COSTS AND PRODUCTIVITY

DISCUSSION QUESTIONS

1. Quality is meeting or exceeding customer expectations on such dimensions as performance, features, reliability, and conformance.

2. Reliability is the probability that a product or service will function as intended for a specified period of time. Durability is how long the product lasts.

3. Quality of conformance refers to the ability of a product to meet or exceed its specifications.

4. The traditional view requires a product to conform to specifications that allow acceptable deviations from a target value. The robust view requires the product to meet the target value.

5. Quality costs are the costs incurred because poor quality may exist or poor quality does exist. Thus, they are incurred because of doing things wrong.

6. Prevention costs are incurred to prevent poor quality; appraisal costs are incurred to determine whether products are conforming to specifications; internal failure costs are incurred when nonconforming products are detected prior to shipment; external failure costs are incurred because nonconforming products are delivered to customers.

7. External failure costs can be the most devastating because of the warranty costs, lawsuits, and damage to the reputation of a company, all of which may greatly exceed the costs of rework or scrap incurred from internal failure costs.

8. Hidden quality costs are opportunity costs that are not recorded by the organization's accounting records. Lost sales due to poor quality is an example.

9. The three methods for estimating hidden quality costs are the multiplier method, the market research method, and the Taguchi quality loss function.

10. A quality cost report highlights quality costs, reveals their magnitude and their relative distribution among categories, and thus reveals the potential for improvement.

11. The AQL model assumes that it is cost-beneficial to produce a certain percentage of defective products. The zero-defects model assumes that producing any defective unit is more costly than preventing its production.

12. There are two key differences. First, the robust model tightens the definition of what is meant by a defective product—any product not meeting a target value. Second, the robust model assumes that it is very costly to vary from the target value, thus providing additional opportunity to decrease quality costs by improving quality.

13. Multiple-period trend analysis is used to track the effects of quality-improvement efforts by assessing the changes that occur over time.

14. Total productive efficiency is the point where technical and input trade-off efficiency are achieved. It is the point where the optimal quantity of inputs is used to produce a given output.

15. If the productivity ratio (output/input) has only one input, then it is a partial measure. If all inputs are included, then it is a total measure of productivity.

16. Partial measures can be misleading because they do not consider possible trade-offs among inputs. They do, however, allow some assessment of how well individual factors are being used and, additionally, often serve as input to total measures. Total measures are preferred because they provide a measure of the overall change in productivity and allow managers to assess trade-offs among inputs.

17. Productivity improvement must be measured with respect to a standard, generally the productivity of a prior period.

18. Profit-linked productivity measurement is an assessment of the amount of profit change, from the base period to the current period, attributable to productivity changes.

19. Profit-linked productivity measurement allows managers to assess the economic effects of productivity improvement programs. It also allows valuation of input trade-offs, a critical element in planning productivity changes.

20. The price-recovery component is the difference between the total profit change and the change attributable to productivity effects.

21. Yes. Even if there are zero defects, there are still ways of improving input-usage efficiency, for example, moving from departmental manufacturing to cellular manufacturing.

22. Productivity and quality both offer opportunities to decrease costs and become more efficient and thus more competitive.

23. Quality is concerned with ensuring that products are produced according to specifications, and productivity is concerned with producing the output efficiently. Quality can improve productivity, since improving quality generally means using less inputs and becoming more efficient. Productivity, however, can be improved without quality improvements.

24. Gainsharing is establishing financial incentives for productivity and quality performance targets. The idea is to share any quality and productivity gains with the employees who create them.

MULTIPLE-CHOICE EXERCISES

1. e
2. e
3. b
4. a
5. c
6. b
7. d
8. b
9. d
10. e
11. c
12. b
13. a
14. d

EXERCISES

Exercise 15

1. Internal failure
2. Appraisal
3. Internal failure
4. External failure
5. External failure
6. Prevention
7. Prevention
8. Appraisal
9. External failure
10. Internal failure
11. External failure
12. Appraisal
13. Prevention
14. Internal failure
15. External failure
16. Appraisal
17. External failure
18. Internal failure
19. Prevention
20. Appraisal
21. External failure
22. Prevention
23. Internal failure

Exercise 16

1. Multiplier method: 3 × \$15,000,000 = \$45,000,000

2. Taguchi: 10 × \$100 × 50,000 = \$50,000,000

Exercise 17

1.

Kellman Company
Quality Cost Report
For the Year Ended December 31, 2010

		Percentage of Quality Costs	Percentage of Sales
Prevention costs:			
Design review	\$150,000		
Quality training	40,000	\$ 190,000	3.17%
Appraisal costs:			
Materials inspection	\$ 60,000		
Process acceptance	0		
Product inspection	50,000	110,000	1.83
Internal failure costs:			
Reinspection	\$100,000		
Scrap	145,000	245,000	4.08
External failure costs:			
Recalls	\$200,000		
Lost sales	300,000		
Returned goods	155,000	655,000	10.92
Total quality costs		\$1,200,000	20.00%

Exercise 17 (Concluded)

Kellman Company
Quality Cost Report
For the Year Ended December 31, 2011

		Percentage of Quality Costs	Percentage of Sales
Prevention costs:			
Design review	$300,000		
Quality training	100,000	$ 400,000	6.67%
Appraisal costs:			
Materials inspection	$ 40,000		
Process acceptance	50,000		
Product inspection	30,000	120,000	2.00
Internal failure costs:			
Reinspection	$ 50,000		
Scrap	35,000	85,000	1.42
External failure costs:			
Recalls	$100,000		
Lost sales	200,000		
Returned goods	95,000	395,000	6.58
Total quality costs		$1,000,000	16.67%

The quality cost report communicates two major outcomes. First, the total quality costs as a percentage of sales is quite high (20 percent), indicating that there are significant opportunities to improve quality and reduce quality costs. Second, most of the quality costs are failure costs and more investment in control costs are needed.

2. (Percentages are rounded to two decimal places)

	Percentage of Total Quality Costs 2010	2011
Prevention	0.16	0.40
Appraisal	0.09	0.12
Internal failure	0.20	0.09
External failure	0.55	0.40

In 2010 the control costs are 25 percent and the failure costs are 75 percent of total quality costs. From 2010 to 2011, the company significantly increased its investment in control costs.

Exercise 18

1.

Diviney Company
Quality Cost Report
For the Year Ended December 31, 2010

		Quality Costs	Percentage of Sales
Prevention costs:			
Field trials	$ 450,000		
Quality training	120,000	$ 570,000	3.17%
Appraisal costs:			
Packaging inspection	$ 180,000		
Process acceptance	0		
Product inspection	150,000	330,000	1.83
Internal failure costs:			
Reinspection	$ 300,000		
Retesting	435,000	735,000	4.08
External failure costs:			
Recalls	$ 600,000		
Lost sales	900,000		
Complaint adjustment	465,000	1,965,000	10.92
Total quality costs		$ 3,600,000	20.00%

Exercise 18 (Concluded)

Diviney Company
Quality Cost Report
For the Year Ended December 31, 2011

		Quality Costs	Percentage of Sales
Prevention costs:			
Field trials	$ 900,000		
Quality training	300,000	$ 1,200,000	6.67%
Appraisal costs:			
Packaging inspection	$ 120,000		
Process acceptance	150,000		
Product inspection	90,000	360,000	2.00
Internal failure costs:			
Reinspection	$ 150,000		
Retesting	105,000	255,000	1.42
External failure costs:			
Recalls	$ 300,000		
Lost sales	600,000		
Complaint adjustment	285,000	1,185,000	6.58
Total quality costs		$ 3,000,000	16.67%

2. Additional investment = Increase in control costs
   Control costs increase = $1,560,000 – $900,000 = $660,000
   Failure costs reduction = $2,700,000 – $1,440,000 = $1,260,000
   A $1,260,000 benefit for a $660,000 investment is certainly sound!

3. (0.1667 – 0.025)$18,000,000 = $2,550,600

   The 2.5 percent goal is the level many quality experts identify as the one that companies should strive to obtain. The experiences of real-world companies such as Tennant Company show that it is an achievable goal. Also, although most Japanese companies do not track quality costs, some have measured their costs of quality and they generally tend to be less than 5 percent compared with the U.S. experience of 20 to 30 percent.

