COQ improvements can be expressed as productivity improvement gains

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Introduction

As economy is deteriorated by our financial crisis, many industries and business are losing their market place. Concerning their money and budget spent, many stakeholders urge their CEO to ensure its sales in tough market. At the same time, people are losing jobs due to layoffs, buying power is reduced and people are not willing to pay for what they paid before. As market becomes competitive with lower sales price, CEO must protect its business by targeting their product / service correct to the customer to make profit; on the other hand, CEO searches for way to improve its process and lowers its cost. With these rapid changes in business environment and financial factors, CEO job becomes harder than ever. From positioning a product / service in tough market, finding way to compete with other product in the market, reducing costs in operation, to making tough decision to keep business survives, CEOs must find appropriate data to support his decision-making.

In this economical downturn, being customer-oriented and producing high quality product / service is not enough. Companies needs to analyze their cost data to minimize any loss related to failure costs. As a trade-off, by improving quality program, a company can correct internal and external issues, and reduces its loss. By evaluating its costs and prices, companies can market better on selling price to compete. As a result, a better business opportunity for the product, simplified and better process, with reduced cost through supplier and waste will help a company to yield profit.

In this paper, we will discuss how to use quality model and business model to lead a company's productivity and competition.

Quality Framework
Cost of Quality (CoQ)

Joseph Juran delivers us the theory of cost of quality, Crosby gives the theory of conformance and non-conformance, Feigenabaum focuses the importance to use the preventive-appraisal-failure cost, and finally, Cooper offers the activity-base-model based on value-added activities and non-value added activities.

From these quality philosophers, there is a common interest in the cost of quality, and they emphasized that cost of quality can be improved by correcting the intangibles / non-conformance / failures. As a result, it will help an organization to increase it productivity and yield profit.

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Table 1: QA Measurement Models

QA Model	Cost / Activity Category
Joseph Juran's opportunity and intangible cost model	Tangible + intangibles
Crosby model	Conformance + non-conformance
Feigenabaum's P-A-F	Prevention + appraisal + failure
Cooper's Activity base cost	value-added+ non-value-added

Cost of quality is commonly divided into the category of preventive, appraisal, internal failure and external failure. As high quality is defined as conformance to specification, poor quality is defined as non-conformance to specification. Understanding CoQ is to understand that a process generates variation. Variation produces internal failure and external failure, which contribute to waste. For example, the waste comes from reworks, losses to end-users, and warranty, etc. In order to reduce the waste, a company must improve its conformance cost through preventive and appraisal measure. By doing so, it will improve and reduce the waste through failures.

Beside the effective way of using CoQ, it is also common to use return of quality, quality rate and process quality to determine a company quality program as follows:

Return of quality (RoQ) = increase in profit / cost of quality improvement program

Quality rate = (input – (quality defects + startup defects + rework))/ input

Process quality = (available time – rework time) / available time

In addition, applying Pareto analysis is also useful in improving its failure. Most company will use Pareto analysis to address its 80% of issues. This 80% of issues are considered as the problem should not be ignored. By correcting the 80% of the problem, it will significantly to improve an organization productivity and cost reduction.

Table 2: CoQ Category and Example

CoQ Category	Example
Preventive	New product review Quality planning Supplier capability surveys Process capability evaluations Quality improvement team meetings Quality improvement projects Quality education and training, etc
Appraisal	Incoming and source inspection Test a purchased material In process and final inspection Product, process, service audits Calibration of measuring a test equipment, etc

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Internal	Scrap
	Rework
	Re-inspection
	Re-testing
	Material review
	Downgrading
External	Processing customer complaints
	Customer returns
	Warranty issues
	Product recalls

Genichi Taguchi

Beside the CoQ analysis approach, Genichi Taguchi's loss function is another useful quality theory. Taguchi applied statistics into quality system to analyze product quality through variation. Taguchi explains if there is loss due to product out of specification, a loss is known. As the variation goes further, the higher loss will incur. As a result, the costs will go sky-high. Therefore, it is necessary to address these variations and reduced its loss. Taguchi loss theory can be expressed mathematically by approximating its function through quadratic function so that larger deviations from target correspond to increasingly larger losses. His idea is that the loss occurs not only when the product falls outside of the specifications, but also the loss continually increases as the part deviates from the nominal. See figure below.

