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| Chapter  2 | Quality Management |

This chapter introduces one of the most critical processes for effective operations, quality management. Chapter 2 discusses the evolution of quality management, tools for solving quality problems, Six Sigma, cost of quality and quality awards and certifications. The next chapter goes into the details of statistical quality control. The material can be covered in two or three 75 minute classes (depending on the number of interactive exercises used).

We present quality early in the text not only because of its importance to industry, but also for its relevance to students. Every student has experienced both good and bad quality and can articulate how that experience has shaped their buying behaviour.

Listed below are learning objectives, a lecture outline, teaching notes, pause and reflect questions, and suggested videos.

**LEARNING OBJECTIVES**

* Discuss the meaning of quality of goods and services from both the producer ’s and consumer’s perspectives.
* Discuss the evolution of quality management into a quality management system, including key figures and their contributions.
* Use several common quality-control tools.
* Describe several approaches used for involving employees in the quality-improvement process.
* Describe the Six Sigma and Lean Six Sigma quality management systems and calculate changes in profit resulting from Six Sigma projects.
* Classify quality-related costs and calculate and interpret quality-measurement indices.
* Use several quality measures that reflect productivity.

LECTURE OUTLINE (*suggested activities in italics*)

*Day 1 What is Q, Q Management Systems, Q Tools, Customer Focus, Employee Involvement, Q in Services*

*Day 2 Six Sigma, Cost of Q, Q & Productivity, Q Awards and Certifications*

A. Quality Management - The Coffee Customer Is Always Right

B. What is Quality? (Figure 2.1) – *Student examples of good and bad Q; match with dimensions of Q*

1. Quality from the Consumer’s Perspective

a. Dimensions of Quality for Manufactured Products

b. Dimensions of Quality for Services

2. Quality From the Producer’s Perspective

3. A Final Perspective on Quality

C. Quality Management System

1. The Evolution of Quality Management – Applying Deming’s principles in award-winning hospitals

a. W. Edwards Deming *Red bead experiment*

b. Deming's Fourteen Points (Table 2.2)

c. Plan-Do-Study-Act Cycle (Figure 2.2)

D. TQM and QMS

E. Quality Tools (Figure 2.3) – *Apply tools in a short case*

1. Process Flowcharts

2. Cause-and-Effect Diagrams (Figure 2.4)

3. Cause-and-Effect Matrix (Figure 2.5)

4. Check Sheets and Histograms

5 Pareto Analysis (Figure 2.6)

6. Scatter Diagrams

7. Process Control Charts and Statistical Quality Control

F. The Focus of Quality Management – Customers (Figure 2.3)

1. Quality Management in the Supply Chain

2. Measuring Customer Satisfaction

G. The Role of Employees in Quality Improvement – Customer Focus and Employee Empowerment at Maple Leaf Foods

1. Kaizen and Continuous Improvement

2. Quality Circles (Figure 2.8)

3. Process Improvement Teams

*What needs to be improved at your university? Create charter for an improvement team.*