Exercise 19

1. **2004: $18,000,000/$72,000,000 = 0.25**
   2011: $2,250,000/$90,000,000 = 0.025

   Over a seven-year period, the quality costs-to-sales ratio improved from 25 percent to 2.5 percent. The 2.5 percent ratio is achievable as evidenced by the experiences of real-world companies [for example, Tennant Company reduced its costs-to-sales ratio from 17 percent to 2.5 percent over an eight-year period (1980 to 1988)].

2.

Internal failure:	**$5,400,000/$18,000,000**	**= 30%**
External failure:	**$7,200,000/$18,000,000**	**= 40%**
Appraisal:	**$3,240,000/$18,000,000**	**= 18%**
Preventive:	**$2,160,000/$18,000,000**	**= 12%**

   The percentage of quality costs spent on internal and external failures is too high. If costs are reduced to 2.5 percent, then the company is approaching the goal of zero defects. As the zero-defect level is approached, failure costs will approach zero, leaving the bulk of quality costs in the prevention and appraisal categories. Of these two categories, the prevention category would likely dominate.

3.

Internal failure:	**$270,000/$2,250,000**	**= 12%**
External failure:	**$180,000/$2,250,000**	**= 8%**
Appraisal:	**$675,000/$2,250,000**	**= 30%**
Preventive:	**$1,125,000/$2,250,000**	**= 50%**

   Quality costs are distributed better than in 2004. Control costs account for 80 percent of the total quality costs (versus only 30 percent in 2004). Failure costs have shrunk from 70 percent of the total in 2004 to only 20 percent in 2011. Moreover, total quality costs have shrunk from 25 percent of sales to 2.5 percent of sales. Costs in every category have been reduced. Failure costs are now only 0.5 percent of sales, which practice indicates is an empirical possibility. From an activity-based management perspective, further reductions are possible, at least in the failure categories. These are nonvalue-added costs and, in theory, can be reduced to zero.

Exercise 19 (Concluded)

4. **Gainsharing provides a strong incentive for managers to improve quality and reduce quality costs. Gainsharing is a good idea provided the incentive system is carefully designed. The bonus must be truly based on quality improvements. Quality gains, stemming from quality cost reductions, must flow from true quality improvements. Thus, there should be operational quality measures that provide evidence of actual quality improvements. One possibility is to base bonuses only on reductions in failure and appraisal categories. This provides an incentive for managers to invest in preventive activities—actions that should reduce "poor" quality costs.**

Exercise 20

1. **Only four of the activities should be implemented: quality training, process control, supplier evaluation, and engineering redesign. Each of these four activities reduces failure costs more than it costs to implement the activity (thus increasing the bonus pool). The cost reduction for failures is less than the amount spent for product inspection and prototype testing.**

Total quality costs:	
Current control	**$ 200,000**
Quality training	**200,000**
Process control	**250,000**
Supplier evaluation	**150,000**
Redesign	**50,000**
Failure costs	**230,000***
	$1,080,000

***$50,000 + ($900,000 – $820,000) + ($250,000 – $150,000) (adds back cost reductions of two activities not implemented)**

Exercise 20 (Concluded)

2. a. **Total quality costs were reduced by $920,000 ($2,000,000 – $1,080,000). Quality training increased costs by $200,000 but reduced failure costs by $500,000, for a net gain of $300,000. Process control increased costs by $250,000 but decreased failure costs by $400,000, for a net gain of $150,000. Supplier evaluation increased costs by $150,000 but decreased failure costs by $570,000, for a net gain of $420,000. Engineering redesign increased costs by $50,000 but decreased failure costs by $100,000, for a net gain of $50,000.**

   Total net gain:

$300,000
150,000
420,000
50,000
$920,000

   b. **Distribution percentage:**

   Control costs: $850,000/$1,080,000 = 79% (rounded)
   Failure costs: $230,000/$1,080,000 = 21% (rounded)

   c. **Bonus pool = 0.10 × $920,000 = $92,000**

3. **All of the same activities would be adopted plus prototype testing. Of the activities adopted, training, supplier evaluation, engineering redesign, and prototype testing are all prevention activities and so would not be counted in the cost reduction calculation. Failure costs would now be $130,000 (prototype addition reduces failure costs by an additional $100,000). The initial failure and appraisal costs are $2,000,000 ($1,800,000 + $200,000). The ending failure and appraisal costs are the sum of the current appraisal costs, ending failure costs, and the cost of adding process control: $200,000 + $130,000 + $250,000 = $580,000. Thus, the cost reductions counted for the bonus pool would be $1,420,000 ($2,000,000 – $580,000), and the bonus would be $142,000 (0.10 × $1,420,000). There is some merit to this approach as it encourages managers to invest in value-added activities and avoid the temptation of reducing prevention costs prematurely. It is possible, however, that some prevention activities are not really worth doing and this approach may lead to an over-investment in this category.**

Exercise 21

1. **Carbon Manufacturing**
Quality Cost Report
For the Year Ended December 31, 2011

		Quality Costs	Percentage of Sales
Prevention costs:			
Training program	$ 72,000		
Supplier evaluation	18,000	$ 90,000	1.5%
Appraisal costs:			
Test labor	$180,000		
Inspection labor	150,000	330,000	5.5
Internal failure costs:			
Scrap	$180,000		
Rework	240,000	420,000	7.0
External failure costs:			
Consumer complaints	$120,000		
Warranty	240,000	360,000	6.0
Total quality costs		$1,200,000	20.0%

2.

Prevention	7.5%	(0.015/0.20)
Appraisal	27.5%	(0.055/0.20)
Internal failure	35.0%	(0.07/0.20)
External failure	30.0%	(0.06/0.20)

Only 35 percent of the total costs are control costs. This suggests a need to push down failure costs by increasing control costs.

3. Hidden costs: $5 × 100,000 = $500,000. This changes the relative distribution to 24.7 percent control costs ($420,000/$1,700,000) and 75.3 percent failure costs ($1,280,000/$1,700,000). Adding the hidden costs to the total provides a greater incentive to invest in control costs to drive down the failure costs.

Exercise 22

1. **$L = k(Y - T)^2$**

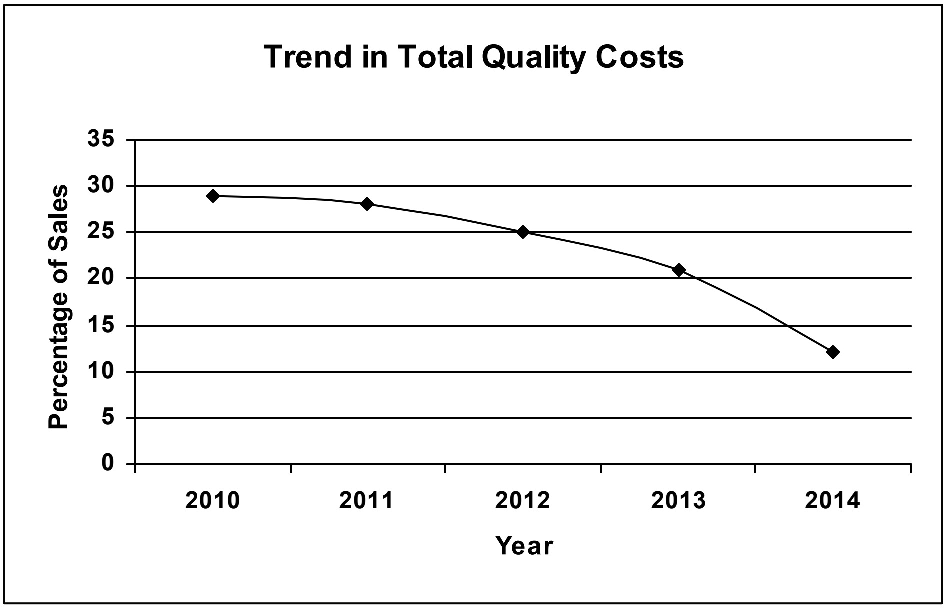
   where k = $120 and T = 32

Unit	Measured Weight	Y – T	$(Y - T)^2$	$k(Y - T)^2$
1	32.30	0.30	0.0900	$ 10.80
2	32.75	0.75	0.5625	67.50
3	32.45	0.45	0.2025	24.30
4	31.75	–0.25	0.0625	7.50
5	31.90	–0.10	0.0100	1.20
			0.9275	$ 111.30
Units			÷ 5	÷ 5
Average			0.1855	$ 22.26

