

## The Support Team

### Need Help? You've Got It.

#### A LIVE SUPPORT TEAM IS AVAILABLE TO ASSIST YOU

We're your support team. We've played the simulation in a class similar to yours. So we can help explain the simulation in ways you truly will understand.

If you need assistance, please submit a support ticket.

#### SUPPORT TICKETS:

Login at [www.capsim.com](http://www.capsim.com)  
Click on Capstone<sup>®</sup>,  
and then select  
Help > Support  
in the left menu.

Support tickets are reviewed Monday-Friday, and on most weekends and holidays.

If you have problems registering, send an email to:  
[support@capsim.com](mailto:support@capsim.com)

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# 1 INTRODUCTION

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Congratulations, you are now in charge of a sensor manufacturing company. Your company was formed when a former monopoly was broken up into identical competitors.

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What are sensors? Cameras, biometric devices, and labs-on-a-chip are all sensors. New sensor businesses are being created today in arenas as diverse as genetics, power generation, and satellites. The most relevant point from your perspective is that your sensors are incorporated into your customer's products. You are in a business-to-business market, not a direct-to-consumer market.

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## 1.1 TIME FOR A SHAKEUP

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Although last year's financial results were decent, your products are getting old, your marketing efforts are falling short, your production lines need revamping and your financial management is almost nonexistent. You and your management team must correct these problems.

## 1.2 THE CAPSTONE® COURIER

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The Capstone Courier is an industry report that has key information about your company and your competitors. The Courier will help you find opportunities and identify your competitors' strengths and weaknesses.

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The Courier displays "Last Year's Results." For example, the Courier available at the start of Round 2 will display the results for Round 1. The Courier available at the start of Round 1 displays Last Year's Results for Round 0, when all companies have equal standing. As the simulation progresses and strategies are implemented, results among the competing companies will begin to vary.

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The Courier is available from two locations:

- On the website, login to your simulation then click the Reports link;
- From the Capstone Spreadsheet (available from the website's Downloads area), click Courier in the menu bar.

## 1.3 PROFORMAS & ANNUAL REPORTS

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Proformas and annual reports both include a balance sheet, cash flow statement and income statement. What is the difference between proformas and annual reports? Proformas are *projections* of the upcoming year. Annual reports are the *results* from the previous year. The proformas and annual reports will help you identify efficiencies and weaknesses within your company.

To access proformas, click the proformas menu in the Capstone Spreadsheet; to access the annual reports, click the Courier menu in the Capstone Spreadsheet or, on the website, login to your simulation and then click the Reports link.

## 1.4 DECISION OVERVIEW

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You need to coordinate strategy and tactics across all functional areas of your company:

- Research & Development or R&D
- Marketing
- Production
- Finance

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Your simulation might also include Human Resources, TQM (Total Quality Management)/Sustainability, Labor Negotiation and Advanced Marketing modules. On the website, your simulation Dashboard will tell you if modules are scheduled.

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### 1.4.1 RESEARCH & DEVELOPMENT (R&D)

R&D is responsible for inventing new sensors and re-engineering old ones. R&D determines each sensor's physical characteristics:

- Size (The sensor's dimensions; there is a trend towards miniaturization.)
- Performance (The sensor's speed and sensitivity; there is a trend towards improvement.)
- MTBF (Mean Time Before Failure; the sensor's expected life span, measured in hours.)

R&D decisions affect the perceived age of your sensors. Revising a sensor's size and/or performance makes the market view it as a newer product. R&D decisions affect the material cost of your sensors. Decreasing size, increasing performance and increasing MTBF increase the cost of material.

The length of time required to revise a sensor varies. Slight revisions can complete in three or four months; more comprehensive projects, two or three years. The longer the project, the greater the expense: a six-month project costs \$500,000; a 12-month project costs \$1,000,000.

R&D invents sensors by assigning a name, performance, size and MTBF. Inventing a sensor always takes more than a year. Your new sensor cannot be built without an assembly line, and new assembly lines take one full year to install. If you invent a sensor, you must coordinate with Production to time the delivery of your design with the delivery of your assembly line.

The number of simultaneous projects affects the time required for each project to complete. As you add projects, dates can slip. Be sure to check the revision dates of all your projects.

### 1.4.2 MARKETING

For each sensor model, the Marketing Department sets a:

- Price
- Promotion Budget (Promotion budgets create awareness; 100% awareness means every customer knows about your sensor.)
- Sales Budget (Sales budgets build accessibility via salespeople and distribution systems; 100% accessibility means every customer can easily interact with your company.)
- Sales Forecast (Forecasts are used by Production and Finance.)

At the beginning of the simulation, each sensor is intended for a primary group of customers, also known as a market segment. Demand and growth rates for each segment vary. Marketing determines a sales forecast by assessing last year's sales, the segment's growth rate and the characteristics of the sensor versus its competitors'.

### 1.4.3 PRODUCTION

For each sensor, your Production Department:

- Schedules the number of sensors to manufacture based on Marketing's sales forecasts, while also considering unsold units from the previous year (inventory);
- Changes capacity and automation on existing assembly lines;
- Adds assembly lines to manufacture new sensors.

Every assembly line has a first shift capacity. First shift capacity is the number of units that can be produced each year with a daily eight hour shift. If your production schedule exceeds the amount that can be built on first shift, work is scheduled on a second shift. Second shift labor costs are 50% higher than the first shift, but adding a second shift saves the expense of adding capacity and increases the asset utilization of the assembly line.

Every assembly line has an automation rating. A line with low automation has more workers and therefore higher labor costs. A line with high automation has fewer workers and lower labor costs, but increasing automation is expensive. Also, R&D revisions for sensors with higher automation take longer to complete because more machines have to be retooled.

Purchases of capacity and automation for new and existing sensors take a full year to implement. Sale of capacity is immediate. Selling all of a sensor's capacity discontinues the sensor— it is no longer available for sale.

### 1.4.4 FINANCE

Your Finance Department makes sure all company activities are funded. While it is possible to fund activities entirely from operations, it is unlikely to happen in the early years. The company will need to turn to the capital markets. The company has three outside sources of money:

- Stock Issues
- Current Debt (These are one year bank notes.)
- Bonds (These are 10 year notes.)

Other Finance Department activities include:

- Issuing Dividends (Reduces retained earnings and increases leverage.)

- Retiring Stock (The company can buy back stock to reduce shares outstanding.)
- Retiring Bonds (The company can retire bonds before they come due.)
- Determining accounts payable and accounts receivable policies

If the company runs out of money during the year, emergency loans are issued by a lender of last resort, affectionately known as Big AI. Big AI will automatically keep the company afloat with a loan for the needed amount. Big AI charges a 7.5% penalty in addition to the company's current debt rate. Emergency loans convert to current debt at the beginning of the following year. Emergency loans will lower your stock price.

### 1.4.5 INTER-DEPARTMENT COORDINATION

#### R&D AND MARKETING

Your R&D Department works with Marketing to make sure your product line meets customer expectations.

#### R&D AND PRODUCTION

R&D works with Production to ensure assembly lines are purchased for new sensor models. If Production discontinues a sensor, it should notify R&D. Production and R&D also discuss automation increases and their impact on revision dates.

#### MARKETING AND PRODUCTION

Your Marketing Department works with Production to make sure manufacturing runs are in line with forecasts. Marketing's market growth projections also help Production determine appropriate levels of capacity. If Marketing decides to discontinue a sensor model, it tells Production to sell all of that sensor's capacity.

#### MARKETING AND FINANCE

Marketing works with Finance to project revenues for each sensor model (price multiplied by forecast).

#### FINANCE AND PRODUCTION

Production tells Finance it needs money for additional capacity and automation. If Finance cannot raise enough money through stock, bonds and working capital, it can tell Production to scale back its requests, or perhaps sell idle capacity.

#### FINANCE AND ALL DEPARTMENTS

The Finance Department acts as a watchdog over company expenditures. Its job is to make sure the company does not run out of money. Finance should review Production's decisions. Is Production manufacturing too many or too few sensors? Does it need additional capacity? Has Production considered labor cost versus automation purchases? Finance should crosscheck Marketing's forecasts and pricing. Are forecasts too high or too low? Is pricing correct for the targeted segment?

Finance can determine a range of possible outcomes for the year by changing (but not saving) Marketing's forecasts then checking the proformas. Lowering the forecasts will decrease revenue and increase inventory (worst case); raising the forecasts will increase revenue and decrease inventory (best case).

## 1.5 The Rehearsal Simulation

Finance can print the worst case and best case proformas then compare them to the annual reports after the round advances.

### 1.5 THE REHEARSAL SIMULATION

The Rehearsal Simulation teaches decision entries for R&D, Marketing, Production and Finance. The Rehearsal is an individual tutorial that you can review before joining a company. The Rehearsal Simulation Spreadsheet is available from the website's Downloads area.

### 1.6 THE CAPSTONE® SPREADSHEET

You will use the Capstone Spreadsheet to enter departmental decisions and review proformas for each round of the simulation. The Capstone Spreadsheet is available from the website's Downloads area.

#### 1.6.1 PRACTICE ROUNDS

The Practice Rounds allow you to organize workflow among the members of your team and practice making departmental decisions.

Some classes ask individuals to run companies on their own.

In Practice Rounds, you will begin to compete against the other companies in your simulation, or, if you are in a Footrace competition, against a common set of computer-run companies.

#### 1.6.2 COMPETITION ROUNDS

After the conclusion of the Practice Rounds, the simulation is reset and the Competition begins. Companies compete for up to eight rounds, with each round simulating one year in the life of a company.

### 1.7 COMPANY SUCCESS

Your company selected you and your fellow managers because of your strategic vision and tactical skills. The company expects you to make it a market leader. Successful managers will:

- Create a strategy;
- Coordinate company activities;
- Analyze the market and its competing products.

Careful study of the rest of this guide can help greatly with these efforts. Best of luck with running your company!

## 2 THE SENSOR INDUSTRY

Your customers fall into five groups which are called market segments. A market segment is a group of customers who have similar needs. The segments are named for the customer's primary requirements, and are called:

- Traditional
- Low End
- High End
- Performance
- Size

At the beginning of the simulation, Traditional and Low End make up more than two thirds of the unit sales (Figure 2.1).

However, the Traditional and Low End growth rates trail the growth rates for High End, Performance and Size (Table 2.1). By year five, High End, Performance and Size will command a greater percentage of the overall market (Figure 2.2).

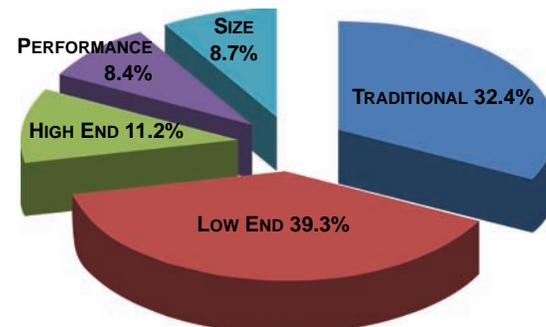


Figure 2.1 Beginning Market Segment Percentages: At the beginning of the simulation, Traditional and Low End account for 71.7% of the units sold to the market.

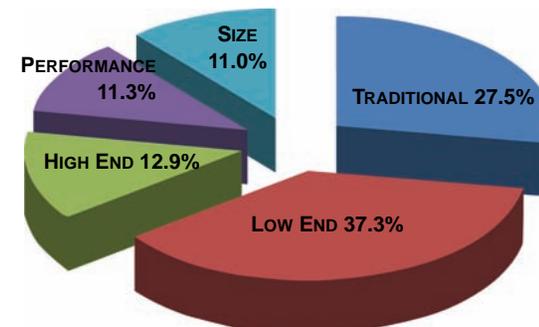


Figure 2.2 Market Segment Percentages in Year 5: Because they grow at a slower rate (Table 2.1), Traditional and Low End now make up only 64.8% of the unit sales (assumes supply for every segment exceeds demand).

Table 2.1 Segment Growth Rates

Traditional	9.2%
Low End	11.7%
High End	16.2%
Performance	19.8%
Size	18.3%

Note that unit sales versus dollar sales also affect the analysis. Although smaller in unit sales, the Performance, Size and High End segments command a higher price.