H. Quality in Services – Customer Satisfaction at Ritz-Carlton Hotels

1. Quality Attributes in Services – *Discuss – how do you measure Q in services?*

I. Six Sigma – *Motorola’s Six Sigma Quality*

1. The Six Sigma Goal – 3.4 DPMO *Give examples of 99.99% good quality*

2. The Six Sigma Process

3. Improvement Projects

4. The Breakthrough Strategy: DMAIC (Figure 2.9)

5. Black Belts and Green Belts (Six Sigma tools, Figure 2.10)

6. Design for Six Sigma

7. Lean Six Sigma

8. The Bottom Line – Profitability

J. The Cost of Quality – *Discuss high profile recalls and their ultimate cost*

1. The Cost of Achieving Good Quality

a. Prevention Costs

b. Appraisal Costs

2. The Cost of Poor Quality

a. Internal Failure Costs

b. External Failure Costs

3. Measuring and Reporting Quality Costs

4. The Quality-Cost Relationship

K. The Effect of Quality Management on Productivity

1. Productivity

2. Measuring Product Yield and Productivity

3. The Quality-Productivity Ratio

L. Quality Awards (Table 2.3)

1. The Canada Awards for Excellence (CAE)

2. Other Awards for Quality

M. ISO 9000 – *ISO Certifications for Sustainability and Social Responsibility – Which*

*companies in your area are ISO 9000 certified?*

1. Standards *What kinds of standards and certifications make a difference to you?*

2. Certification

3. Implications of ISO 9000 for Canadian companies

4. ISO Registrars

N. Summary of Learning Objectives

O. Summary of Key Formulas

P. Summary of Key Terms

**MAPPING OF LEARNING OBJECTIVES TO ASSIGNMENTS**

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|  | **Topic** | **Learning Objective** | **Questions** | **Problems** | **Other** |
| 2.1 | WHAT IS QUALITY? | ***LO 2.1 Discuss the meaning of quality of goods and services from both the producer’s and consumer’s perspectives.*** | 1, 2, 3, 7, 10, 18, 21, 22, 27, 28, 29, 31, 42, 49, 51 |  | Case problem 2.1, 2.2 |
| 2.2 | QUALITY MANAGEMENT SYSTEM | ***LO 2.2*** ***Discuss the evolution of quality management into a quality management system, including key figures and their contributions.*** | 14, 15, 16, 17, 19, 20, 23, 24, 25, 26, 35, 36, 37, 42, 47, 48, 50, 51 |  | Case problem 2.1, 2.2 |
| 2.3 | QUALITY TOOLS | ***LO 2.3 Use several common quality-control tools.*** | 30, 32, 33, 34, 38, , 45, 46, 49 | 15 | Case problem 2.1, 2.2, 2.3 |
| 2.4 | THE ROLE OF EMPLOYEES IN QUALITY IMPROVEMENT | ***LO 2.4 Describe several approaches used for involving employees in the quality-improvement process.*** | 19 |  | Case problem 2.1, 2.2 |
| 2.5 | SIX SIGMA | ***LO 2.5 Describe the Six Sigma and Lean Six Sigma quality management systems and calculate changes in profit resulting from Six Sigma projects.*** | 39, 40, 41, 43, 44 | 13, 14 | Case problem 2.1, 2.2 |
| 2.6 | THE COST OF QUALITY | ***LO 2.6 Classify quality-related costs and calculate and interpret quality-measurement indices.*** | 4, 5, 6, 9, 12, 13 | 1 | Case problem 2.1, 2.2, 2.3 |
| 2.7 | THE EFFECT OF QUALITY MANAGEMENT ON PRODUCTIVITY | ***LO 2.7 Use several quality measures that reflect productivity.*** | 8, 11 | 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 16 | Solved problem 1, 2  Case problem 2.1, 2.2, 2.4 |

**SUGGESTED VIDEOS**

There are numerous videos available on the Internet on quality management, ISO 9000, Six Sigma and more. CAE has a website containing videos on the gold and platinum level winners, 2010 onwards. NIST has a channel on YouTube that describes the Baldrige National Quality Winners. These are good resources for either chapter 2 or 3. Listed below are the links to CAE and NIST videos.

Videos on the 2013 Canada Awards for Excellence (CAE) gold and platinum level winners are available from [http://www.nqi.ca/en/awards/2013-cae-recipients/](http://www.nqi.ca/en/awards/2013-cae-recipients/%20) The same page gives links to the videos on the 2010-2012 CAE winners.

Videos of Baldrige Award winners are available on the NIST channel, <http://www.youtube.com/user/usnistgov>

**EXPERIENTIAL EXERCISES**

**The Red Bead Experiment (Chapter 2 or 3)**

Description:

<http://www.redbead.com/>

**PDCA Card Game**

*Source*: Clemson’s Deming website

This activity is designed to illustrate the benefits of the PDCA cycle. Prior to the activity you will need to pre-sort several decks of cards. Arrange the decks so that each deck has eights aces, eight 2s, eight 3s, and so on through eight 10s. Do not use the face cards. There should be 80 cards in the deck – eight of each number ace through 10. The suits should be mixed, i.e., not an equal no. of cards in each suit. Teams should have either 5 or 6 members each.