2. **Hidden costs = $22.26 × 50,000 = $1,113,000**

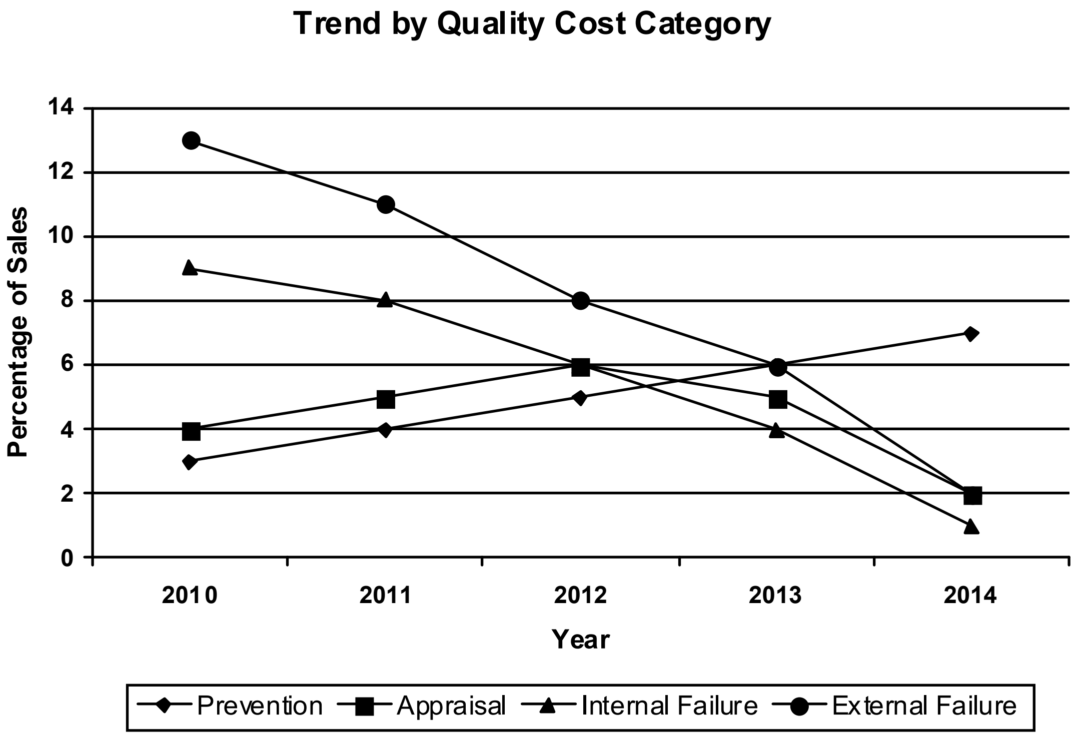
Exercise 23

1. **There has been a steady downward trend in quality costs expressed as a percentage of sales. Costs declined in the last year so it is possible to reduce costs more. Overall, the percentage has decreased from 29 percent to 12 percent, a significant improvement.**



Exercise 23 (Concluded)

2.



There have been significant reductions in internal and external failure costs. Prevention costs have increased, while appraisal costs have remained the same. The graph reveals the trend for each category of costs. It also reveals how management is changing the expenditure pattern for each category. In 2010, a greater percentage of sales was spent on external and internal costs than for appraisal and prevention costs. By contrast, in 2014, the amount spent on internal and external failures is less than the amount spent on appraisal and prevention. The strategy of shifting more resources to appraisal and prevention seems to have worked since total quality costs have dropped from 29 percent to 12 percent.

Exercise 24

1. **Output-input ratios:**

	2010	2011
Materials	**14,000/3,500 = 4.0**	**14,000/2,800 = 5.0**
Labor	**14,000/11,200 = 1.25**	**14,000/7,000 = 2.0**

Both materials and labor productivity improved and so overall productivity improved.

2. **For this scenario, the partial productivity ratio for labor is 1.00 (14,000/14,000) for 2011; thus, productivity went down for labor (from 1.25 to 1.00). In this case, materials productivity improved while labor productivity declined. The solution is to value the tradeoffs for the two inputs using the input prices:**

   Value of materials savings: (3,500 – 2,800)$8 = $5,600
   Cost of increased labor: (11,200 – 14,000)$10 = $(28,000)

Thus, the cost of inputs increased by $22,400 signaling an overall decline in productivity.

Exercise 25

1. **Output-input ratios (Combination A):**

   Energy: 400/200 = 2.00
   Labor: 400/800 = 0.50

   Yes, there is improvement. Current productivity is as follows:

   Energy: 400/320 = 1.25
   Labor: 400/1,280 = 0.31*

   Since 2 > 1.25 and 0.50 > 0.31, Combination A dominates the current input combination, and productivity would definitely improve.

Cost of current input combination:	**($18 × 320) + ($15 × 1,280)**	**=**	**$24,960**
Cost of input Combination A:	**($18 × 200) + ($15 × 800)**	**=**	**15,600**
Value of productivity improvement			**$ 9,360**

   This improvement is all attributable to technical efficiency. The same output is produced with proportionately less inputs (note that the inputs are in the same ratio, 1:4, and that Combination A reduces each input in the same proportion).

   ***Rounded**

Exercise 25 (Concluded)

2. **Output-input ratios (Combination B):**

   Energy: 400/320 = 1.25
   Labor: 400/500 = 0.80

   Compared to the current use, productivity is the same for energy and better for labor (1.25 = 1.25 and 0.80 > 0.31).

   Compared to Combination A, however, Combination B has lower productivity for energy (1.25 < 2.00) and higher productivity for labor (0.80 > 0.50). Trade-offs must be considered.

3. | | |
   |---|---|
   | **Cost of Combination B: ($18 × 320) + ($15 × 500) =** | **$ 13,260** |
   | **Cost of Combination A:** | **15,600** |
   | **Difference** | **$ (2,340)** |

   Combination B is a less costly input combination than A. Thus, less resources are used by B than A, and moving from A to B would be a productivity improvement (same output at a lower cost). This is an example of improving price (input trade-off) efficiency.

Exercise 26

1. **Partial operational productivity ratios:**

   2010 X: 96,000/12,000 = 8
   2010 Y: 96,000/24,000 = 4
   2011 X: 120,000/12,000 = 10
   2011 Y: 120,000/35,000 = 3.43

   Productivity improved for X but not for Input Y. We cannot say what happened to overall productivity using partial ratios because the signals are mixed.

2. **Profit-linked productivity measurement:**

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Input X	15,000	$ 30,000	12,000	$ 24,000	$ 6,000
Input Y	30,000	150,000	35,000	175,000	(25,000)
		$180,000		$199,000	$(19,000)

   ***Input X: 120,000/8 = 15,000; Input Y: 120,000/4 = 30,000**

   Profits decreased by $19,000 due to productivity changes.

3. **Price recovery = Total profit change – Productivity-induced change**

   Total profit change:
   [($2.50 × 120,000) – ($2 × 12,000) – ($5 × 35,000)] = $101,000
   [($2 × 96,000) – ($1 × 12,000) – ($4 × 24,000)] = 84,000
   $ 17,000

   Price recovery = $17,000 + $19,000
   = $36,000

   Price recovery is the profit change that would have been realized without any changes in productivity.

Exercise 27

1. Partial ratios:

	Base Year	Current Year
Materials	200,000/50,000 = 4	240,000/40,000 = 6.0
Labor	200,000/10,000 = 20	240,000/4,000 = 60.0
Capital	200,000/10,000 = 20	240,000/600,000 = 0.4

The increase in labor and materials productivity was caused by reducing labor and material usage by using more capital input.