## 2.1 BUYING CRITERIA

Customers within each market segment employ different standards as they evaluate sensors. They consider four buying criteria: Price, age, MTBF (reliability), and positioning.

### 2.1.1 PRICE

Each segment has different price expectations. For example, Low End customers seek inexpensive sensors while High End customers, who need premium products, are willing to pay higher prices.

### 2.1.2 AGE

Each segment has different age expectations, that is, the length of time since the sensor was invented or revised. High End customers want brand new technology while Traditional customers prefer technology that has been in the market for a few years.

### 2.1.3 MTBF (MEAN TIME BEFORE FAILURE) OR RELIABILITY

Each segment has different reliability or MTBF (Mean Time Before Failure) criteria. MTBF predicts the number of hours a sensor is expected to operate before it fails. Performance customers are extremely interested in high MTBFs while Low End customers are satisfied with lower MTBFs.

## 2.1.4 POSITIONING

Sensors vary in their dimensions (size) and the speed/sensitivity with which they respond to changes in physical conditions (performance). Combining size and performance creates a product attribute called positioning.

### THE PERCEPTUAL MAP

Positioning is such an important concept that marketers developed a tool to track the position of their products and those of their competitors. This tool is called a Perceptual Map. Note the Perceptual Map in Figure 2.3. You will see this map quite often through the course of the simulation. The map measures size on the vertical axis and performance on the horizontal axis. The arrow points to a sensor with a performance of 8 and a size of 12.

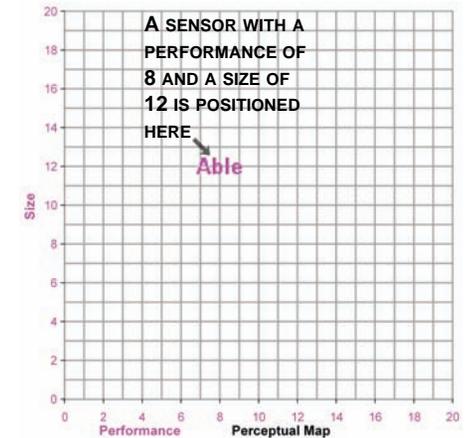


Figure 2.3 The Perceptual Map Used in the Simulation: The Perceptual Map plots sensor size and performance characteristics.

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Research & Development controls the performance and size, and therefore the positioning of your sensor products.

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### A REAL-WORLD PERCEPTUAL MAP: AUTOMOBILE EXTENDED WARRANTIES

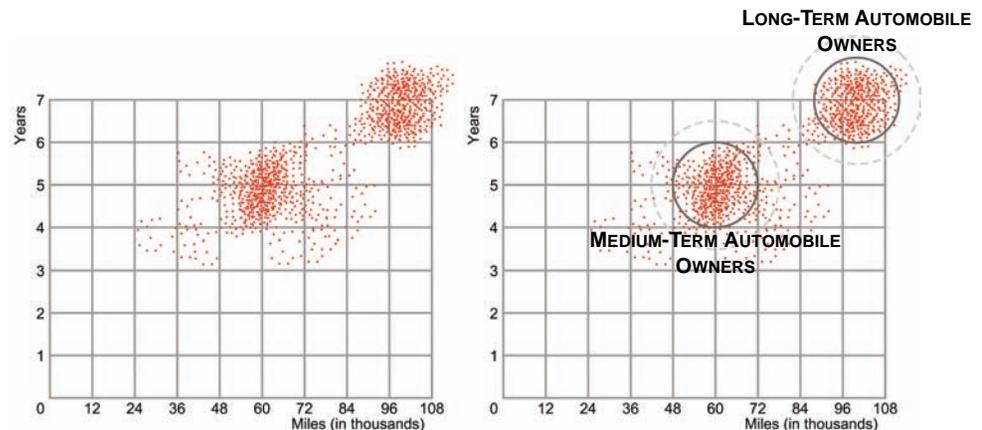
Perceptual Maps can be used to plot any two product characteristics. For example, marketers of extended car warranties could plot years and miles (axes in the figures to the left). The dots in the first figure represent survey results. Each dot indicates the age and mileage on a car when it was traded in or sold.

#### IDENTIFYING MARKET SEGMENTS

As they review these dots, the marketers would note two distinct clusters; the first positioned near the 5 year/60,000 mile area and the second positioned near the 7 year/100,000 mile area. The clusters indicate strong customer interest near those year/mile positions.

Marketers could then label these clusters as market segments. They could call the segment positioned near the 5 year/60,000 mile cluster Medium-Term Owners, and the segment positioned near the 7 year/100,000 mile cluster Long-Term Owners (second figure).

The simulation uses a similar positioning method to name its market segments.



## 2.2 Buying Criteria By Segment

### MARKET SEGMENT POSITIONS ON THE PERCEPTUAL MAP

Each market segment has a different positioning preference. Therefore, each segment demands sensors that are positioned in different parts of the map. Low End customers want slow performing products that are large in size. They want products that fall inside the set of circles to the upper left in Figure 2.4. High End customers want products that are fast performing and small in size. They want products that fall within the set of circles to the lower right.

Over time, your customers will want products that are smaller and faster. This causes the segments to move or *drift* a little each month. As the years progress, the drift becomes significant. Figure 2.5 shows the location of the market segments at the end of the fourth year; Figure 2.6, at the end of the eighth.

High End, Performance and Size customers demand greater product improvement than Traditional and Low End customers. Therefore, the High End, Performance and Size market segments drift at a faster rate. As time goes on, the overlap between the segments is less and less.

Market segments will not move faster to catch up with sensors that are better than their expectations. High End customers will refuse to buy a product to the lower right of the circles. Customers are only interested in products that fall within the circles on the Perceptual Map!

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There are zero customers interested in products positioned outside of the dashed circles.

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Your R&D and Marketing Departments have to make sure your sensors keep up with changing customer positioning requirements. To do this, R&D must reposition sensors, keeping them within the moving segment circles. See 4.1 Research & Development (R&D) on page 11 for more information.

## 2.2 BUYING CRITERIA BY SEGMENT

Buyers in each segment place a different emphasis upon the four buying criteria. For example, Low End customers are most interested in price, while High End customers are most interested in positioning.

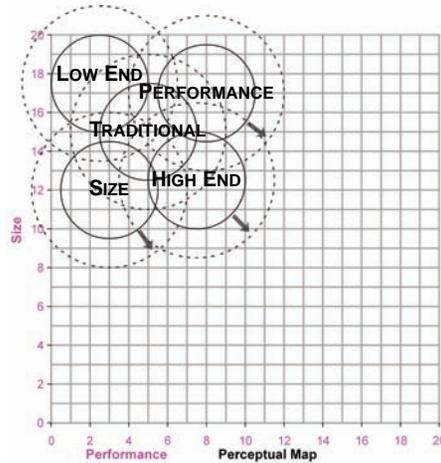


Figure 2.4 Beginning Segment Positions: As the years progress, the segments will move or *drift* apart at different speeds toward the lower right.

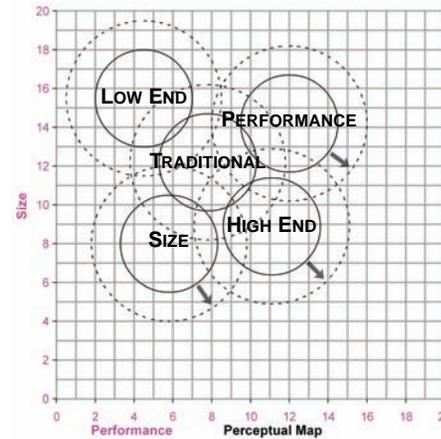


Figure 2.5 Segment Positions at the End of Year 4: Segment overlap decreases.

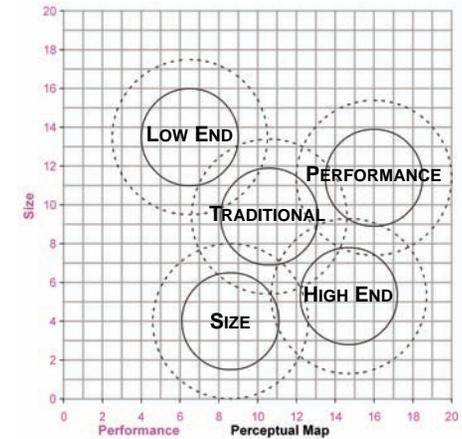


Figure 2.6 Segment Positions at the End of Year 8: Very little overlap remains.

Positioning and price criteria change each year (see 2.1.4 Positioning, and 3.1.2 Pricing). Age and MTBF criteria remain the same year after year.

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Buying Criteria for the previous year are reported in the Capstone® Courier's Segment Analyses pages.

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As you take over the company to make decisions for Round 1, your reports reflect customer expectations as of December 31, Round 0 (yesterday). Here are the buying criteria customers expected at the end of last year:

### 2.2.1 TRADITIONAL SEGMENT BUYING CRITERIA (ROUND 0)

Traditional customers seek proven products at a modest price.

- Age, 2 years– importance: 47%
- Price, \$20.00-\$30.00– importance: 23%
- Ideal Position, performance 5.0 size 15.0– importance: 21%
- MTBF, 14,000-19,000– importance: 9%

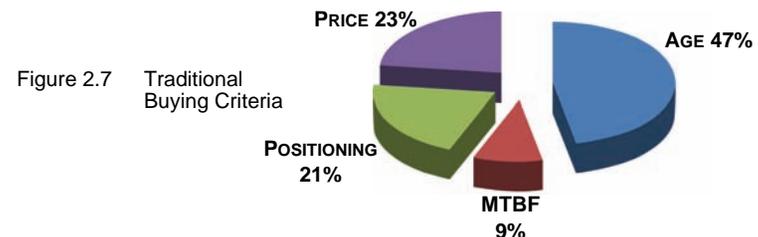


Figure 2.7 Traditional Buying Criteria

### 2.2.2 LOW END SEGMENT BUYING CRITERIA (ROUND 0)

Low End customers seek low prices and well proven products.

- Price, \$15.00-\$25.00– importance: 53%
- Age, 7 years– importance: 24%
- Ideal Position, performance 1.7 size 18.3– importance: 16%
- MTBF, 12,000-17,000– importance: 7%

Figure 2.8 Low End Buying Criteria

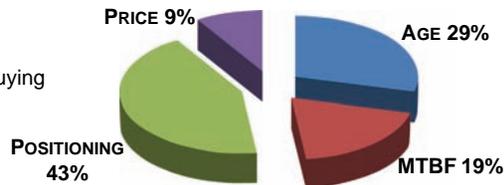


### 2.2.3 HIGH END SEGMENT BUYING CRITERIA (ROUND 0)

High End customers seek cutting-edge technology in size/performance and new designs.

- Ideal Position, performance 8.9 size 11.1– importance: 43%
- Age, 0 years– importance: 29%
- MTBF, 20,000-25,000– importance: 19%
- Price, \$30.00-\$40.00– importance: 9%

Figure 2.9 High End Buying Criteria

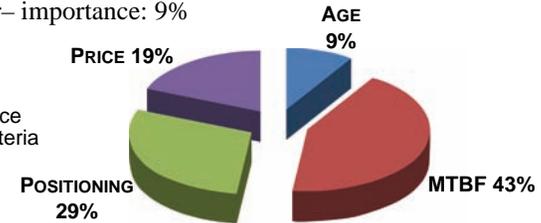


### 2.2.4 PERFORMANCE SEGMENT BUYING CRITERIA (ROUND 0)

Performance customers seek high reliability and cutting edge performance technology.

- MTBF, 22,000-27,000– importance: 43%
- Ideal Position, performance 9.4 size 16.0– importance: 29%
- Price, \$25.00-\$35.00– importance: 19%
- Age, 1 year– importance: 9%

Figure 2.10 Performance Buying Criteria

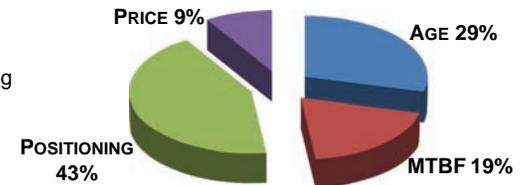


### 2.2.5 SIZE SEGMENT BUYING CRITERIA (ROUND 0)

Size customers seek cutting edge size technology and younger designs.