Taguchi method:

$$L(x) = k(x-T)^2$$

L: Loss in dollars
k: cost coefficient
x: value of quality characteristic
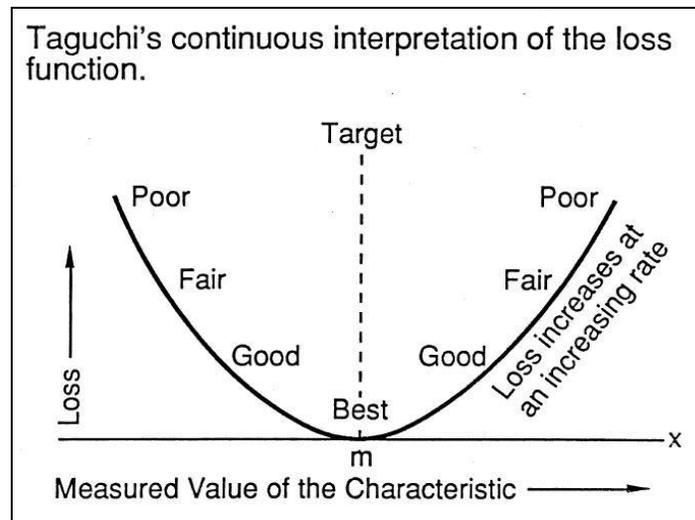T: target value (m)

Figure 1: Taguchi Loss Function Curve (ref – 10)

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P-A-F and Taguchi loss function both helps a company to carry out preventive and appraisal corrective actions. In exchange, a better quality program, will reduce cost of quality, and increase productivity and profit from a product / service.

Build a business framework for performance improvement

Besides using CoQ, a company can use business framework to address its opportunity potential. Building a business framework can help a company to collect appropriate data and make proper decision. A business framework should include four areas, includes: (a) analyzing cost and price, (b) evaluating competition position, (c) understanding segment needs and performance, and (d) simplifying.

Analyze Cost and Price

In a rapid market, competition frequently drives the cost and price declined. Without understanding the cost and price of a product / service, it will put the business in an inferior position. In order to predict the company product cost and industry price in the future, company can use "experience curve" to evaluate it. Experience curve is a graphical presentation that shows the decline in a company cost and an industry price as a function of accumulated experience.

For example: a company found that a product price might drop its price 10% per year. An experience curve can construct for its cost and price experience to predict cost reduction if needed.
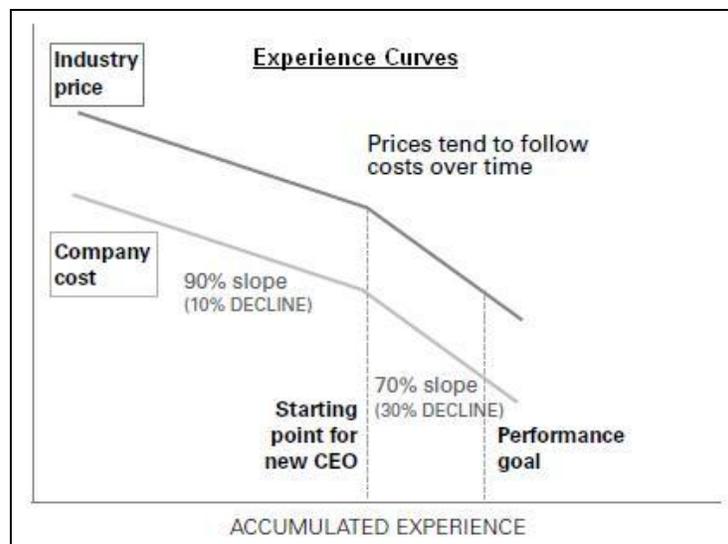

Figure 2: Experience Curve (ref-4)

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By positioning a right cost and price, it allows company to make top priority decision and market product at a right price to compete with others. For example: if an industry price is going down with a similar product, while the company product cost is going up or holding steady, it will raise some urgent challenge to the company. By using the experience curve, a company can decide when and how to lower it cost and price ahead of time.