***The Problem:***Give out one deck to each team. Don't describe the cards or allow them to touch the cards until the instructor says “GO.” Tell them the object is to divide the cards as evenly as possible among the team members according to point value on the face of the cards. Ace counts 1 point, 10 counts 10 points, all others count the actual number (2 counts 2, 3 counts 3, etc.). Member totals may vary by one point.Say "GO" and stop them after 30 seconds. Did they get them all divided evenly? Probably not. Collect the cards and put them in the middle of the table.

***Plan:*** Briefly explain the concept of PDCA. Tell them they will now have a chance to "plan" how to divide the cards equally before actually doing it. Tell them anything they want to know about the cards now, but do not allow them to touch the cards until you say "GO". (Most teams will go to great lengths to get their hands on the cards. Do not allow it.) After most of the teams have their plan together, tell them they have 2 minutes to execute their plans, say "GO".

***Do:*** Let them execute their plans, time them, and record them. Note the number of defects (unequal points). This will take from 2–4 minutes.

***Check:*** Have the teams discuss at their tables how they can improve their process. Again, they may not touch the cards until you say "GO". After 3-5 minutes, say "GO".

***Act:*** Let them execute their improved plans. Record the results. Most everyone will improve. If you have time for another round, tell them that world class is 45 seconds with zero defects. The groups may find this incredulous, but it will motivate them to think of new ways of organizing the process, and they will be immensely satisfied when world class is reached and exceeded. (One group was able to perform the task in 34 seconds with zero defects. Their technique was to spread cards out face up and have each of the 4 team members pull out pairs of cards totalling 11, repeated 10 times.)

Discuss as a large group the various processes and improvements. Review the usefulness of the PDCA process, and the importance of a benchmark.

**The Koosh Ball Exercise**

*Source*: Clemson’s Deming Website

***To begin:*** Arrange the class into a loose circle. Using a koosh ball or bean bag, define a work process. For example, have each participant raise one hand. Give the ball to one of the participants to start. They may throw the ball to any other person with their hand up. The person who gets the ball throws it to any other person with their hand up and then lowers his/her hand. (The hand up is just a way of identifying who has had it and who has not). Continue tossing the ball around until everyone has had the ball. The last person to touch the ball throws it back to the one who started.

***Identifying the Process:*** The group has just defined a process for this activity. Now repeat the process. Each person must touch the ball in the same order as defined above and return it to the starter. This requires that you pay attention to who your supplier and customer are in completing the process.

***Practicing the Process:*** Let the group practice the process and record the time it takes them to complete it.

***Improving the Process:*** Explain to the group that since a competitor down the street can complete the process in 2 seconds, they will have to do better. Let them try again. (Usually three trials is enough).

The only rules are that everyone must touch the ball in the same order as defined at the start and the same person has the ball at the start and finish. The groups will usually start by moving closer or throwing harder or faster. This usually causes someone to miss and then they get blamed for the failure to meet the time goal. Blaming people of course is counterproductive when it is the process that needs to be changed. Improvements begin when the participants line up in order and pass the ball around. Then the person who starts might run around the circle or down the line and touch the ball to the outstretched hands of the participants in order. The fastest way seems to be if they form a tight circle in order and the starter kneels in the middle and twirls the ball over his/her head and touches all the hands in order.

Discuss the activity and what people observed and experienced. The main point is that things don't improve by working faster and harder, they get better by improving the process.

**TEACHING NOTES**

**Teaching Note 1—The Japanese learned quality from Deming after WWII**

After World War II, the Japanese found their reputation for poor quality to be a major obstacle in their ability to compete in world markets. This created an eager atmosphere of acceptance for the ideas and philosophies about quality provided by such individuals as W. E. Deming when he visited Japan as a consultant after the war.

**Teaching Note 2—Quality issues pervade this textbook**

The impact of quality management on some of the operational functions discussed in these sections of the text is addressed in greater detail in other chapters of this text. For example, the relationship between quality management and product design is discussed in greater detail in Chapters 4 (Product Design) and 5 (Service Design). The relationship of quality to job design and employees is considered in Chapter 8 (Human Resources). Quality and statistical process control is discussed in greater depth in Chapter 3 (Statistical Quality Control) and its Supplement (Acceptance Sampling). Quality is also an issue in shipping, materials management, and logistics, which are addressed in Chapters 10 (Supply Chain Strategy and Design) and 11 (Global Sourcing and Logistics).