- Ideal Position, performance 4.0 size 10.6– importance: 43%
- Age, 1.5 years– importance: 29%
- MTBF, 16,000-21,000– importance: 19%
- Price, \$25.00-\$35.00– importance: 9%

Figure 2.11 Size Buying Criteria



## 3 THE CUSTOMER SURVEY SCORE

In any month, a sensor’s demand is driven by its monthly customer survey score. Assuming it does not run out of inventory, a sensor with a higher score will outsell a sensor with a lower score.

Customer survey scores are calculated 12 times a year. The December customer survey scores are reported in the Capstone® Courier’s Segment Analyses pages.

A customer survey score reflects how well a sensor meets its segment’s buying criteria. Company promotion, sales and accounts receivable policies also affect the survey score.

Scores are calculated once each month because a sensor’s age and positioning change a little each month. If during the year a sensor is revised by Research and Development, the sensor’s age, positioning and MTBF characteristics can change

quite a bit. As a result, it is possible for a sensor with a very good December customer survey score to have had a much poorer score – and therefore poorer sales – in the months prior to an R&D revision.

Prices, set by Marketing at the beginning of the year, will not change during the year.

### 3.1 BUYING CRITERIA AND THE CUSTOMER SURVEY SCORE

The customer survey starts by evaluating each sensor against its segment’s buying criteria. Next, these assessments are weighted by the criteria’s level of importance. For example, in the High End segment the importance of positioning is 43%, but in the Low End segment the importance of positioning is only 16%. This means a well-positioned product in the High End will have a greater overall impact on its survey score than a well-positioned product in the Low End (see 3.2 Estimating the Customer Survey Score on page 10).

### 3.1 Buying Criteria and the Customer Survey Score

A perfect customer survey score of 100 requires that the sensor: Be positioned at the ideal spot (the segment drifts each month, so this can occur only one month per year if at all); be priced at the bottom of the expected range; have the ideal age for that segment (unless they are revised, products grow older each month, so this can occur only one month per year if at all); and have an MTBF specification at the top of the expected range.

Your customers want perfection, but it is impractical to have a perfect sensor, and the more “perfect” the product, the higher its costs. Your task is to give customers great products while still making a profit. Your competitors face the same dilemma.

#### 3.1.1 POSITIONING SCORE

Conceptually, a segment is defined by customers saying, “I want this (whatever ‘this’ is), but within limits.” It is vital for marketers to understand both what the customers want and their boundaries. The Perceptual Map captures these ideas with circles. Each segment is described with a dashed outer circle, a solid inner circle, and a dot we call the “ideal spot.”

The dashed outer circle defines the outer limit of the segment. Customers are saying, “I will NOT purchase a product outside this boundary.” We call the dashed circle “the rough cut circle” because any product beyond it “fails the rough cut” and is dropped from consideration. However, that does not mean customers are delighted. A product near the outer limit is badly positioned.

The solid inner circle defines the heart of the segment. Customers want products in the heart of segment. We call the solid circle “the fine cut” because products within it “make the fine cut.”

The “ideal spot” is that point in the heart of the segment where, all other things being equal, demand is highest.

In Figure 3.1 we call the orange boundary areas “the rough cut area.” The green areas represent “the fine cut area.” The black dots are the ideal spots.

The segment is moving across the Perceptual Map a little each month. In a perfect world your product would be positioned in front of the ideal spot in January, on top of the ideal spot in June, and trail the ideal spot in December. In December it would complete an R&D project to jump in front of the ideal spot for next year.

#### POSITIONING IN THE ROUGH CUT AREA

What happens to products that plot in the rough cut area? These products are badly positioned. Customers will consider them, but they are at a significant disadvantage to products inside the fine cut circle.

Specifically, sensors inside the rough cut have reduced customer survey scores. Their customer survey score drops in a linear fashion. Just beyond the fine cut circle the score drops 1%. Halfway between the fine and rough cut circles the score drops 50%. The customer survey score drops 99% for products that are just inside the rough cut circle.

Sensors that are about to enter the orange areas can be revised by Research & Development (see 4.1.1 Changing Performance, Size and MTBF on page 12).

The location of each segment’s rough cut circle as of December 31 of the previous year appears on page 11 of the Courier (see Perceptual Map on page 20).

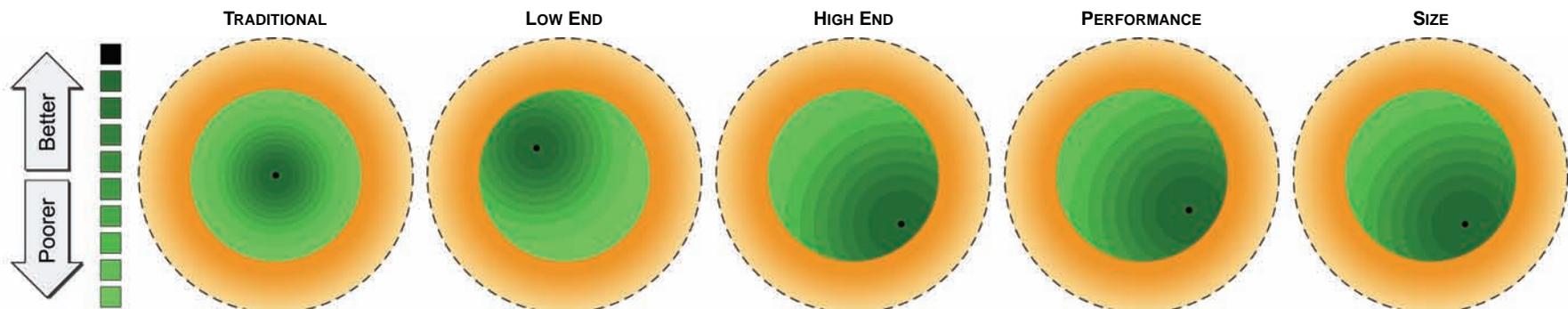


Figure 3.1 Positioning Scores: Traditional customers give higher position scores to sensors located in the center of the segment circle. Low End customers prefer sensors with slower performance and larger size. High End customers demand cutting edge sensors with high performance and small size. As their names imply, Performance customers emphasize performance over size, and Size customers size over performance.

The orange areas represent the segment rough cuts, where scores rapidly decrease towards 0.

**POSITIONING INSIDE THE FINE CUT**

Products that plot within 2.5 units of the center of the segment are inside the green, fine cut circles. Ideal spots for each segment are illustrated by the black dots. Exact ideal spot locations relative to the segment centers can be found in Table 8.3 on page 28.

Customers in the high technology segments (High End, Performance and Size) want cutting-edge sensors. The ideal spots for these segments are located towards the leading edge of the circles, where size is smaller and performance is faster. Positioning is important in these segments. Participants often ask, “Why are the ideal spots ahead of the segment centers?” The segments are moving. From a customer’s perspective, if they buy a sensor at the ideal spot, it will still be a high tech sensor when it wears out. For contrast, if they buy a sensor at the trailing edge, it will not be inside the segment when it wears out.

Low technology customers (Traditional and Low End) are less concerned about positioning. They want proven technology at a lower price. As a consequence their ideal spots trail in the segment, where costs are lower and ages are higher.

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A sensor’s positioning score changes each month because segments and ideal spots drift a little each month. Placing a sensor in the path of the ideal spot will return the greatest benefit though the course of a year. See 2.1.4 Positioning on page 5 and 8.1 Perceptual Map on page 27 for more information.

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**3.1.2 PRICING**

Every segment has a \$10.00 price range. For example, in the year prior to Round 1 (Round 0), Low End customers expected to pay \$15.00 to \$25.00 for a sensor, well below the \$30.00 to \$40.00 range expected by High End customers. Segment price expectations correlate with the segment’s position on the Perceptual Map. Segments that demand higher performance and smaller sizes are willing to pay higher prices.

Price ranges in all segments drop \$0.50 per year. In Round 1 the Low End price range will be \$14.50 to \$24.50. In Round 2 it will be \$14.00 to \$24.00.

**PRICE ROUGH CUT**

Sensors priced \$5.00 above or below the segment guidelines will not be considered for purchase. Those sensors fail the price rough cut.

Sensors priced \$1.00 above or below the segment guidelines lose about 20% of their customer survey score. Sensors continue to lose approximately 20% of their customer

survey score for each dollar above or below the guideline, on up to \$4.99, where the score is reduced by approximately 99%. At \$5.00 outside the range, demand for the product is zero.

**PRICE FINE CUT**

Within each segment’s price range, price scores follow a classic economic demand curve: As price goes down, the price score goes up (Figure 3.2).



Figure 3.2 Classic Price/Demand Curve: As price drops demand (price score) rises.

**3.1.3 MTBF SCORE**

Each segment sets a 5,000 hour range for MTBF (Mean Time Before Failure), the number of hours a sensor is expected to operate before it malfunctions.

**MTBF ROUGH CUT**

Demand scores fall rapidly for sensors with MTBFs beneath the segment’s guidelines. Sensors with an MTBF 1,000 hours below the segment guideline lose 20% of their customer survey score. Sensors continue to lose approximately 20% of their customer survey score for every 1,000 hours below the guideline, on down to 4,999 hours, where the customer survey score is reduced by approximately 99%. At 5,000 hours below the range, demand for the product falls to zero.

**MTBF FINE CUT**

Within the segment’s MTBF range, the customer survey score improves as MTBF increases. However, material costs increase \$0.30 for every additional 1000 hours of reliability. Customers ignore reliability above the expected range– demand plateaus at the top of the range.

### 3.2 Estimating the Customer Survey Score

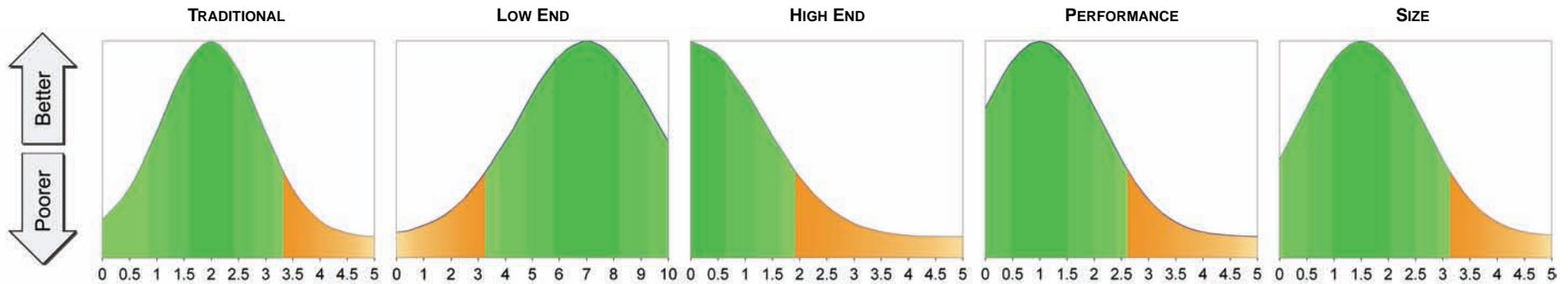


Figure 3.3 Age Scores: Traditional customers give higher scores to sensors in the 2 year range; Low End customers give higher scores to sensors in the 7 year range; High End customers give higher scores to newer sensors; Performance customers want sensors in the 1 year range; Size customers prefer sensors in the 1.5 year range.

#### 3.1.4 AGE SCORE

The age criteria does not have a rough cut; a sensor will never be too young or too old to be considered for purchase.

Customers in the high technology segments (High End, Performance and Size) prefer newer products. The ideal ages for these segments range from zero (brand new) to one and a half years. Low technology customers (Traditional and Low End) prefer proven technology. The Low End ideal age is seven years. Low End customers have less interest in newer sensors, which would require redesigns of their products.

Each month, customers assess a sensor's age and award an age score based upon their preferences. For example, Traditional customers prefer sensors that are two years old. Age preferences are illustrated in Figure 3.3.

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Traditional, High End, Performance and Size sensors with ages in the orange areas can be revised by Research & Development (see 4.1.4 A Sensor's Age on page 13).