2. Profit-linked measurement:

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	60,000	$120,000	40,000	$ 80,000	$ 40,000
Labor	12,000	60,000	4,000	20,000	40,000
Capital	12,000	1,800	600,000	90,000	(88,200)
		$181,800		$190,000	$ (8,200)

***240,000/4; 240,000/20; 240,000/20**

Profits decreased by $8,200 due to productivity changes. Assuming that this outcome will persist, the trade-off was not favorable, and automating was a poor decision.

Exercise 28

1. Partial operational productivity ratios:

	Status Quo[a]	Proposal A[b]	Proposal B[c]
Materials	0.56*	0.67*	0.60
Labor	1.25	1.50	2.00
Energy	2.50	3.00	3.00

[a]250,000/450,000; 250,000/200,000; 250,000/100,000

[b]300,000/450,000; 300,000/200,000; 300,000/100,000

[c]300,000/500,000; 300,000/150,000; 300,000/100,000

Both proposals improve technical efficiency because more output is produced per unit of input for all inputs. A recommendation cannot be made without valuing trade-offs.

*Rounded

2. Profit-linked productivity measurement:

Proposal A:

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	535,714	$4,285,712	450,000	$3,600,000	$ 685,712
Labor	240,000	2,400,000	200,000	2,000,000	400,000
Energy	120,000	240,000	100,000	200,000	40,000
		$6,925,712		$5,800,000	$1,125,712

Proposal B:

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	535,714	$4,285,712	500,000	$4,000,000	$ 285,712
Labor	240,000	2,400,000	150,000	1,500,000	900,000
Energy	120,000	240,000	100,000	200,000	40,000
		$6,925,712		$5,700,000	$1,225,712

*300,000/0.56; 300,000/1.25; 300,000/2.5

The analysis favors Proposal B. Price efficiency is concerned with valuing trade-offs. Once these trade-offs were valued, it became clear that Proposal B was better than Proposal A.

Exercise 29

1. Partial operational productivity ratios:

Without acquisition:
Materials: 10,000/40,000 = 0.25
Labor: 10,000/20,000 = 0.50

With acquisition:
Materials: 10,000/35,000 = 0.29*
Labor: 10,000/15,000 = 0.67*

Materials and labor productivity increase with the acquisition (as claimed by the production manager).

***Rounded**

2. To compare the alternatives, all inputs must be considered:

Partial operational productivity ratios:

	With	Without
Materials	0.29	0.25
Labor	0.67	0.50
Capital	0.10	0.50
Energy	0.40	1.00

The partial operational productivity ratios indicate a mixed outcome—some improve and some do not. Trade-offs, therefore, must be valued.

3. Profit-linked productivity measurement:

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	40,000	$160,000	35,000	$140,000	$ 20,000
Labor	20,000	180,000	15,000	135,000	45,000
Capital	20,000	2,000	100,000	10,000	(8,000)
Energy	10,000	25,000	25,000	62,500	(37,500)
		$367,000		$347,500	$ 19,500

***10,000/0.25; 10,000/0.50; 10,000/0.50; 10,000/1.0**

The trade-offs are favorable. The system will increase profitability by $19,500.

Exercise 30

1. **Partial operational productivity measures:**

	Base Year[a]	Current Year[b]
Materials	0.75	1.00
Labor	3.00	2.00

[a]150,000/200,000; 150,000/50,000

[b]180,000/180,000; 180,000/90,000

2. **Income statements:**

	Base Year	Current Year
Sales	$ 3,000,000	$ 3,600,000
Materials	(1,000,000)	(1,080,000)
Labor	(400,000)	(720,000)
Income	$ 1,600,000	$ 1,800,000

Change in income = $1,800,000 – $1,600,000
= $200,000

3. **Profit-linked productivity measurement:**

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	240,000	$1,440,000	180,000	$1,080,000	$ 360,000
Labor	60,000	480,000	90,000	720,000	(240,000)
		$1,920,000		$1,800,000	$ 120,000

*180,000/0.75; 180,000/3.00

Change attributable to productivity = $120,000

4. **Price-recovery component = $200,000 – $120,000**
= $80,000

In the absence of productivity changes, input costs would have increased by $520,000 ($1,920,000 – $1,400,000), and this increase would have been more than offset by the $600,000 increase in revenues, producing an $80,000 increase in profits. Price recovery is simply the amount by which profits will change without considering any productivity changes. The productivity improvement adds an additional $120,000 so that total profits increased by $200,000.

PROBLEMS

Problem 31

1. **Prevention**
2. **Internal failure**
3. **Internal failure**
4. **External failure**
5. **Prevention**
6. **Appraisal**
7. **Internal failure**
8. **Prevention**
9. **Prevention**
10. **Internal failure**
11. **External failure**
12. **Appraisal**
13. **Internal failure**
14. **Internal failure**
15. **Appraisal**
16. **Prevention**
17. **External failure**
18. **Appraisal**
19. **Prevention**
20. **Prevention**
21. **External failure**
22. **Appraisal**
23. **Appraisal**
24. **External failure**
25. **Appraisal**

Problem 32

1. **e**
2. **f**
3. **d**
4. **b**
5. **g**
6. **c**
7. **k**
8. **i**
9. **h**
10. **a**
11. **l**
12. **j**
13. **o**
14. **n**
15. **m**

Problem 33

1.

		Quality Costs	Percentage of Sales
Prevention costs:			
Quality training		$ 240,000	0.80%
Appraisal costs:			
Product inspection	$ 450,000		
Test equipment	360,000	810,000	2.70
Internal failure costs:			
Scrap	$1,350,000		
Rework	1,080,000	2,430,000	8.10
External failure costs:			
Repair	$ 630,000		
Order cancellation	750,000		
Customer complaints	300,000		
Sales allowances	375,000	2,055,000	6.85
Total quality costs		$5,535,000	18.45%

The president should be concerned because the quality cost ratio is 18.45 percent, and the quality costs are almost as large as income. Although the ratio is lower than the 20 to 30 percent range many companies apparently have (or had), there is still ample opportunity for improvement. In fact, if quality is improved to the point where quality costs are 2.5 percent of sales, total quality costs would be $750,000. Thus, improving quality offers a profit improvement potential of $4,785,000 ($5,535,000 – $750,000).

Problem 33 (Continued)

2. **Prevention: $240,000/5,535,000 = 4.4% (rounded up)**
   Appraisal: $810,000/5,535,000 = 14.6%
   Internal failure: $2,430,000/5,535,000 = 43.9%
   External failure: $2,055,000/5,535,000 = 37.1%

   It seems that 81 percent of the total quality costs are spent on failure costs. These costs are nonvalue-added costs and should eventually be eliminated (as eventually should appraisal costs, according to the results achieved). Prevention and appraisal activities should be given much more emphasis. If anything, experiences of real-world companies (e.g., Tennant and Westinghouse) indicate that the control costs should be 81 percent and the failure costs 19 percent. The distribution of quality costs needs to be reversed!

3. **The fundamental principle that needs to be understood and emphasized is that quality is essentially free. Quality costs exist because *poor* quality either exists or may exist. The key, therefore, to reducing quality costs is improving quality. The strategy advocated by the ASQC is directly attacking failure costs to drive them to zero. This is done by investing in control activities, particularly prevention activities, reducing appraisal costs as appropriate. It assumes that there is a root cause for each failure, that it is preventable, and that the costs of prevention are always less than failure. Activity management can play an important role in this effort. For Troy Company, activity selection and activity reduction are vital elements. More attention needs to be paid to control activities, especially prevention. More than quality training is needed. Other prevention activities like quality engineering, quality planning, design verification, and statistical process control could bring significant benefits. Initially, more may be spent as these activities are introduced to reduce the internal and external failure activities.**

Problem 33 (Concluded)

4. **Total costs of quality = 0.025 × $30,000,000 = $750,000**
   Control costs: 0.80 × $750,000 = $600,000
   Failure costs: 0.20 × $750,000 = $150,000

   Profit improvement = $4,785,000 ($5,535,000 – $750,000)