**Teaching Note 3—Quality Management and Design Teams**

A recent trend in QM is to use design teams for product design. Design teams include members from various functions and operations in the organization that can affect product quality such as engineering, quality, purchasing, manufacturing, and marketing. For example, members from purchasing can provide input or supplier capabilities, and frequently representatives from the actual suppliers are members of the team. Other members might include marketing representatives to indicate consumer preferences and the quality features most likely to appeal to consumer tastes and demands. In some cases, important consumers are informal members of the design team. The use of design teams is discussed in greater detail in Chapters 4 and 5.

**Teaching Note 4—Templates and Software for Quality Tools**

Templates are available for most of the tools of quality management. Microsoft’s Visio has a library of templates for business use; this includes a cause-and-effect diagram. Excel makes easy work of Pareto analysis problems, histograms, and scatter diagrams, and in chapter 3 Excel is used for statistical process control and process capability.

**Teaching Note 5—Deming Brings Statistical Process Control to the Masses**

During the mid-1930s, W. E. Deming took a one-year leave of absence from the U. S. Department of Agriculture to study statistical theory under noted statistician, Ronald A. Fisher. After he returned to the USDA, he organized a series of evening lectures on statistical theory for the USDA’s graduate school of continuing education. Deming invited a number of prominent international scholars to lecture, and it was in this forum that Deming promoted Walter Shewhart's work on statistical process control. Shewhart delivered a four-part lecture which Deming helped compile into the book that for many years was the bible of statistical quality control, *Statistical Method from the Viewpoint of Quality Control*. Through this lecture series Deming became well-known to many prominent individuals who attended the lectures, including Milton Friedman.

*Source*: Gabor, A., "Deming Demystifies the Black Art of Statistics,” Quality Progress, December 1991, pp. 26–28.

**Teaching Note 6—Baldrige Awards**

A detailed presentation of each Baldrige Award winning company can be accessed at the Baldrige Award site. This site and the website addresses for many of he Baldrige companies are provided in the web links section for this chapter on the text website.

**Teaching Note 7—Canadian Awards for Excellence (CAE)**

Excellence Canada, founded in 1992, is an independent, not-for-profit organization that recognizes excellence within Canadian companies and non-profits. The link to CAE is: [http://www.nqi.ca/](http://www.nqi.ca/%20)

**PAUSE AND REFLECT**

1. What are the different quality characteristics you (as a consumer) would expect to find in the following three products: a DVD player, a pizza, running shoes? Conduct threaded discussion on each selected product.
2. In most consumer markets, there exist low-quality, moderate-quality, and high-quality products. There appears to be a market for each. Can the Definitions of Quality or the Cost of Quality models illuminate this seemingly odd phenomenon?
3. Identify a company or organization from which you have received high-quality products and describe the characteristics which make it high quality. Identify a company or organization from which you have received poor-quality products or services, describe the nature of the defects, and suggest ways in which you might improve quality.
4. Match up the components of Six Sigma with the tools and precepts espoused by Deming and other quality gurus, i.e., trace the roots of Six Sigma. Why does Six Sigma use these particular components and not others?
5. A defence contractor manufacturers rifles for the military. The military has exacting quality standards that the contractor must meet. The military is very pleased with the quality of the products provided by the contractor and rarely has to return products or has reason for complaint. However, the contractor is experiencing extremely high quality-related costs. Speculate on the reasons for the contractor's high quality-related costs.
6. Consider your university or college as a production system in which the final product is a graduate. For this system:

a. Define quality from the producer's and customer's perspectives.

b. Develop a fitness-for-use description for final product quality.

c. Give examples of the cost of poor quality (internal and external failure costs) and the cost of quality assurance (prevention and appraisal) costs.

1. This question is relevant if your College of Business is accredited by AASCB, an agency that embraces Quality Management. How and where do you see Deming’s 14 points being applied in your College of Business? Do some appear to be more prevalent than others? Why do you think this is?