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### 3.2 ESTIMATING THE CUSTOMER SURVEY SCORE

The customer survey score drives demand for your product in a segment. Your demand in any given month is your score divided by the sum of the scores. (For example, if your product's score in April is 20, and your competitors' scores are 27, 19, 21, and 3, then your product's April demand is  $20/(20+27+19+21+3) = 22\%$  of the segment.)

What generates the score itself? Marketers speak of "the 4 P's" – price, product, promo and place. Price and product are found in the buying criteria. Together they present a price-value relationship. Your promotion budget builds "awareness," the number of customers who know about your product before shopping. Your sales budget (place) builds "accessibility," the ease with which customers can work with you after they begin shopping. To the 4 P's we can add two additional elements–

credit terms and availability. Credit terms are expressed by your accounts receivable policy. Availability addresses inventory shortages.

To estimate the customer survey score, begin with the buying criteria. A perfect product scores 100. For example, a perfect Traditional product in December of Round 0 would have an age of 2.0 years, a price of \$20.00, positioning at the ideal spot (5,15), and reliability of 19,000 hours.

Observe that the Traditional customer weights the criteria at: Age 47%, Price 23%, Positioning 21%, and Reliability 9%. We can convert these into points. For Traditional customers, price is worth 23 points. The perfect Round 0 price of \$20.00 gets 23 points, but at the opposite end of the price range, a \$30.00 price would get only 1 point. Therefore, we can use the figures that describe the buying criteria in Chapters 2 and 3 to estimate a base score for our product.

However, our base score can fall because of poor awareness, accessibility, or credit terms. Product shortages and stock outs also affect results.

#### 3.2.1 ACCOUNTS RECEIVABLE

A company's accounts receivable policy sets the amount of time customers have to pay for their purchases. At 120 days, there is no reduction in the customer survey score. At 60 days, the score is reduced 1.5%. At 30 days the score is reduced 8%. Offering no credit terms (0 days) reduces the score by 35%.

#### 3.2.2 AWARENESS

Awareness is built over time by the product's promotion budget. Promotion budgets are put towards advertising and public relations campaigns.

Suppose your sensor has not been promoted for many years while a competitor has aggressively promoted its sensor. Your awareness is 0%, their awareness is 100%. If you and your competitor's sensors are otherwise identical, your sensor's survey score will be half the score of the competitor's.

A product with 0% awareness loses half its base score. At 50% awareness, it loses 25% of its base score. At 100% awareness it keeps its entire base score. Mathematically this expresses itself as:  $(1 + \text{awareness})/2 * \text{base score}$ .

A product with 0% awareness does not have 0% demand. Consider a world where all products had 0% awareness. Customers need sensors. They would search until they found products that met their criteria. But in this world, suppose a mediocre product had 100% awareness. It would have a significant advantage against similar products. Awareness, then, affects the competitive rivalry. It reduces search costs for customers, and increases costs for vendors.

### 3.2.3 ACCESSIBILITY

Accessibility is built over time by the product's sales budget. Sales budgets are put towards salespeople and distribution systems.

For estimating the impact upon the customer survey score, accessibility works like awareness. However, the processes for building awareness and accessibility are quite different (see 4.2 Marketing): Awareness is concerned with "before the sale;" accessibility is concerned with "during and after the sale."

A product with 0% accessibility loses half its base score. At 50% accessibility, it loses 25% of its base score. At 100% accessibility it keeps its entire base score. Mathematically this expresses itself as  $(1 + \text{accessibility})/2 * \text{base score}$ .

Like awareness, 0% accessibility does not imply zero sales. The arguments parallel those presented for awareness. Accessibility affects the competitive rivalry. It reduces acquisition costs for customers, and increases costs for vendors.

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If the TQM/Sustainability module is enabled, some initiatives can increase the customer survey score. See 7.2 TQM/Sustainability on page 24.

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## 3.3 STOCK OUTS AND SELLER'S MARKET

What happens when a product generates high demand but stocks out? The unmet demand is divided between the remaining products in proportion to their customer survey scores. This could happen in any month. To assist with diagnosing stock outs and their impacts, see the Market Share Report on page 10 of the Capstone® Courier.

Usually, a sensor with a low customer survey score has low sales. However, if a segment's demand exceeds the supply of sensors available for sale, a seller's market

emerges. In a seller's market, customers will accept low scoring products as long as they fall within the segment's rough cut limits. For example, desperate customers with no better alternatives will buy:

- A product positioned just inside the rough cut circle on the Perceptual Map—outside the circle they say "no" to the product;
- A product priced \$4.99 above the price range— at \$5.00 customers reach their tolerance limit and refuse to buy the product;
- A product with an MTBF 4,999 hours below the range— at 5,000 hours below the range customers refuse to buy the product.

Watch out for three common tactical mistakes in a seller's market:

1. After completing a capacity analysis, a team decides that industry demand exceeds supply. They price their product \$4.99 above last round's published price range, forgetting that price ranges fall by \$0.50 each round. Demand for the product becomes zero. They should have priced \$4.49 above last year's range.
2. A team disregards products that are in the positioning rough cut. These products normally can be ignored because they have low customer survey scores. However when the team increases the price, the customer survey score falls below the products in the rough cut areas, which are suddenly more attractive than their product.
3. The team fails to add capacity for the next round. Typically a seller's market appears because a competitor exits the segment unexpectedly. This creates a windfall opportunity for the remaining competitors. However it is easy to demonstrate that a team should always have enough capacity (including second shift production) to meet the demand from its own customers (consider the question, "What happens to price if every competitor has just enough capacity to meet its own demand?").

---

How can you be sure of a seller's market? You can't, unless you are certain that industry capacity, including a second shift, cannot meet demand for the segment. In that case even very poor products will stock out as customers search for anything that will meet their needs.

See 8.2 Industry Demand Analysis and 8.3 Capacity Analysis to learn more about demand and capacity.

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## 4 OPERATIONS

Every company starts the simulation with five sensors. Your company has one sensor for each segment. You have one assembly line per sensor. Sensors can be terminated or added. Your company must have at least one sensor and cannot have more than eight. Your decisions, made every year on January 1, are carried out by your employees throughout the year.

### 4.1 RESEARCH & DEVELOPMENT (R&D)

The Research & Development (R&D) Department invents new sensors and changes specifications for existing sensors. Changing size and/or performance repositions a sensor on the Perceptual Map (see page 5). Improving performance and shrinking size moves the sensor towards the lower right on the map.

## 4.1 Research & Development (R&D)

Your R&D decisions are fundamental to your Marketing and Production plans. In Marketing, R&D addresses:

- The positioning of each sensor inside a market segment on the Perceptual Map
- The number of sensors in each segment
- The age of your sensors
- The reliability (MTBF rating) of each sensor

In Production, R&D affects or is affected by:

- The cost of material
- The purchase of new facilities to build new sensors
- Automation levels (The higher the automation level, the longer it takes to complete an R&D project.)

All R&D projects begin on January 1. If a sensor does not have a project already underway, you can launch a new project for that sensor. However, if a project begun in a previous year has not finished by December 31 of last year, you will not be able to launch a new project for that sensor (the decision entry cells in the R&D area of the Capstone® Spreadsheet will be locked).

### 4.1.1 CHANGING PERFORMANCE, SIZE AND MTBF

A repositioning project moves an existing sensor from one location on the Perceptual Map to a new location, generally (but not always) down and to the right. Repositioning requires a new size attribute and/or a new performance attribute. To keep up with segment drift, a sensor must be made smaller (that is, decrease its size) and better performing (that is, increase its performance).

Positioning affects material costs (Figure 4.1). The more advanced the positioning, the higher the cost. At the beginning of the simulation, the trailing edge of the Low End fine cut has the lowest cost, at \$1.00; the leading edge of the High End fine cut has the highest cost, at \$10.00.

The reliability rating, or MTBF, for existing sensors can be adjusted up or down. Each 1,000 hours of reliability (MTBF) adds \$0.30 to the material cost. A sensor with 20,000 hours reliability includes \$6.00 in reliability costs ( $\$0.30 * 20,000 / 1,000 = \$6.00$ ).

Improving positioning and reliability will make a sensor more appealing to

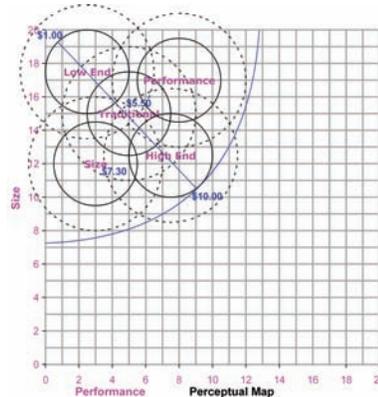


Figure 4.1 Material Positioning Costs: Material positioning costs vary depending on the sensor's relative location on the Perceptual Map. Sensors placed at the trailing edge of the Low End segment have a positioning component cost of \$1.00; sensors placed at the leading edge of the High End segment have a positioning component cost of \$10.00. Positioning component cost locations for a Traditional product (\$5.50) and a Size product (\$7.30) are also illustrated.

customers but doing so increases material cost. See 8.4.1 Margin Potential on page 31.

Material costs displayed in the spreadsheet and reports are the combined positioning and MTBF costs.

### 4.1.2 INVENTING SENSORS

New sensors are assigned a name (click in the first cell that reads NA in the name column), performance, size and MTBF. Of course, these specifications should conform to the criteria of the intended market segment. The name of all new sensors must have the same first letter of the company name.

The Production Department must order production capacity to build the new sensor one year in advance. Invention projects take at least one year to complete.

All new sensors require capacity and automation, which should be purchased by the Production Department in the year prior to the sensor's revision (release) date. If you don't buy the assembly line the year prior to its introduction, you cannot manufacture your new sensor! See 4.3.1 Capacity on page 15.

It is not possible to produce sensors prior to the revision date. A new sensor with a revision date of July 1 will be produced in the second half of the year. The capacity and automation will stand idle for the first half of the year.

### 4.1.3 PROJECT MANAGEMENT

Segment circles on the Perceptual Map move at speeds ranging from 0.7 to 1.3 units each year. You must plan to move your sensors (or retire them) as the simulation progresses. Generally, the longer the move on the Perceptual Map, the longer it takes the R&D Department to complete the project.

Project lengths can be as short as three months, or as long as three years. Project lengths will increase when the company puts two or more sensors into R&D at the same time. When this happens each R&D project takes longer. Assembly line automation levels also affect project lengths (see Figure 4.3 on page 15). R&D project costs are driven by the amount of time they take to complete. A six-month project costs \$500,000; a one-year project costs \$1,000,000.

Sensors will continue to produce and sell at the old performance, size and MTBF specifications up until the day the project completes, shown on the spreadsheet as the revision date. Unsold sensors built prior to the revision date are reworked free of charge to match the new specifications.

If the project length takes more than a year, the revision date will be reported in the next Capstone Courier. However the new performance, size and MTBF will not appear; old sensor attributes are reported prior to project completion.

When sensors are created or moved close to existing sensors, R&D completion times diminish. This is because your R&D Department can take advantage of existing technology. If the module is active, TQM/Sustainability investments can also decrease R&D times (see 7.2 TQM/Sustainability on page 24). It is important to verify completion dates after all decisions have been entered. Usually you want repositioning projects to finish in less than a year. For example, consider breaking an 18 month project into two separate projects, with the first stage ending just before the end of the current year and the second ending halfway through the following year.

#### 4.1.4 A SENSOR'S AGE

It is possible for a sensor to go from an age of 4 years to 2 years. How can that be? When a sensor is moved on the Perceptual Map, customers perceive the repositioned sensor as newer and improved, but not brand new. As a compromise, customers cut the age in half. If the product's age is 4 years old, on the day it is repositioned, its age becomes 2 years old. Therefore, you can manage the age of a product by repositioning the product. It does not matter how far the product moves. Aging commences from the revision date.

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Changing MTBF alone will not affect a sensor's age.

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Age criteria vary from segment to segment. For example, Traditional customers prefer an age of 2 years. This accounts for 47% of the Traditional customers' purchase decision. If a Traditional sensor's age approaches 3 years, customers will begin to turn away (see Figure 3.3 on page 10). Repositioning the sensor drops the age from 3 to 1.5 years and customers become interested again.