5. **Bonus pool = 0.20 × $4,785,000 = $957,000. Establishing a bonus pool allows employees to share in the gains from quality and thus provides an incentive to improve quality. Pay-for-performance plans, however, must be carefully designed. Paying for reductions in quality costs is OK provided the cost reductions actually are due to quality improvements. The suggestion by the quality manager addresses this very issue. By exempting prevention costs and paying only for reductions in nonvalue-added costs, the incentive is to invest in prevention activities and to reduce failure and appraisal activities. A good suggestion, but it carries with it the risk of overinvesting in prevention activities.**

6. **Actual external failure costs = 3 × $2,055,000 = $6,165,000. Other methods besides the multiplier approach are market research and the Taguchi quality loss function. Knowing the hidden failure costs provides additional justification for investing in prevention activities. The hidden costs strengthen the case for a vigorous quality improvement program. Including the costs in the bonus pool would perhaps strengthen the incentive to improve quality and also increase the awareness of how important quality is to customers. The downside is the fact that these costs are not directly observable and must be estimated each year. If included, total quality costs increase by $4,110,000 (6,165,000 – 2,055,000) (in the initial year). Since quality costs are reduced to $750,000, this means that the quality cost reductions also increase by $4,110,000. Thus, the bonus pool for the five-year period would be increased by $822,000 (0.20 × $4,110,000).**

Problem 34

1. **Lost contribution margin = \$8 × 100,000**
   = \$800,000 or \$200,000 per quarter

   Sales revenue per quarter = \$92 × 25,000
   = \$2,300,000

   Percent of sales needed to regain lost contribution margin:

   \$200,000/\$2,300,000 = 8.7%*

   At 1 percent gain per quarter, approximately 8.7 quarters would be needed, or a little over two years, to regain former profitability.

   ***Rounded**

2. **At the end of three years, quality costs will be reduced to 4 percent of sales, a reduction equal to 12 percent of sales. The savings are computed as follows:**

   Savings = 0.12 × \$9,200,000
   = \$1,104,000

   Increase in unit contribution margin = \$1,104,000/100,000
   = \$11.04

   Projected unit CM = \$11.04 + (\$92 – \$90) = \$13.04

   Projected total CM at \$92 price = \$13.04 × 100,000
   = \$1,304,000

   Price decreases:

   \$1.00: Total CM = \$12.04 × 110,000 = \$1,324,400
   \$2.00: Total CM = \$11.04 × 120,000 = \$1,324,800
   \$3.00: Total CM = \$10.04 × 130,000 = \$1,305,200

   Recommended decrease is from \$92 to \$90.

   Increase in contribution margin:

	\$1,324,800
	1,304,000
\$	**20,800**

Problem 34 (Concluded)

3. **From Requirement 2, we know that prices should be reduced, at least at the end of three years. To find the point where prices should first be reduced, we need to find the point where total contribution margin remains unchanged. Let X = CM/unit.**

   Current CM = 100,000X
   New CM = 110,000(X – $1)

   100,000X = 110,000(X – $1)
   10,000X = $110,000
   X = $11

   So, when the unit CM is greater than $11, the price should be reduced by $1.00. To find this point in time:

   Current CM = $92 – $90 = $2
   Gain needed = $11 – $2 = $9

   Annual CM needed = $900,000 ($9 × 100,000)
   Quarterly CM needed = $900,000/4 = $225,000
   Quarterly percent of sales needed = $225,000/$2,300,000
   = 9.8%*

   At 1 percent gain per quarter, it will take 9.8 quarters to gain $9.00 per unit. Thus, after 9.8 quarters, the price should be decreased by $1.00.

   ***Rounded**

4. **The difference is long-run versus short-run thinking. The marketing manager had a strategic orientation. The problem illustrates the value of cost information, and particularly quality cost information, in strategic decision making. In fact, it was the emphasis on total quality control and the identification of specific quality costs that drove the decision. It also implicitly emphasizes the importance of a quality cost control program. Once the decision is made, the need to reduce the costs as planned is critical. Interim and longer-range reports would be quite useful in controlling quality costs.**

Problem 35

1. **Break-even point = Fixed costs/CM ratio**
   = $72,000,000/0.2
   = $360,000,000

   Loss: 0.2 × ($360,000,000 – $300,000,000) = ($12,000,000)

2. **New fixed costs = $72,000,000 + $18,000,000 = $90,000,000**

   New variable cost ratio:

   Old variable costs = 0.8 × $300,000,000
   = $240,000,000

   New variable costs = $240,000,000 – $30,000,000
   = $210,000,000

   New variable cost ratio = $210,000,000/$300,000,000
   = 0.7

   New break-even point = $90,000,000/0.3
   = $300,000,000

   Mary Lou chose to spend more fixed costs on appraisal and prevention activities. This had the effect of reducing variable quality costs (failure costs) and lowering the variable cost ratio from 0.8 to 0.7. Although the change in one year was not dramatic, it did produce a break-even outcome for the division.

Problem 35 (Concluded)

3. New fixed costs = $72,000,000 – $19,200,000
= $52,800,000

New variable costs = $240,000,000 – $94,800,000
= $145,200,000

New variable cost ratio = $145,200,000/$300,000,000
= 0.484

New break-even point = $52,800,000/0.516
= $102,325,581

Yes, based on the experiences of numerous companies, quality costs can be reduced dramatically as quality improves. Reducing costs to 2.5 percent of sales with 80 percent of total quality costs belonging to the control categories has been done (e.g., consider Tennant and Westinghouse). Quality improvement offers significant opportunities to improve profitability.

4. 2011 cost structure:

Loss = 0.2($180,000,000 – $360,000,000)
= ($36,000,000)

2016 cost structure:

Profit = 0.516($180,000,000 – $102,325,581)
= $40,080,000

By improving quality, quality costs were reduced so that prices could be reduced in response to competitive forces—and still maintain profitability. Otherwise, the division might not have survived. Strategic cost analysis is an effort to use cost information to help companies gain a sustainable competitive advantage. Quality costing certainly offers this potential use. Managing quality costs is critical in today's competitive environment.

Problem 36

1. **Quality cost savings:**

Quarter 1:	**$ 50,000**	**(0.01 × $5,000,000)**
Quarter 2:	**100,000**	**(0.02 × $5,000,000)**
Quarter 3:	**150,000**	**(0.03 × $5,000,000)**
Quarter 4:	**250,000**	**(0.05 × $5,000,000)**
Total	**$550,000**	

At the beginning of the year, quality costs were 25 percent of sales. Thus, for the year, without any reduction, the total quality costs would have been $5,000,000 (0.25 × $20,000,000). The projected costs for the year 2011 would then be computed as follows:

Projected quality costs = $5,000,000 – $550,000
= $4,450,000

As a percent of sales: $4,450,000/$20,000,000 = 22.25%

Whether the company achieves its goal depends on the interpretation of the 22 percent benchmark. If it means 22 percent of 2011 sales, then Olson Company falls just short of that mark (22.25 percent). However, if it means from the end of 2011 on, then Olson exceeds the goal because quality costs are reduced to 20 percent of sales by the end of the fourth quarter. The 22.25 percent figure is an average figure for the year and does not represent the actual state at the end of the year.

Problem 36 (Concluded)

2.

	Quarter 1	Quarter 2
Prevention costs:		
Quality planning (F)	$ 40,000	$ 60,000
New product review (F)	10,000	10,000
Quality training (F)	30,000	70,000
Quality engineering (F)	0	40,000
Design verification (F)	0	20,000
Total prevention	$ 80,000	$ 200,000
Appraisal costs:		
Materials inspection (V)	$ 25,000	$ 50,000
Product acceptance (F)	125,000	150,000
Field inspection (F)	30,000	0
Process control measurement (F)	0	30,000
Total appraisal	$ 180,000	$ 230,000
Internal failure costs:		
Scrap (V)	$ 150,000	$ 125,000
Retesting (V)	50,000	40,000
Rework (V)	130,000	100,000
Downtime (F)	50,000	40,000
Total internal failure	$ 380,000	$ 305,000
External failure costs:		
Warranty (V)	$ 300,000	$ 250,000
Allowances (V)	65,000	50,000
Complaint adjustment (V)	60,000	20,000
Repairs (V)	50,000	35,000
Product liability (F)	85,000	60,000
Total external failure	$ 560,000	$ 415,000
Total quality costs	$1,200,000	$1,150,000

3. The budget indicates that Olson plans on significantly increasing its emphasis on control costs—especially prevention activities. From quarter 1 to quarter 2, prevention costs increase from 6.7* percent of the total to 17.4* percent of the total. Control costs increase from 21.7* percent of the total to 37.4* percent. Failure costs are expected to decrease from 78.3* percent of the total to 62.6* percent of the total.