Using experience curve, it will help an organization to address cost and price issue to compete. After knowing upcoming price change by Experience Curve, an organization can carry out prevention and appraisal methods to improve the CoQ cost and waste. By doing this, it will reduce the company product cost through reduction of failure cost. As a result, it allows the company to compete easier with a lower cost.

Evaluate competition position

Even in economical downturn, there is an opportunity for a business. Understanding competition will determine the options for a business. Therefore, it is important for comparing a competitor in term of returns on assets and relative market share. Evaluating how much money competitor is making, finding the potential of a company, determining the size of a market, and understanding where the business loses will happen, these questions will help a company to position themselves through competition.

Commonly, industries are preferred to use relative market share (RMS) and return of asset (ROA) to determine a company position in the market.

> **Relative Market Share (RMS):**
>
> **Company is a leading company in the industry:**
> Relative market share (RMS) = leading company share / competitor company share.
>
> **Company is a follower n the industry:**
> Relative market share (RMS) = company share / leading company share

After obtaining relative market share (RMS), company can plot return of asset (ROA) against relative market share (RMS). RMS vs. ROA chart can indicates how well a company performs within a market. In general, company with a higher RMS is likely to have a high ROA, and vice versa. A company with higher RMS reflects that they are outperformed than other companies.

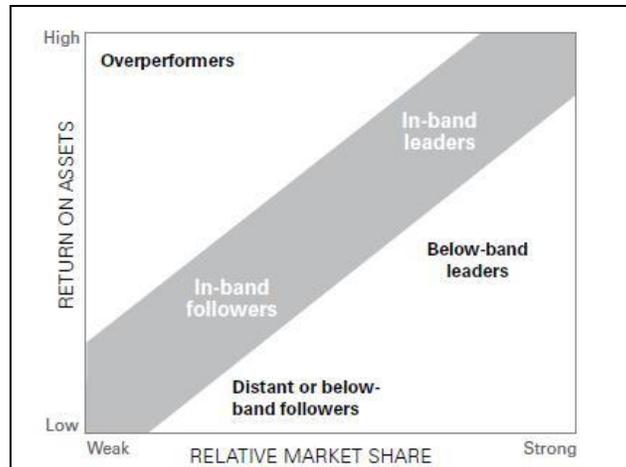COQ improvements can be expressed as productivity improvement gains

Figure 3: ROA vs. RMS to compare with competitor position (ref – 4)

In a ROA vs. RMS curve, for example, if a company stays within in-band leaders region, it indicates that the company is outperformed. If a company found its position within in-band follower, it means that the company needs to work harder and keep up with its competitor.

For example, in 1990s Sony Play station found themselves as in-band leaders and outperformed Nintendo. After a decade of hard working, Nintendo finally caught up with Sony Play station market in 2006 due to the change of game technology in Wii system and it demonstrated as customer wanted.

Segment needs and performance

Since profit and market does not stand still, and market trend can change by customer needs and preference, or new competitor joins the market; it will impact the company profit and market share. Therefore it is necessary to study customer needs by segment. Correctly segmenting customers, it allows a company to develop insights to their purchasing behavior. As a result, company can build better project based on customer's need. Hopefully, it will gain loyal relationship. Gaining faith customer relationship will be an important key to business success, which increases business growth and gains market share. One of a common measure to analyze a company performance against competitor is to use "Segment Needs and Performance (SNAP)" chart. A SNAP chart is a graphical presentation that plots company and competitor performances over customer needs. See the example curve below.