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Login to the Capstone® Spreadsheet and click the Decisions menu. Select Research & Development. To change a sensor's performance, enter a number in the New Pfmn cell; to change its size, enter a number in the New Size cell. To change the reliability rating, enter a number in the MTBF cell. As you vary the specifications, observe the effect upon the revision date, project cost, material cost, and age.

Name	New Pfmn	New Size	MTBF	Revision Date	Age at Revision	R&D Cost (\$000)
Able	5.5	14.5	17,500		-	\$0

Round 1 of the Rehearsal Simulation covers R&D decisions. See the website's Downloads section for complete information about the Rehearsal Simulation.

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## 4.2 MARKETING

Marketing is concerned with pricing, promotion budgets, sales budgets and sales forecasts.

### 4.2.1 PRICING SENSORS

Price was discussed in 3.1.2 Pricing. To review, appeal falls to zero when prices go \$5.00 above or below the expected price range. Price drives the sensor's contribution to profit margin. Dropping the price increases appeal but reduces profit per unit.

Segment price ranges fall at a rate of \$0.50 per year. For example, in Round 0, Traditional customers expected a price between \$20.00 and \$30.00. In Round 1, the Traditional price range will be \$19.50-\$29.50; Round 2, \$19.00-\$29.00, etc. This puts pressure on companies to improve their cost structures.

### 4.2.2 PROMOTION AND SALES BUDGETS

Promotion and sales budgets affect sensor appeal. See 3.2 Estimating the Customer Survey Score on page 10 for more information.

#### PROMOTION

Each sensor's promotion budget determines its level of awareness. A sensor's awareness percentage reflects the number of customers who know about the sensor. 50% awareness indicates half of the potential customers know it exists. From one year to the next, a third of those who knew about a sensor forget about it.

$$\text{Last Year's Awareness} - (33\% * \text{Last Year's Awareness}) = \text{Starting Awareness}$$

If a sensor ended last year with an awareness of 50%, this year it will start with an awareness of approximately 33%. This year's promotion budget would build from a starting awareness of 33%.

$$\text{Starting Awareness} + \text{Additional Awareness From Figure 4.2} = \text{New Awareness}$$

Figure 4.2 indicates a \$1,500,000 promotion budget would add 36% to the starting awareness, for a total awareness of 69% (33 + 36 = 69).

Figure 4.2 indicates a \$3,000,000 budget would add 50% to the starting awareness, only 14% more than the \$1,500,000 expenditure (33 + 50 = 83). This is because further expenditures tend to reach customers who already know about the sensor. Once your sensor achieves 100% awareness, you can scale back the sensor's promotion budget to around \$1,400,000. This will maintain 100% awareness year after year.

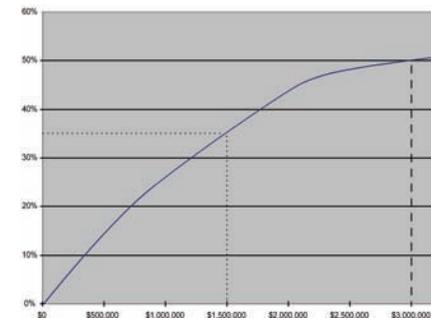


Figure 4.2 Promotion Budget: Increases in promotion budget have diminishing returns. The first \$1,500,000 buys 36% awareness; spending another \$1,500,000 (for a total of \$3,000,000) buys approximately 50%. The second \$1,500,000 buys only 14% more awareness.

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The Segment Analyses pages in the Capstone Courier report awareness. See Figure 5.3 on page 19.

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## 4.2 Marketing

New sensors are newsworthy events. The buzz creates 25% awareness at no cost. The 25% is added to any additional awareness you create with your promotion budget.

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Accessibility and Awareness numbers change if the Advanced Marketing module is active (see 7.4 Advanced Marketing on page 26).

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### SALES

Each sensor's sales budget contributes to segment accessibility. A segment's accessibility percentage indicates the number of customers who can easily interact with your company— salespeople, customer support, delivery, etc. Like awareness, if your sales budgets drop to zero, you lose one third of your accessibility each year. Unlike awareness, accessibility applies to the segment, not the sensor. If your sensor exits a segment, it leaves the old accessibility behind. When it enters a different segment, it inherits that segment's accessibility.

If you have two or more sensors that meet a segment's fine cut criteria, the sales budget for each sensor contributes to that segment's accessibility percentage. This has two important implications:

1. The more sensors you have in the segment's fine cut, the stronger your distribution channels, support systems, etc. This is because each sensor's sales budget contributes to the segment's accessibility.
2. Achieving 100% accessibility is difficult. Companies must have at least two sensors in the segment's fine cut. Each sensor experiences diminishing returns at a sales budget of \$3,000,000. Diminishing returns for the overall segment are not reached until the budgets total \$4,500,000 (for example, two sensors with sales budgets of \$2,250,000 each). Once 100% accessibility is reached, you can scale back to around \$3,300,000 to maintain 100%.

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Sales budgets are less effective when products are not completely positioned in the fine cut circle, when prices rise above segment guidelines or when MTBFs fall below segment guidelines.

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The Segment Analyses pages in the Capstone® Courier report accessibility. See Figure 5.2 on page 19.

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Think of awareness and accessibility as “before” and “after” the sale. The promotion budget drives awareness, which persuades the customer to look at your sensor. The sales budget drives accessibility, which governs everything during and after the sale. The promotion budget is spent on advertising and public relations. The sales budget is spent on distribution, order entry, customer service, etc. Awareness and accessibility go hand and hand in making the sale. The former is about encouraging the customer

to choose your sensor; the latter about closing the deal via your salespeople and distribution channels.

### 4.2.3 SALES FORECASTING

Accurate sales forecasting is a key element to company success. Manufacturing too many units results in higher inventory carrying costs. Manufacturing too few units results in stock outs and lost sales opportunities, which can cost even more. See Forecasting on page 33.

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Login to the Capstone Spreadsheet and click the Decisions menu. Select Marketing. Use this area to determine each sensor's Price, Promotion Budget, Sales Budget and Sales Forecast.

What's the difference between the Computer Prediction and Your Sales Forecast? The Computer Prediction (in yellow) cannot consider what your competitors are actually doing. It does not know. Instead it assumes each of your competitors will offer one mediocre product (with a customer survey score of 20) in each segment. It benchmarks how your sensor would do against this mediocre playing field. The Computer Prediction, expressed as units demanded, changes as you make decisions about your product. You use the Computer Prediction to evaluate the impact your decisions will have upon your product's appeal. For example, you can estimate the impact a price change will have upon demand.

The Your Sales Forecast column overrides the Computer Prediction with your own projection for unit sales (see Forecasting on page 33). Until you provide a sales forecast, the computer uses its mediocre Computer Prediction to predict your proforma financial statements. Always override the Computer Prediction with your own forecast.

The remaining cells display the financial impacts of your decisions:

- Gross Revenue Forecast (Price multiplied by either the Computer Prediction or, if entered, Your Sales Forecast.)
- Variable Costs (Labor, Material and Inventory Carrying costs subtracted from the Gross Revenue Forecast.)
- Contribution Margin Forecast (Gross Revenue minus variable costs.)
- Less Promotion and Sales (Contribution Margin Forecast minus the sensor's Promotion Budget and Sales Budget.)

NAME	Price	Promo Budget	Sales Budget	Computer Prediction	Your Sales Forecast	Gross Revenue Forecast	Variable Costs	Contrib. Margin Forecast	Less Promo & Sales
Able	\$28.00	\$1,000	\$1,000	896	1200	\$25,078	\$17,462	\$7,616	\$5,616

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Round 2 of the Rehearsal Simulation covers Marketing decisions. See the website's Downloads section for complete information about the Rehearsal Simulation.

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## 4.3 PRODUCTION

The Production Department schedules manufacturing runs for each sensor model. At the start of the simulation, your production plant has five lines with room for three more. Each assembly line is unique to the sensor it manufactures. You cannot move a sensor from one assembly line to another because automation levels vary and each sensor requires special tooling. Production schedules for each sensor should consider Marketing's forecasts and any inventory left over from the previous year.

### 4.3.1 CAPACITY

First shift capacity is defined as the number of sensors that can be produced on an assembly line in a single year with a daily eight hour shift. An assembly line can produce up to twice its first shift capacity with a second shift. An assembly line with a capacity of 2,000,000 units per year could produce 4,000,000 units with a second shift. However, second shift wages are 50% higher than the first shift.

Each new unit of capacity costs \$6.00 for the floor space plus \$4.00 multiplied by the automation rating. The Production spreadsheet will calculate the cost and display it for you. Increases in capacity require a full year to take effect— increase it this year, use it next year.

Capacity can be sold at the beginning of the year for \$0.65 on the dollar value of the original investment. You can replace the capacity in later years, but you have to pay full price. If you sell capacity for less than its depreciated value, you lose money, which is reflected as a write-off on your income statement. If you sell capacity for more than its depreciated value, you make a gain on the sale. This will be reflected as a negative write-off on the income statement (see 6.3 Income Statement on page 21).

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The dollar value limit of capacity and automation purchases is largely determined by the maximum amount of capital that can be raised through stock and bond issues plus excess working capital. See 4.4 Finance on page 16.

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### 4.3.2 DISCONTINUING A SENSOR

If you sell all the capacity on an assembly line, Capstone® interprets this as a liquidation instruction and will sell your remaining inventory for half the average cost of production. Capstone writes off the loss on your income statement. If you sell all but one unit of capacity, your inventory will not be liquidated and it can be sold for full price.

### 4.3.3 AUTOMATION

Automation levels are given a scale of 1.0 to 10.0. The lowest automation level is 1.0; the highest level is 10.0. At the start of the simulation, all assembly lines have an automation level between 3.0 and 5.0. As automation levels increase, the number of labor hours required to produce each unit falls.

At an automation rating of 1.0, labor costs are highest. Each additional point of automation decreases labor costs approximately 10%. At a rating of 10.0, labor costs fall about 90%.

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Labor costs increase each year because of the Annual Raise in labor's contract. Optional Labor Negotiations, TQM/Sustainability and Human Resources modules can also affect labor costs (see 7 Additional Modules on page 21).

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Despite its attractiveness, two factors should be considered before raising automation:

1. Automation is expensive: At \$4.00 per point of automation, raising automation from 1.0 to 10.0 costs \$36.00 per unit of capacity;
2. As you raise automation, it becomes increasingly difficult for R&D to reposition sensors short distances on the Perceptual Map (Figure 4.3). For example, a project that moves a product 0.7 on the map takes significantly longer at an automation level of 8.0 than at 5.0. Long moves greater than a distance of 2.0 are not affected. You can move a sensor a long distance at any automation level, but the project will take between 2.5 and 3.0 years to complete.

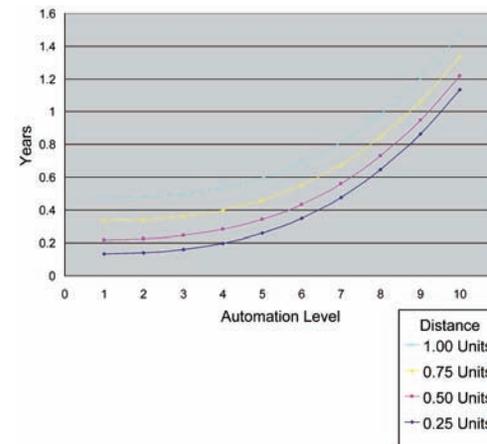


Figure 4.3 Time Required to Move a Sensor on the Perceptual Map at Automation Levels 1 Through 10: Note that at all automation levels, less time is required to move a product 0.25 units (dark blue line) than to move a product 1.0 units (light blue line). These times will increase when two or more R&D projects are underway.

Sensors in the High End, Performance and Size segments, where positioning is an important criteria, can be repositioned more quickly with lower automation.

### 4.3.4 CHANGING AUTOMATION

For each point of change in automation, up or down, the company is charged \$4.00 per unit of capacity. For example, if a line has a capacity of 1,000,000 units, the cost of changing the automation level from 5.0 to 6.0 would be \$4,000,000. Reducing automation costs money. If you reduce automation, you will be billed for a retooling cost. The net result is you will be paying money to make your plant *less* efficient. While reduced automation will speed R&D redesigns, by and large it is not wise to reduce an automation level. Changes in automation require a full year to take effect— change it this year, use it next year.