*Rounded

Problem 37

1.

	Diapers	Napkins	Towels	Total
Prevention	0.9%	1.00%	1.63%	1.08%
Appraisal	0.8	1.17	1.63	1.08
Internal failure	1.8	1.08	1.63	1.55
External failure	1.5	0.75	1.63	1.30
Total	5.0%	4.00%	6.52%	5.01%

The company has achieved its goal as no more than 5 percent of sales was spent on quality (in total). Looking at individual products, the best outcome (napkins) seems to be where appraisal and prevention costs are nearly equal to failure costs, bearing out to some extent the view that the costs should be evenly distributed. Assuming that this even distribution is optimal, the total suggests that more should be spent on prevention and appraisal. Opportunities to do so are present in the diaper and towel lines.

2.

	Diapers	Napkins	Towels	Total
Prevention	1.8%	2.00%	3.25%	2.15%
Appraisal	1.6	2.33	3.25	2.15
Internal failure	3.6	2.17	3.25	3.10
External failure	3.0	1.50	3.25	2.60
Total	10.0%	8.00%	13.00%	10.00%

For this scenario, the goal of 5 percent is far from being reached. If the idea of balancing costs by category is true, then further reductions can be achieved by shifting more resources into prevention and appraisal activities. Of the three lines, the diaper line is one where more resources should be spent on prevention and appraisal activities. Shifting more resources into these two activities has the potential to reduce the percentage for the diaper line to 5 percent or below. Shifting more resources into prevention for towels and napkins would not create balanced categories. It appears difficult to achieve the overall 5 percent goal by balancing category costs. The above results may suggest that the even distribution suggestion of the production manager may not be the optimal combination. Perhaps even more emphasis should be placed on prevention and appraisal.

Problem 37 (Concluded)

3.

	Diapers	Napkins	Towels	Total
Prevention	1.8%	3.33%	2.03%	2.15%
Appraisal	1.6	3.89	2.03	2.15
Internal failure	3.6	3.61	2.03	3.10
External failure	3.0	2.50	2.03	2.60
Total	10.0%	13.33%	8.12%	10.00%

This scenario also suggests that more resources need to be spent on prevention and appraisal activities. However, the resources should be concentrated on the diaper and paper towel lines.

4. **If quality costs are reported by segment, a manager will know where to concentrate efforts for cost reduction.**

Problem 38

1.

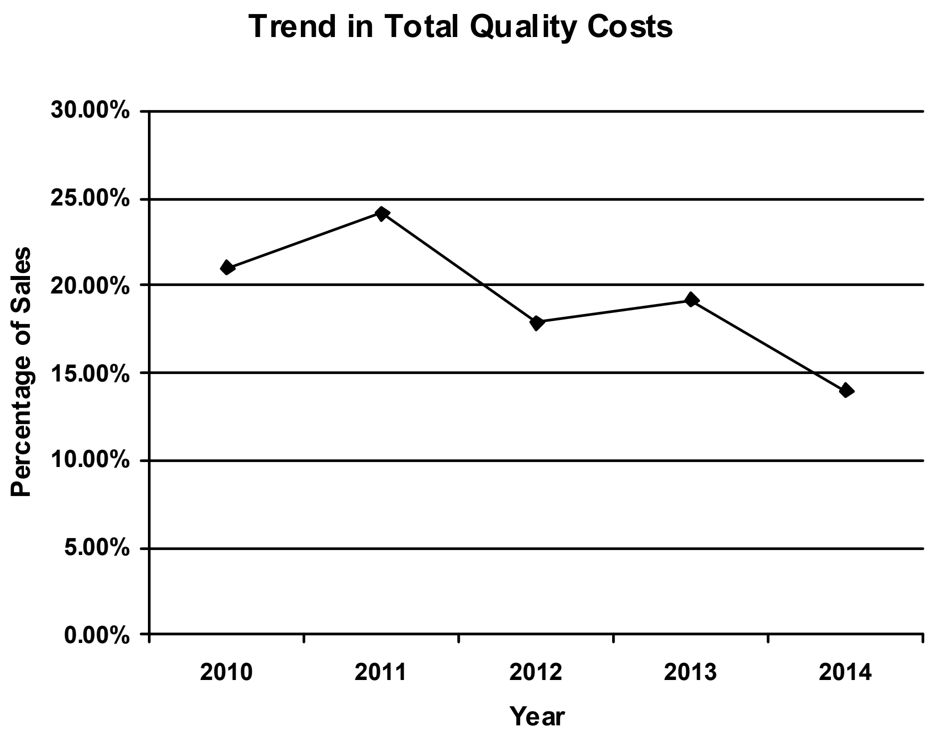
	Prevention	Appraisal	Internal Failure	External Failure	Total
2010	1.00%	2.00%	8.00%	10.00%	21.00%
2011	2.50*	3.33*	8.33*	10.00	24.16*
2012	4.29*	3.57*	4.29*	5.71*	17.86*
2013	5.83*	5.83*	3.33*	4.17*	19.16*
2014	7.00	3.00	1.60	2.40	14.00

*Rounded

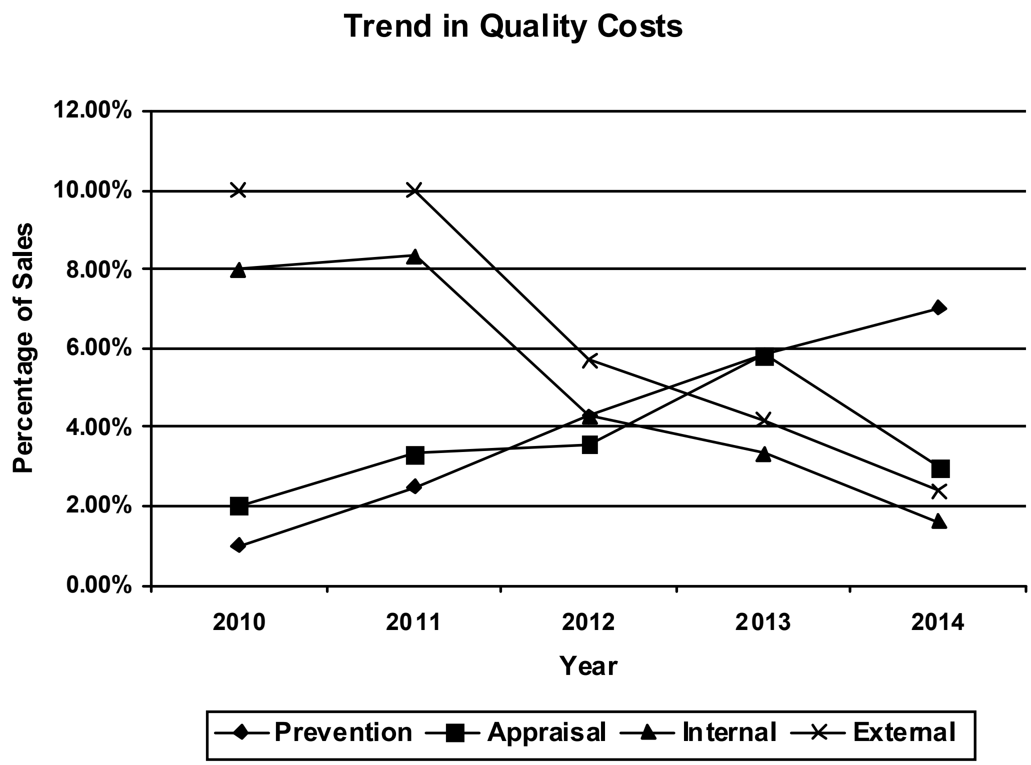
2. **Prevention and appraisal costs increase when a company implements a quality program to reduce failure costs. It may take at least a year before failure costs decline because workers need to be trained, products may need to be redesigned, and so on.**

Problem 38 (Continued)

3.