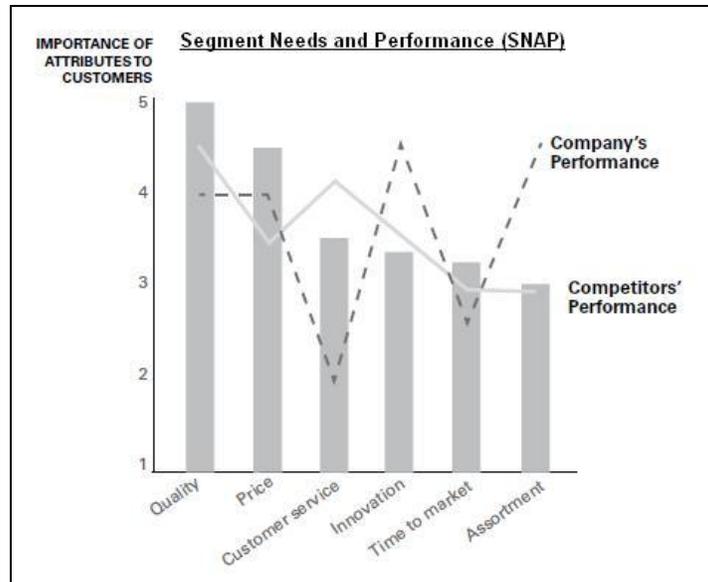COQ improvements can be expressed as productivity improvement gains

Figure 4: SNAP chart (ref – 4)

To develop SNAP chart, first identify the attributes of products / services that a company offers. By identify the attributes of the product / service, a company demonstrated their understanding of the target audience. Then conduct a customer survey to determine how important these attribute to customer. At last, scale the performances between the company and competitor through the curve as above.

Through SNAP chart, company can track customer retention and loyalty as indicator to carry out product improvements.

    a.   Identify the most attractive target segment

    b.   Design the best value proportions to meet customer needs

    c.   Acquire more customers in the target segment

    d.   Deliver a better customer experience by using CoQ to improve product through the quality program

    e.   Reduce failure and improve produce will yield gains.

Simplifying can reduce waste

Based on a study from Harvard Business Review "New Leader's Guide to Diagnosing Business", a company conducted a survey over 110 companies to evaluate importance of product and process complexity, it found out that over 70% of company reflects that simplicity gets more results, and complexity increases waste.

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Complexity, either of a process or product, raises the cost, and it hinders a company growth. Therefore, it is important for a company to review the product and process complexity and find ways to simplify it.

For example: in 2006 Ritz-Carlton hotel chain renowned for its high quality. After decades of demanding on employees strictly to practice a 20-points list of customer service basics, company management realized that the specified routines were not adequately addressing the wide range expectation of the luxury chain's customers. These customers are more young, diversified, technology savvy, and often travel with family and children. Therefore, the company leaders saw the customer segment changes and simplified its 20-points list of customer service to 12-point set of values that allowed employees to use their judgment and improvise. By simplifying the service quality, employees are encouraged to sense customer's needs and act accordingly. Customer satisfaction improved.

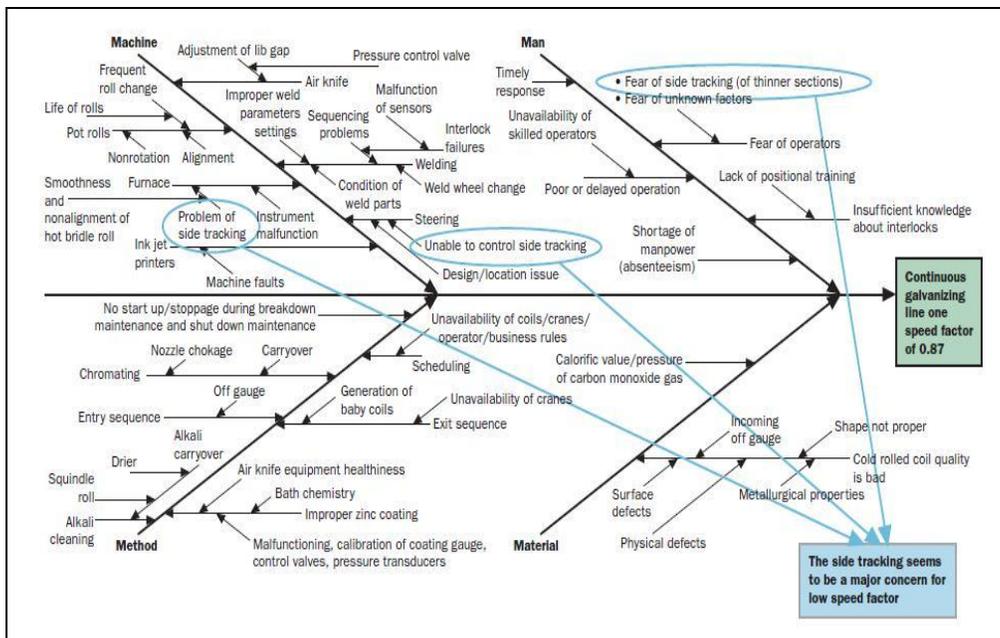COQ improvements can be expressed as productivity improvement gains