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Login to the Capstone Spreadsheet and click the Decisions menu. Select Production. Use this area to enter for each sensor:

- A Production Schedule

## 4.4 Finance

- Increases in first shift capacity (Put a positive number in Buy/Sell Capacity.)
- Decreases in first shift capacity (Put a negative number in Buy/Sell Capacity.)
- Changes in automation level (Enter a number in New Automation Rating.)

Round 3 of the Rehearsal Simulation covers Production decisions. See the website's Downloads section for complete information about the Rehearsal Simulation.

Schedule	Able
Unit Sales Forecast	1200
Inventory On Hand	189
Production Schedule	1,200
Production After Adj.	1,188
<b>Physical Plant</b>	
1st Shift Capacity	1,800
Buy/Sell Capacity	0
Automation Rating	4.0
New Autom. Rating	4.0
Investment (\$000)	\$0

more debt you have relative to your assets, the more risk you present to debt holders and the higher the current debt rates.

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As a general rule, companies fund short term assets like accounts receivable and inventory with current debt offered by banks.

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Bankers will loan current debt up to about 75% of your accounts receivable (found on last year's balance sheet) and 50% of this year's inventory. They estimate your inventory for the upcoming year by examining last year's income statement. Bankers assume your worst case scenario will leave a three to four month inventory, and they will loan you up to 50% of that amount. This works out to be about 15% of the combined value of last year's total direct labor and total direct material, which display on the income statement.

Because they know your industry is growing, as a final step bankers increase your borrowing limit by 20% to provide you with room for expansion in inventory and accounts receivable.

## 4.4 FINANCE

Your Finance Department is primarily concerned with five issues:

1. Acquiring the capital needed to expand assets, particularly plant and equipment. Capital can be acquired through:
  - Current Debt
  - Stock Issues
  - Bond Issues (Long Term Debt)
  - Profits
2. Establishing a dividend policy that maximizes the return to shareholders.
3. Setting accounts payable policy (which is entered on the Production spreadsheet) and accounts receivable policy (which is entered on the Marketing spreadsheet).
4. Driving the financial structure of the firm and its relationship between debt and equity.
5. Selecting and monitoring performance measures that support your strategy.

Finance decisions should be made after the other departments enter their decisions. After the management team decides what resources the company needs, the Finance Department addresses funding issues and financial structure.

One of the Finance Department's fiduciary duties is to verify that sales forecasts and sensor prices are realistic. Unrealistic prices and forecasts will predict unrealistic cash flow. The department should challenge the Marketing managers to defend their forecasts and pricing decisions.

### 4.4.1 CURRENT DEBT

Your bank issues current debt in one year notes. The Finance area in the Capstone® Spreadsheet displays the amount of current debt due from the previous year. The company can "roll" that debt by simply borrowing the same amount again. There are no brokerage fees for current debt. Interest rates are a function of your debt level. The

### 4.4.2 BONDS

All bonds are ten year notes. Your company pays a 5% brokerage fee for issuing bonds. The first three digits of the bond, the series number, reflect the interest rate. The last four digits indicate the year in which the bond is due. The numbers are separated by the letter S which stands for "series." For example, a bond with the number 12.6S2011 has an interest rate of 12.6% and is due December 31, 2011.

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As a general rule, bond issues are used to fund long term investments in capacity and automation.

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Bondholders will lend total amounts up to 80% of the value of your plant and equipment (the Production Department's capacity and automation). Each bond issue pays a coupon, the annual interest payment, to investors. If the face amount or principal of bond 12.6S2011 were \$1,000,000, then the holder of the bond would receive a payment of \$126,000 every year for ten years. The holder would also receive the \$1,000,000 principal at the end of the tenth year. Each year your company is given a credit rating that ranges from AAA (best) to D (worst). In Capstone, ratings are evaluated by comparing current debt interest rates with the prime rate.

When issuing new bonds, the interest rate will be 1.4% over the current debt interest rates. If your current debt interest rate were 12.1%, then the bond rate would be 13.5%.

You can buy back outstanding bonds before their due date. A 1.5% brokerage fee applies. These bonds are repurchased at their market value or street price on January 1 of the current year. The street price is determined by the amount of interest the bond pays and your credit worthiness. It is therefore different from the face amount of the bond. If you buy back bonds with a street price that is less than its face amount, you make a gain on the repurchase. This will be reflected as a negative write-off on the income statement (see 6.3 Income Statement on page 21).

Bonds are retired in the order they were issued. The oldest bonds retire first. There are no brokerage fees for bonds that are allowed to mature to their due date.

If a bond remains on December 31 of the year it becomes due, your banker lends you current debt to pay off the bond principal. This, in effect, converts the bond to current debt. This amount is combined with any other current debt due at the beginning of the next year.

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**When Bonds Come Due:** Assume the face amount of bond 12.6S2011 is \$1,000,000. The \$1,000,000 repayment is acknowledged in your reports and spreadsheets in the following manner: Your annual reports from December 31, 2011 would reflect an increase in current debt of \$1,000,000 offset by a decrease in long term debt of \$1,000,000.

The 2011 spreadsheet will list the bond because you are making decisions on January 1, 2011, when the bond still exists. Your 2012 spreadsheet would show a \$1,000,000 increase in current debt and the bond no longer appears.

**When Bonds Are Retired Early:** A bond with a face amount of \$10,000,000 could cost \$11,000,000 to repurchase because of fluctuations in interest rates and your credit worthiness. A 1.5% brokerage fee applies. The difference between the face value and the repurchase price will reflect as a gain or loss in the income statement's fees and write-offs.

**Bond Ratings:** If your company has no debt at all, your company is awarded a AAA bond rating. As your debt-to-assets ratio increases, your current debt interest rates increase. Your bond rating slips one category for each additional 0.5% in current debt interest. For example, if the prime rate is 10%, and your current debt interest rate is 10.5%, then you would be given a AA bond rating instead of a AAA.

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#### 4.4.3 STOCK

Stock issue transactions take place at the current market price. Your company pays a 5% brokerage fee for issuing stock. New stock issues are limited to 20% of your company's outstanding shares in that year.

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As a general rule, stock issues are used to fund long term investments in capacity and automation.

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Stock price is driven by book value, the last two years' earnings per share (EPS) and the last two years' annual dividend.

Book value is equity divided by shares outstanding. Equity equals the common stock and retained earnings values listed on the balance sheet. Shares outstanding is the number of shares that have been issued. For example, if equity is \$50,000,000 and there are 2,000,000 shares outstanding, book value is \$25.00 per share.

EPS is calculated by dividing net profit by shares outstanding.

The dividend is the amount of money paid per share to stockholders each year. Stockholders do not respond to dividends beyond the EPS; they consider them unsustainable. For example, if your EPS is \$1.50 per share, and your dividend is \$2.00 per share, stockholders would ignore anything above \$1.50 per share as a driver of stock price. In general dividends have little effect upon stock price. However, Capstone® is unlike the real world in one important respect—there are no external investment opportunities. If you cannot use profits to grow the company, idle assets will accumulate. Capstone is designed such that in later rounds your company is likely to become a “cash cow,” spinning off excess cash. How you manage that spin off is an important consideration in the end game, and dividends are an important tool at your disposal.

You can retire stock. The amount cannot exceed the lesser of either:

- 5% of your outstanding shares, listed on page 2 of last year's Courier; or
- Your total equity listed on page 3 of last year's Courier.

You are charged a 1.5% brokerage fee to retire stock.

#### 4.4.4 EMERGENCY LOANS

Financial transactions are carried on throughout the year directly from your cash account. If you manage your cash position poorly, Capstone will give you an emergency loan to cover the shortfall. The loan comes from a gentleman named Big Al, who arrives at your door with a checkbook and a smile. Big Al gives you a loan exactly equal to the shortfall. You pay one year's worth of current debt interest on the loan and Big Al adds a 7.5% penalty fee on top to make it worth his while.

For example, suppose the current debt interest rate is 10%, and you are short \$10,000,000 on December 31. You pay one year's worth of interest on the \$10,000,000 (\$1,000,000) plus an additional 7.5% or \$750,000 penalty. The emergency loan is combined with any other current debt due at the beginning of the next year. You do not need to do anything special to repay it. However, you need to decide what to do with the current debt (pay it off, re-borrow it, etc.). The interest penalty only applies to the year in which the emergency loan is taken, not to future years.

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Emergency loans depress stock prices, even when you are profitable. Stockholders take a dim view of your performance when they witness a liquidity crisis. Emergency loans are combined with any current debt from last year. The total amount displays in the Due This Year cell under Current Debt.

Emergency loans are often encountered when last year's sales forecasts were higher than actual sales or when the Finance Department fails to raise funds needed for expenditures like capacity and automation purchases.

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#### 4.4.5 CREDIT POLICY

Your company determines the number of days between transactions and payments. For example, your company could give customers 30 days to pay their bills (accounts receivable) while holding up payment to suppliers for 60 days (accounts payable).

## 5.1 Front Page, Stock & Bond Summaries, Financial Statements and Production Analysis

Shortening A/R (accounts receivable) lag from 30 to 15 days in effect recovers a loan made to customers. Similarly, extending the A/P (accounts payable) lag from 30 to 45 days extracts a loan from your suppliers.

The accounts receivable lag impacts the customer survey score. If your company offers no credit terms, your sensor's customer survey score falls to about 65% of maximum. At 30 days, the score is 92%. At 60 days, the score is 98.5%. At 120 days there is no reduction. The longer the lag, the more cash is tied up in receivables.

The accounts payable lag has implications for Production. Suppliers become concerned as the lag grows and they start to withhold material for production. At 30 days, they withhold 1%. At 60 days, they withhold 8%. At 90 days, they withhold 26%. At 120 days, they withhold 63%. At 150 days, they withhold all material. Withholding material creates shortages on the assembly line. As a result, workers stand idle and per-unit labor costs rise.

Login to the Capstone® Spreadsheet and click the Decisions menu. Select Finance. Use this area to raise money:

- Current Debt (These are one year loans.)
- Long Term Debt (These are 10 year bonds.)
- Issue Stock

As resources permit, companies can:

- Retire Stock
- Retire Bonds
- Issue a Dividend

Round 4 of the Rehearsal Simulation covers Finance decisions. See the website's Downloads section for complete information about the Rehearsal Simulation.

Plant Improvements	
Total Investments (\$000)	\$0
Sales of Plant & Equipment	\$0
Common Stock	
Shares Outstanding (000)	2,000
Price Per Share 1/1/2007	\$40.16
Earnings Per Share	\$1.07
Max Stock Issue (\$000)	\$16,064
Issue Stock (\$000)	\$2,000
Max Stock Retire (\$000)	\$4,016
Retire Stock (\$000)	\$0
Dividend Per Share	\$0.00
Current Debt	
Interest Rate	9.4%
Due This Year	\$0
Borrow (\$000)	\$2,000
Cash Positions	
December 31, 2006	\$3,434
December 31, 2007	\$3,678
Long Term Debt	
Retire Long Term Debt (\$000)	\$0
Issue Long Term Debt (\$000)	\$3,000
Long term interest rate	10.8%
Maximum issue this year	\$25,887

## 5 THE CAPSTONE COURIER

Customer purchases and sensor company financial results are reported in an industry newsletter called The Capstone Courier. The Courier is available from two locations:

- On the website, login to your simulation then click the Reports link;
- From the Capstone Spreadsheet, click Courier in the menu bar.

The Courier displays "Last Year's Results." For example, the Courier available at the start of Round 2 will display the results for Round 1. The Courier available at the start of Round 1 displays Last Year's Results for Round 0, when all companies have equal standing.

Successful companies will study the Courier to understand the marketplace and find opportunities. As the simulation progresses and strategies are implemented, company results will begin to vary.

### 5.1 FRONT PAGE, STOCK & BOND SUMMARIES, FINANCIAL STATEMENTS AND PRODUCTION ANALYSIS

Use the front page of the Courier to see a snapshot of last year's results. Be sure to compare your company's sales, profits and cumulative profits with your competitors'.

Page 2, Stock and Bond Summaries, reports stock prices and bond ratings for all companies.