Problem 38 (Concluded)



Yes, quality costs overall have dropped from 21 percent of sales to 14 percent of sales, a significant improvement. Real evidence for quality improvement stems from the fact that internal failure costs have gone from 8 percent to 1.6 percent and external failure costs from 10 percent to 2.4 percent. This reduction of failure costs has been achieved by putting more resources into prevention (from 1 percent to 7 percent) and appraisal (2 percent to 3 percent).

Problem 39

1.

	Materials[a]	Labor[b]
2010	0.50	2.0
2011	0.60	2.4

[a]300,000/600,000; 360,000/600,000

[b]300,000/150,000; 360,000/150,000

Materials and labor productivity have increased.

2. Profit-linked productivity measurement (dollars in thousands):

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	720,000	$15,840	600,000	$13,200	$2,640
Labor	180,000	2,700	150,000	2,250	450
		$18,540		$15,450	$3,090

*360,000/0.5; 360,000/2

Increase in profits due to productivity = $3,090,000
Net of bonus: $3,090,000 – $309,000 = $2,781,000

3. Price-recovery component:

Total profit change:

2011:	Revenues ($80 × 360,000)	$ 28,800,000
	Materials ($22 × 600,000)	(13,200,000)
	Labor ($15 × 150,000)	(2,250,000)
	Profit	$ 13,350,000
2010:	Revenues ($80 × 300,000)	$ 24,000,000
	Materials ($20 × 600,000)	(12,000,000)
	Labor ($13 × 150,000)	(1,950,000)
	Profit	$ 10,050,000

Total profit change = $13,350,000 – $10,050,000
= $3,300,000

Price-recovery component = $3,300,000 – $3,090,000
= $210,000

Without the productivity improvement, profits would have increased by $210,000. The increase in sales would have recovered the increase in the cost of inputs.

Problem 40

1.

		Cost	Ratios* Materials	Labor
a.	2010	(17,600 × $40) + (16,000 × $10) = $864,000	0.455	0.50
b.	2011	(9,600 × $40) + (50,000 × $10) = $884,000	0.833	0.16
c.	Optimal	(8,000 × $40) + (32,000 × $10) = $640,000	1.000	0.25

*Output/Input = 8,000/17,600; 8,000/16,000 for 2010; 8,000/9,600; 8,000/50,000 for 2011; 8,000/8,000; 8,000/32,000 for optimal.

Materials productivity improved, and labor productivity declined. The trade-off would need to be valued to assess whether overall productivity improved.

2. $864,000 – $640,000 = $224,000

3. $864,000 – $884,000 = $(20,000)

4. $884,000 – $640,000 = $244,000

Problem 41

1. **Partial operational productivity ratios:**

	2010[a]	2011[b]
Materials	4.00	5.00
Labor	1.00	2.50
Capital	0.10	0.05
Energy	4.00	1.67

[a]400,000/100,000; 400,000/400,000; 400,000/4,000,000; 400,000/100,000

[b]500,000/100,000; 500,000/200,000; 500,000/10,000,000; 500,000/300,000

Since the ratio changes are mixed, no statement on overall productivity improvement can be made. Valuation of the trade-offs is needed.

2. **Profit-linked productivity measurement (numbers in thousands):**

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	125	$ 375	100	$ 300	$ 75
Labor	500	5,000	200	2,000	3,000
Capital	5,000	500	10,000	1,000	(500)
Energy	125	250	300	600	(350)
		$6,125		$3,900	$2,225

*500,000/4; 500,000/1; 500,000/0.10; 500,000/4

Productivity-induced profit change: $2,225,000 increase

3. **2010 per-unit input cost = $4,200,000/400,000**
= $10.50

2011 per-unit input cost = $3,900,000/500,000
= $7.80

Yes, the per-unit cost has been reduced by $2.70. The division's continued existence was brought about by improving productivity. Productive improvements can be used to maintain competitive ability by reducing the cost of producing. They also may permit a company to achieve a sustainable competitive advantage and ensure its long-term survival. Thus, productivity is an important competitive tool—one essential for survival.

Problem 42

1. **Shop-floor workers relate well to operational measures. They are expressed in terms they can understand. Also, they are easily measured and tracked. Charts can be visibly posted that track the performance of the measures over time. Finally, the measures are usually available on a more timely basis—they can be computed and reported daily.**

2. **Profit-linked productivity measurement, materials and labor:**

	PQ[a]	PQ × P	AQ[b]	AQ × P	(PQ × P) – (AQ × P)
Materials	4,000	$20,000	3,333	$16,665	$ 3,335
Labor	2,000	20,000	2,500	25,000	(5,000)
		$40,000		$41,665	$(1,665)

[a]Batch size is constant; so, PQ is the inputs used in the first batch.

[b]10,000/3; 10,000/4

Profits will drop by $1,665.

3. **Profit-linked measurement, three inputs:**

	PQ	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	4,000	$20,000	3,333	$16,665	$ 3,335
Labor	2,000	20,000	2,500	25,000	(5,000)
Quality	20	20,000	5	5,000	15,000
		$60,000		$46,665	$13,335

Profits now increase by $13,335. Operational measures are limited; a firm also needs a comprehensive, integrated productivity system. Viewing quality as an input is useful.

Problem 43

1. **Partial operational measures of productivity:**

	Current Setting	Setting A	Setting B
Materials	0.40	1.00	0.50
Equipment	1.67	1.00	2.00

Setting B signals a productivity improvement for both inputs.

Problem 43 (Concluded)

2. Income statements:

	Setting A	Setting B
Sales revenues ($40 × 15,000)	$ 600,000	$ 600,000
Cost of inputs:		
Materials:		
($12 × 15,000)	(180,000)	
($12 × 30,000)		(360,000)
Machine hours:		
($12 × 15,000)	(180,000)	
($12 × 7,500)		(90,000)
Net income	$ 240,000	$ 150,000

Setting A provides the greatest increase.

3. Profit-linked productivity measurement (measured relative to current setting):

***Setting A*:**

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	37,500	$450,000	15,000	$180,000	$270,000
Equipment	8,982	107,784	15,000	180,000	(72,216)
		$557,784		$360,000	$197,784

***Setting B*:**

	PQ*	PQ × P	AQ	AQ × P	(PQ × P) – (AQ × P)
Materials	37,500	$450,000	30,000	$360,000	$ 90,000
Equipment	8,982	107,784	7,500	90,000	17,784
		$557,784		$450,000	$107,784

***15,000/0.40; 15,000/1.67**

Setting A offers the greatest improvement, greater by $90,000. Setting A is better because the productivity gain for materials offsets the loss for equipment by more than the combined productivity gains of Setting B. This illustrates a different kind of trade-off—one that is concerned with the relative magnitude of productivity gains.

CASES

Case 44

1.

Nickles Company
Performance Report: Quality Costs
For the Year Ended December 31, 2014

	Actual Costs	Budgeted Costs	Variance	
Prevention costs:				
Fixed:				
Quality planning	$ 150,000	$ 150,000	$ 0	
Quality training	20,000	20,000	0	
Special project	100,000	80,000	20,000	U
Quality reporting	12,000	10,000	2,000	U
Total prevention	$ 282,000	$ 260,000	$22,000	U
Appraisal costs:				
Variable:				
Proofreading	$ 520,000	$ 500,000	$20,000	U
Other inspection	60,000	50,000	10,000	U
Total appraisal	$ 580,000	$ 550,000	$30,000	U
Failure costs:				
Variable:				
Correction of typos	$ 165,000	$ 150,000	$15,000	U
Rework	76,000	75,000	1,000	U
Plate revisions	58,000	55,000	3,000	U
Press downtime	102,000	100,000	2,000	U
Waste	136,000	130,000	6,000	U
Total failure	$ 537,000	$ 510,000	$27,000	U
Total quality costs	$1,399,000	$1,320,000	$79,000	U

The firm failed across the board to meet its budgeted goals for the year. All categories and each item were greater than the budgeted amounts.

Case 44 (Continued)

2.

