvement of 6.5 per cent were achieved. The outgoing defects reduced to 400ppm level and the overall test yield reached 98.4 per cent.

Conclusion

The experience that the author has in applying Deming's principles in his company is discussed in this paper. Among the 14 principles, seven are selected for discussion. These seven principles are, according to this case, more important for the changing of the employees' mind set and behaviour. Managing people is the key success factor for change management.

The road map of PCAP in its pursuance of operational excellence is an example of evolutionary changes management. Once the company culture of changes is established, employees do see managing changes as their normal way of doing business, and are able to initiate and implement continuous improvement. Deming's 14 points are useful guidelines in formulating such transformation. These management principles are particularly suitable for the Eastern culture, and are thus applicable in PCAP which is operated in Hong Kong where Eastern culture is prevailing.

To compete in the global electronics market, a company takes a leadership position only if it can improve itself at a pace faster than its competitors. Such a pace of improvement can only be sustained with a strong culture that encourages continuous improvement. The Deming principles help build up such a culture, as demonstrated by Computer Products Asia-Pacific Ltd.

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Commentary

What you often see with Deming's methodology (and others) is that people pick and mix – we like this bit, we don't like this bit, so we'll use the bits we like. Then they are surprised when it fails. Hey, it's supposed to be a whole system, folks. Try baking a cake and saying – I like eggs, I don't much care for flour so I'll leave it out, I do quite like pepperoni so I'll put some of that in. You won't get a cake. Anyway Wai-Kwok Lo tells a nice story of a real firm which took the recipe and made a cake for iteslf.