Page 3, Financial Statements, surveys each company's cash flow, balance sheet and income statements. This will give you an idea of your competitors' financial health.

Page 4, The Production Analysis, reports detailed information about each product in the market, including sales and inventory levels, price, material cost and labor cost. Are you or your competitors building excess inventory? Excess inventory puts pressure on profits (see Forecasting on page 33).

The Production Analysis also reports product revision dates. Does a competitor have a product with a revision date in the year after the year of the report? This indicates a long repositioning project that will possibly put that product into another segment.

If a revision date has yet to conclude, the Courier will report the product's current performance, size and MTBF. The new coordinates and MTBF will not be revealed until after the completion of the project.

Check your competitors' automation, capacity and plant utilization. Increases in automation reduce labor costs and this could indicate competitors might drop prices for those products. Did a competitor reduce capacity? Selling capacity reduces assets. Running the remaining capacity at 150% to 200% can improve Return on Assets (ROA).

The Production Analysis will report the release date (but not the coordinates) of a new product if:

- Production capacity is purchased;
- A promotion budget is entered;
- A sales budget is entered.

Are your competitors investing in capacity and automation? The Production Analysis reports capacity and automation ratings for the upcoming round. The Financial Statements survey reports the cost of plant improvements for all companies.

percentage. 100% means every customer can easily interact with your company—sales, customer support, etc.

The Market Share Actual vs. Potential Chart (Figure 5.2) displays two bars per company. The actual bar reports the market percentage each company attained in the segment. The potential bar indicates what the company deserved to sell in the segment. If the potential bar is higher than the actual, the company under produced and missed sales opportunities. If the potential is lower than the actual, the company picked up sales because other companies under produced and stocked out.

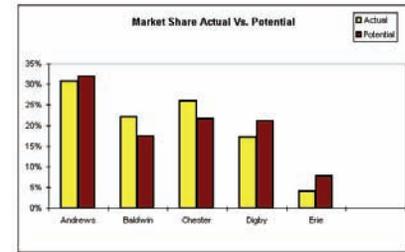
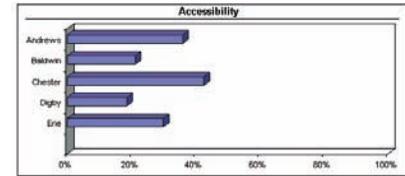


Figure 5.2 Segment Analysis Accessibility and Market Share Actual vs. Potential Charts

Top Products in Segment lists the products selling in the segment and reports:

- Market Share
- Units Sold to Segment
- Revision Date
- Stock Out (Whether the product ran out of inventory.)
- Performance and Size coordinates
- Price
- MTBF
- The product's Age on December 31
- Promotion and sales budgets
- Awareness and customer survey score

## 5.2 SEGMENT ANALYSES

The Market Segment Analyses, pages 5 - 9 of the Courier (Figure 5.1), review each market segment in detail.

The Statistics table in the upper-left corner reports Total Industry Unit Demand, Actual Industry Unit Sales, Segment Percent of Total Industry and the segment's Growth Rate. The Customer Buying Criteria table ranks the customer criteria within each segment (these are the criteria listed in 2.2 Buying Criteria By Segment on page 6):

- Ideal Position: The preferred product location as of December 31 of the previous year (the preferred location is also called the ideal spot— ideal spots drift with the segments, moving a little each month);
- Price: Every year on January 1, price ranges drop by \$0.50— this is the price range from last year;
- Age: Age preferences stay the same year after year;
- Reliability: MTBF requirements stay the same year after year.

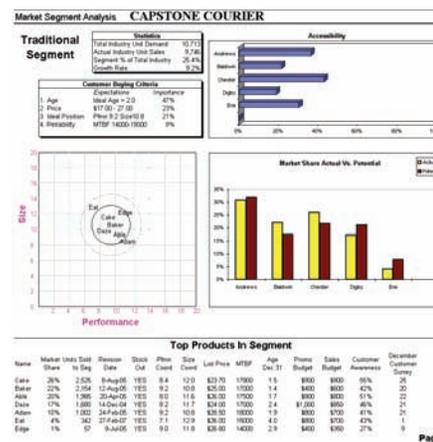


Figure 5.1 Traditional Market Segment Analysis: Segment Statistics and Buying Criteria display in the upper-left corner of each segment analysis.

Are your products meeting your buyers' expectations?

The Perceptual Map shows the position of each product in the segment as of December 31 of the previous year.

### 5.2.1 ACCESSIBILITY, MARKET SHARE AND TOP PRODUCTS IN SEGMENT

The Accessibility Chart (Figure 5.2) rates each company's level of accessibility. Accessibility is determined by the Marketing Department's sales budget—the higher the budget, the higher the accessibility. Accessibility is measured by

### 5.2.2 AWARENESS AND THE DECEMBER CUSTOMER SURVEY SCORE

Customer Awareness (Figure 5.3) is determined by the Marketing Department's promotion budget—the higher the budget, the higher the awareness. Awareness is measured by percentage. 100% means every customer knew about your product.

The December Customer Survey Score (Figure 5.3) indicates how customers perceived the products in the segment. The survey evaluates the product against the buying criteria.

Ages and distances from the ideal spots change throughout the year, therefore scores change month to month (see The Customer Survey Score on page 7).

If a repositioning project concludes late in the year, the survey score for December could be significantly higher than the scores for the previous months.

Customer Awareness	December Customer Survey
55%	25
42%	20
51%	22
46%	21
41%	21
43%	1
27%	9

Figure 5.3 Customer Awareness and December Customer Survey Score: Customer Awareness reports the percentage of customers who knew about your product. The December Customer Survey reports what customers thought about your product—the higher the score, the better they liked it.



Total depreciation for the period is reflected as a gain on the cash flow statement. On the balance sheet, accumulated depreciation is subtracted from the value of the plant and equipment. The simulation uses a straight line depreciation method calculated over fifteen years.

## 6.2 CASH FLOW STATEMENT

The cash flow statement indicates the movement of cash through the organization, including operating, investing and financing activities. The annual report's cash flow statement shows the change in the amount of cash from the previous year. The proforma cash flow statement indicates the expected change at the end of the upcoming year.

## 6.3 INCOME STATEMENT

Your company can use the income statement to diagnose problems on a product by product basis. Sales for each product are reported in dollars (not the number of products). Subtracting variable costs from sales determines the contribution margin. Inventory carrying costs are driven by the number of products in the warehouse. If

your company has \$0 inventory carrying costs, you stocked out of the product and most likely missed sales opportunities. If your company has excessive inventory, your carrying costs will be high. Sound sales forecasts matched to reasonable production schedules will result in a modest inventory carrying costs.

Period costs are depreciation added to Sales, General and Administrative (SG&A) costs, which include R&D, Promotion, Sales and Administration expenses. Period costs are subtracted from the contribution margin to determine the net margin.

The net margin for all products is totaled then subtracted from other expenses, which in the simulation include fees, write-offs and, if it is enabled, TQM/Sustainability costs. This determines earnings before interest and taxes, or EBIT. Finally, interest, taxes and profit sharing costs are subtracted to determine net profit.

After finalizing your decisions, use the printer icon in the spreadsheet to print your proforma income statement. When the simulation advances to the next year, compare the proforma income statement to the results in the annual report income statement. The proforma menu also links to projected financial ratios and, if your instructor has enabled it, a projected Balanced Scorecard (see Balanced Scorecard on page 36).

# 7 ADDITIONAL MODULES

Instructors have the option of activating up to four additional modules: Human Resources, TQM (Total Quality Management)/Sustainability, Labor Negotiations and Advanced Marketing. Instructors set the round in which the modules will begin. On the website, your Dashboard will notify you if the modules are scheduled.

## 7.1 HUMAN RESOURCES

When the Human Resources Module is activated, three areas must be addressed:

1. **Complement:** The number of workers in the workforce. Needed Complement is the number of workers required to fill the production schedule without overtime.
2. **Caliber:** The talent of the workforce. If companies are willing to spend the money, they can recruit a higher caliber of worker. This results in higher productivity and lower turnover. Companies set a Recruiting Spend budget of up to an additional \$5,000 per worker. If they spend nothing extra, their recruitment cost per worker remains at \$1,000 and they get an average person off the street. The more they spend, the higher the caliber of the worker.
3. **Training:** The amount of time workers spend in training each year. Training leads to higher productivity and lower turnover, but takes people off the job while they are in the classroom. Each training hour costs \$20.00 per worker.

Assuming you have sufficient workers (Complement), investments in Recruiting and Training raise your Productivity Index, which in turn lowers your per unit labor costs.

Human Resources decisions are made in two locations:

1. The Workforce Complement is entered at the bottom in the Production area;
2. Recruiting Spend and Training decisions are made in the Human Resource area.

When the module is not active, the Needed Complement, Recruiting and Separation costs will update as production schedules are adjusted, however, users cannot directly control the entries.

### 7.1.1 NEEDED COMPLEMENT

In the Production area, the Needed Complement cell in the Worker Complement row conveys the number of workers needed to run the production lines. This number changes as Production Schedules change.

At the start of the simulation, the Traditional line has a capacity of 1,800,000 units (shown as 1,800 on the Production spreadsheet).

Production schedules above 1,800,000 units require hiring a second shift or paying first shift workers overtime.

## 7.1 Human Resources

If the company chooses to build 2,000,000 units (2,000 on the spreadsheet) it could:

- Keep the number of workers constant. This means employees will have to work overtime hours with a wage rate of an additional 50%. Running overtime allows companies to avoid Recruiting and Training costs, but overtime wears out the workforce, reducing any gains in worker productivity and increasing turnover. Higher turnover increases future Recruiting Costs; or
- Consider paying the Recruiting Costs and hire a second shift. Second shift workers are paid the same wage rate as first shift workers on overtime (an additional 50%), however second shift workers are more efficient than first shift workers on overtime (they are not as tired) and the employee Turnover Rate is lower (they are not disgruntled by the extra hours). Lower turnover reduces future Recruiting Costs.

The examples below use the production line capacities (in thousands) at the beginning of the simulation:

- 1,800 for Traditional
- 1,400 for Low End
- 900 for High End
- 600 for Performance
- 600 for Size

Figure 7.1 shows the Production and the Human Resources areas where production scheduled equals capacity (1,800, 1,400, 900, 600, 600) and the Needed Workforce Complement is hired (909). Notice that there is no overtime, and that second shift reads 0.

The Human Resources area reflects the information that has been entered in the Production area. It also shows a Turnover Rate of 10% and a Productivity Index of 100%.

In Figure 7.2, the production schedule has been increased by 200,000 for each product line (2,000, 1,600, 1,100, 800, 800). The increased production jumps the Needed Complement to 1,087, but the Workforce Complement has been held at 909. The result, 19.6% overtime.

In the Human Resource area, the Turnover Rate is now 12%, up from 10%.

In Figure 7.3, the Needed Complement of 1,087 is entered in the This Year column. The result, overtime has dropped to 0% and the second shift now employs 178 people. In the Human Resources area, the staffing Complement of 1,087 eliminates overtime and therefore the Turnover Rate drops back to 10%. Notice, however, that the Recruiting Cost row has been steadily increasing—\$300,000 in Figure 7.1, \$318,000 in Figure 7.2 and \$496,000 in Figure 7.3 (due to the hiring of the second shift).