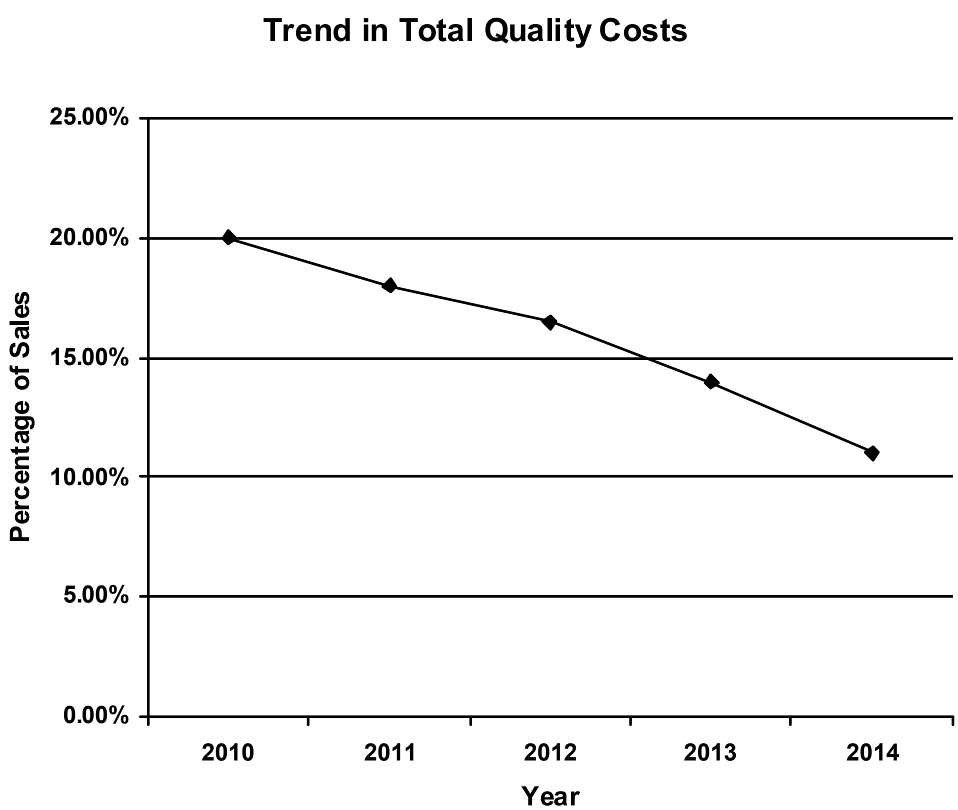
Performance Report: Quality Costs
One-Year Trend
Nickles Company
For the Year Ended December 31, 2014

	Actual Costs 2014	Actual Costs 2013	Variance	
Prevention costs:				
Fixed:				
Quality planning	$ 150,000	$ 140,000	$ 10,000	U
Quality training	20,000	20,000	0	
Special project	100,000	120,000	20,000	F
Quality reporting	12,000	12,000	0	
Total prevention	$ 282,000	$ 292,000	$ 10,000	F
Appraisal costs:				
Variable:				
Proofreading	$ 520,000	$ 580,000	$ 60,000	F
Other inspection	60,000	80,000	20,000	F
Total appraisal	$ 580,000	$ 660,000	$ 80,000	F
Failure costs:				
Variable:				
Correction of typos	$ 165,000	$ 200,000	$ 35,000	F
Rework	76,000	131,000	55,000	F
Plate revisions	58,000	83,000	25,000	F
Press downtime	102,000	123,000	21,000	F
Waste	136,000	191,000	55,000	F
Total failure	$ 537,000	$ 728,000	$191,000	F
Total quality costs	$1,399,000	$1,680,000	$281,000	F

Profits increased $281,000 because of the reduction in quality costs from 2013 to 2014. Thus, even though the budgeted reductions for the year were not met, there was still significant improvement. Moreover, most of the improvement came from reduction of failure costs, a positive signal indicating that quality is indeed increasing.

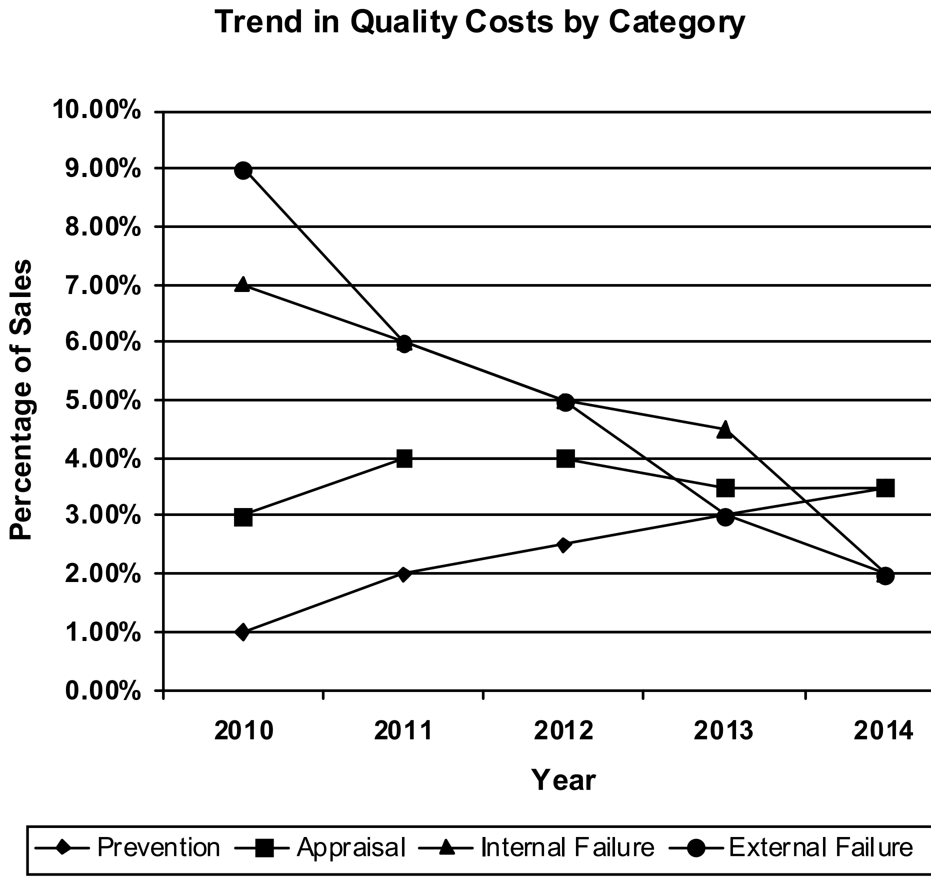
Case 44 (Continued)

3.



Case 44 (Concluded)

4. **Increases in prevention and appraisal costs with simultaneous reductions in failure costs are good signals that overall quality is increasing (decreases in external failure costs are particularly hard to achieve without quality actually increasing).**



Case 45

1. **Matt should know that the reward is intended for those who legitimately achieve the budgeted productivity goals. Both actions taken by Matt were manipulative in nature—their objective simply to massage the performance statistic so that he could receive his bonus. Since Matt's bonus is achieved simultaneously with that of his employees, there is some question whether he really had their interest in mind or simply his own. The behavior exhibited by Matt is not ethical. The heart of ethical behavior is sacrificing one's self-interest for the well-being of others. By engaging in manipulative behavior, Matt is damaging the reputation of the company and providing poor services and products to customers. Matt should have stressed the importance of achieving the productivity goals by continuing to strive for the current year's goal by improving quality. If the goal is not achieved this year, then the lack of financial reward should be an additional incentive for better performance for the coming year.**

2. **First and foremost, the company should attempt to hire individuals with integrity. Second, the company should make sure that the performance and reward system is fair and acceptable to managers and employees. Perhaps the company could provide a percentage of the savings from quality improvements rather than making it an all-or-nothing bonus based on achieving some predetermined target. Finally, the company should have in place a good monitoring system to discourage the type of behavior Matt is exhibiting (e.g., a good internal audit program).**

3. **Matt has violated the ethical code as he has a responsibility to "refrain from engaging in any activity that would prejudice his abilities to carry out his duties ethically" (III-2) and to "refrain from either actively or passively subverting the attainment of the organization's legitimate and ethical objectives" (III-4).**