Case Study of Tata's Steel Domestic and International

As we learned that business framework is the way to open the doors for a company to gain business opportunity and target its business to customer, and quality models are the way to help an organization to reduce its cost and waste by improving its product / service quality. It seems that combining both will help an organization to reach its utmost result.

However, it based on a study from ASQ publication "The power of balance", it indicates that many company are quality follower, but not many companies are able to understand, collect and analyze the use of CoQ. It leaves much company without CoQ practice and results in million dollars loss. It is necessary to educate quality practitioner to understand the usage of CoQ principle, and the effect of business framework. Combining both methods in a business practice and quality measure, it will help a quality practitioner to address issue and improve the productivity in an organization.

Based on a study by "Tata Steel's domestic and international" in 2003, Tata Steel's domestic and international yielded a market share gain from 23% to 32% between 2002 and 2003. In this study, it indicates that Tata implemented a CoQ program and used appraisal and internal failure measures to improve its manufacturing process. At a result, it saves $1.65 million through waste reduction and process improvement

From this study, Tata applied root-cause analysis and control chart to address its failure causes and found out that a major concern is focusing on machine side tracking. As a result, Tata carries corrective measure to improve the side tracking issues.

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Figure 5: Tata Steel Domestic and Internal Fish Bone analysis

From their analysis, Tata implements a quality improvement process through

    a. Identify the problem

    b. Measure the current state

    c. Analyze the root causes

    d. Generate potential solution

    e. Experiment and then execute proven solutions

    f. Sustain the improvement over time using Control Chart.

Through the year 2003, it indicates Tata successfully improved its failure issue due to the side tracking. And it found that before the project, it has 759,774 defects per million, and after the CoQ project implemented, it reduces to 235,525 defects per million. As a result, it yields a gain from 23% to 32% in profit in $ 1.65 millions.

Parameters	Before the project (December 2002 to March 2003)	After the project (July 2003 to August 2003)
Defects per million opportunities	759,774	235,525
Sigma level (short-term)	1.50	2.24
Average speed factor	0.874	0.969
Yield of speed factor	24.02%	76.44%

Figure 6: Tata's Steel Domestic and Internal Before and After CoQ implementation Comparison

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Conclusion

In this economical tough times, many companies have reduced budget, and urges company leader to secure its market share. Business leader are commonly understand the importance of quality, cost and customer needs. It is importance to find ways to satisfy these rules as higher quality, lower cost, and happy customer. In many situations, a business leader has only few months to response and demonstrates their ability in business. It is necessary to use business model and quality model to increase business opportunity and waste reduction.

One way to act effectively is to apply business framework and quality model in a business environment. Business framework should focus on cost and price, competition position, customer segment needs and performance, and simplify product and process. Apply cost of quality framework to analyze the cost analysis through preventive-appraisal-failures, it will help an organization to improve its quality and reduce the cost. With both model helps, a business leader can determine what needs to be done in a competitive market, and what needs to be improve within an organization internally and externally.

In my conclusion, a better understanding on the competitive market will open many business opportunities through business model. Correcting internal and external failure can increase productivity at work and quality through product and process. With an optimized process and productivity, reduced waste and cost, additional business opportunity, it will help a business to survive and succeed for many years.

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