Production Schedule							
	1,800	1,400	900	600	600		
Workforce Complement	Last Year	700	909	This Year	909	909	
	1st Shift	909	909	2nd Shift	0	Overtime	0.0%
<b>STAFFING</b>							
	Last Year	701	This Year	909			
Needed Complement	701	909	700	909			
Complement	700	909	640	909			
1st Shift Complement	640	909	60	0			
2nd Shift Complement	60	0	0.2%	0.0%			
Overtime%	0.2%	0.0%	10.0%	10.0%			
Turnover Rate	10.0%	10.0%	70	300			
New Employees	70	300	0	0			
Separated Employees	0	0	\$0	\$0			
Recruiting Spend	\$0	\$0	0	0			
Training Hours	0	0	100.0%	100.0%			
Productivity Index	100.0%	100.0%					
Recruiting Cost				\$300			
Separation Cost				\$0			
Training Cost				\$0			
Total HR Admin Costs				\$300			

Figure 7.1

Production Schedule							
	2,000	1,600	1,100	800	800		
Workforce Complement	Last Year	700	1,087	This Year	909	909	
	1st Shift	909	909	2nd Shift	0	Overtime	19.6%
<b>STAFFING</b>							
	Last Year	701	This Year	1,087			
Needed Complement	701	1,087	700	909			
Complement	700	909	640	909			
1st Shift Complement	640	909	60	0			
2nd Shift Complement	60	0	0.2%	19.6%			
Overtime%	0.2%	19.6%	10.0%	12.0%			
Turnover Rate	10.0%	12.0%	70	318			
New Employees	70	318	0	0			
Separated Employees	0	0	\$0	\$0			
Recruiting Spend	\$0	\$0	0	0			
Training Hours	0	0	100.0%	100.0%			
Productivity Index	100.0%	100.0%					
Recruiting Cost				\$318			
Separation Cost				\$0			
Training Cost				\$0			
Total HR Admin Costs				\$318			

Figure 7.2

Production Schedule							
	2,000	1,600	1,100	800	800		
Workforce Complement	Last Year	700	1,087	This Year	1,087	1,087	
	1st Shift	909	909	2nd Shift	178	Overtime	0.0%
<b>STAFFING</b>							
	Last Year	701	This Year	1,087			
Needed Complement	701	1,087	700	1,087			
Complement	700	1,087	640	909			
1st Shift Complement	640	909	60	178			
2nd Shift Complement	60	178	0.2%	0.0%			
Overtime%	0.2%	0.0%	10.0%	10.0%			
Turnover Rate	10.0%	10.0%	70	496			
New Employees	70	496	0	0			
Separated Employees	0	0	\$0	\$0			
Recruiting Spend	\$0	\$0	0	0			
Training Hours	0	0	100.0%	100.0%			
Productivity Index	100.0%	100.0%					
Recruiting Cost				\$496			
Separation Cost				\$0			
Training Cost				\$0			
Total HR Admin Costs				\$496			

Figure 7.3

In Figure 7.4, This Year's Complement has been dropped to 400. Now there is no second shift and the first shift is working 100% overtime. In the Human Resources area turnover jumps to 20%. Recruiting Cost has dropped to \$80,000, but there is now a Separation Cost (the cost of firing the workers) of \$1,500,000. Also, note that Production After Adjustment in Figure 7.4 has dropped well below the schedules. This is because not enough workers are available and output is curtailed by a significant amount.

In Figure 7.5, This Year's Complement is entered as 1,130, which is above the Needed Complement of 1,087. Overtime is now back to 0% and the second shift returns to 178. In the Human Resources area the Recruiting Cost has skyrocketed to \$543,000, but the Total HR Admin Cost is somewhat less than the \$1,500,000 when the workforce was reduced to 400.

Production Schedule							
	2,000	1,600	1,100	800	800		
Production After Adj.	1,569	1,220	785	523	523		
Workforce Complement	Last Year	700	1,087	This Year	400	400	
	1st Shift	909	909	2nd Shift	0	Overtime	100.0%
<b>STAFFING</b>							
	Last Year	701	This Year	1,087			
Needed Complement	701	1,087	700	400			
Complement	700	400	640	400			
1st Shift Complement	640	400	60	0			
2nd Shift Complement	60	0	0.2%	100.0%			
Overtime%	0.2%	100.0%	10.0%	20.0%			
Turnover Rate	10.0%	20.0%	70	\$0			
New Employees	70	\$0	0	300			
Separated Employees	0	300	\$0	\$0			
Recruiting Spend	\$0	\$0	0	0			
Training Hours	0	0	100.0%	100.0%			
Productivity Index	100.0%	100.0%					
Recruiting Cost				\$80			
Separation Cost				\$1,500			
Training Cost				\$0			
Total HR Admin Costs				\$1,580			

Figure 7.4

Production Schedule							
	2,000	1,600	1,100	800	800		
Workforce Complement	Last Year	700	1,087	This Year	1,130	1,130	
	1st Shift	909	909	2nd Shift	178	Overtime	0.0%
<b>STAFFING</b>							
	Last Year	701	This Year	1,087			
Needed Complement	701	1,087	700	1,130			
Complement	700	1,130	640	952			
1st Shift Complement	640	952	60	178			
2nd Shift Complement	60	178	0.2%	0.0%			
Overtime%	0.2%	0.0%	10.0%	10.0%			
Turnover Rate	10.0%	10.0%	70	543			
New Employees	70	543	0	0			
Separated Employees	0	0	\$0	\$0			
Recruiting Spend	\$0	\$0	0	0			
Training Hours	0	0	100.0%	100.0%			
Productivity Index	100.0%	100.0%					
Recruiting Cost				\$543			
Separation Cost				\$0			
Training Cost				\$0			
Total HR Admin Costs				\$543			

Figure 7.5

### 7.1.2 RECRUITMENT AND TRAINING

In Figure 7.6, each worker is assigned 80 hours of training per year, bringing the Needed Complement up to 1,130 (more workers are needed to fill in for workers in the classroom). Investing in training increases the Productivity Index and reduces the Turnover Rate.

The training costs \$1,808,000, however, turnover has dropped to 7%. Part of the expense of the extra payroll and training will be offset by lower Recruiting Costs and future gains in productivity.

	Last Year	This Year
<b>STAFFING</b>		
Needed Complement	701	1,130
Complement	700	1,130
1st Shift Complement	640	945
2nd Shift Complement	60	185
Overtime%	0.2%	0.0%
Turnover Rate	10.0%	7.0%
New Employees	70	509
Separated Employees	0	0
Recruiting Spend	\$0	\$0
Training Hours	0	80
Productivity Index	100.0%	100.0%
Recruiting Cost		\$509
Separation Cost		\$0
Training Cost		\$1,808
Total HR Admin Costs		\$2,317

Figure 7.6

In this example the Productivity Index remains at 100%. This is due to the 509 employees added this year. Had fewer employees been added the 80 Training Hours would have increased the Productivity Index.

	Last Year	This Year
<b>STAFFING</b>		
Needed Complement	701	1,130
Complement	700	1,130
1st Shift Complement	640	945
2nd Shift Complement	60	185
Overtime%	0.2%	0.0%
Turnover Rate	10.0%	7.0%
New Employees	70	509
Separated Employees	0	0
Recruiting Spend	\$0	\$2,000
Training Hours	0	80
Productivity Index	100.0%	101.8%
Recruiting Cost		\$1,527
Separation Cost		\$0
Training Cost		\$1,808
Total HR Admin Costs		\$3,335

Figure 7.7

In Figure 7.7, \$2,000 is entered in Recruiting Spend (the amount of additional money spent per worker to attract a higher caliber employee). Note that the Productivity Index has increased almost 2% to 101.8. Part of the extra recruitment expense will be recouped by increased production line efficiency.

If Labor Negotiations are scheduled, increases in the Productivity Index can be lost if the company uses a low wage/benefit tactic (see 7.3 Labor Negotiations on page 25). The Productivity Index can never fall below 100%.

After the round is processed, the results of all HR investments appear on page 12 of The Capstone® Courier in the HR/TQM Report.

### 7.1.3 HUMAN RESOURCE DEFINITIONS

**Needed Complement:** The number of workers needed this year if you are to avoid overtime.

**Complement:** The number of workers in your workforce this year. This year's workforce Complement is entered on the Production spreadsheet and appears in the second row of the Human Resource spreadsheet. There are two shifts. As you add workers, the first shift is completely filled, then the second shift begins to fill. Suppose that you do not have enough workers. The first shift must then work overtime to complete the work schedule. Excessive overtime drags down productivity and increases turnover. Second shift and overtime workers cost 50% more per hour than workers on first shift.

**1st Shift Complement:** As you increase the workforce, the simulation completely fills the needed first shift Complement before adding second shift workers.

**2nd Shift Complement:** The number of workers on second shift. Second shift workers are paid 50% more per hour than first shift workers. Second shift scheduling has no impact upon the Productivity Index.

**Overtime Percent:** The percentage of first shift workers on overtime. 100% means that every first shift worker is working a double shift. 15% means that, on average, each first shift worker performs 15% overtime. Overtime increases turnover and drags down productivity.

**Turnover Rate:** The percentage of workers who left the company last year, excluding downsizing. About 5% is rooted in unavoidable factors like retirement, relocation and weeding out poor workers. Remaining turnover is a function of employee dissatisfaction. The best workers leave first. Turnover is driven down by Recruiting Spend and Training Hours. Turnover also goes up as a result of overtime and a substandard compensation package from the Labor Negotiation.

The Turnover Rate ignores downsizing factors. It reflects the turnover in the population of workers that you keep after downsizing (that is, reducing production schedules or increasing automation).

**New Employees:** Employees recruited this year. At a minimum, New Employees reflects replacement of workers lost during the course of the year to turnover. It also includes workers hired in January to increase the Complement from last year. New employees incur a Recruiting Cost. As a simplifying assumption, the simulation does not rehire fired or separated workers.

**Separated Employees:** Employees lost because of downsizing or increases in Automation. Specifically, Separated Employees is Last Year's Complement minus This Year's Complement. All separations occur in January and incur a Separation Cost.

**Recruiting Spend:** Recruiting Spend is the extra amount budgeted per worker to recruit high caliber workers. The higher the budget, the better the worker, resulting in a higher Productivity Index and lower Turnover. Your entry is added to a base amount of \$1,000 per new employee. \$0 means no extraordinary effort is spent recruiting new people. Diminishing returns apply after \$5,000 per worker.

It may take several years to see a significant impact, but the effect is cumulative. Minimum turnover is 5%. If you replace 5% of the workforce each year with high caliber people, after 8 years you would replace a significant percentage of your workforce with high caliber workers.

**Training Hours:** Training Hours is the number of hours each year that each individual worker is taken off-line for training and development. For example, 40 means that each worker will spend 40 hours in training this year. Training produces a higher Productivity Index and a lower Turnover Rate. The more time off-line, the higher the needed Complement. Each training hour costs \$20.00 per worker in training costs.

## 7.2 TQM/Sustainability

**Productivity Index:** The Productivity Index indicates how the general workforce compares with the workers employed in Round 0. 100% means that current workers are just as good as original workers. 110% means that, on average, you only need 91% ( $100 / 110 = 91$ ) of the Complement to do the same work as a workforce comprised of original workers. In short, higher productivity means fewer workers are required, and that drives down per unit labor cost. Recruiting Spend and Training Hours drive up the Productivity Index. Overtime drags down the Productivity Index. This Year actually means by the end of this year. Last year's Productivity is the driver behind your Complement requirements this year because it indicates your productivity level on January 1.

**Recruiting Cost:** The amount spent to recruit new workers. It equals the number of workers recruited times (\$1,000 + Recruiting Spend).

**Separation Cost:** The cost to separate (fire) workers. If you downsize your workforce (by reducing production schedules or increasing automation), each worker is given a separation package worth \$5,000.

**Training Cost:** Training costs are driven by Training Hours. Each worker-training hour costs \$20.00 and pays for such things as educational materials, instructors, etc. Training costs do not include time off the job.

**Total HR Admin Costs:** Total HR Administrative Costs are incorporated into the income statement's admin line item. Costs are allocated to products based upon their Complement. For example, if Able has 10 workers and Acre has 20, then the HR Admin costs (training, recruiting, etc.) would be twice as much for Acre as for Able.

---

Login to the Capstone® Spreadsheet and click the Decisions menu. Select Production to enter the This Year's Workforce Complement. Select Human Resources to enter Training Hours and Recruitment Budgets.

---

## 7.2 TQM/SUSTAINABILITY

TQM/Sustainability initiatives can reduce material, labor and administrative costs, shorten the length of time required for R&D projects to complete and increase demand for the product line.

The two sustainability-oriented initiatives, the UNEP Green Program and GEMI TQEM, can lower labor and material costs. The UNEP Green Program also can improve customer perceptions about your company, which leads to increased sales.

The remaining initiatives can also increase efficiency and lower costs. Your company needs to determine which initiatives best serve its purposes. If you are keeping automation levels low so R&D projects complete more quickly, you might want to invest in areas that lower labor costs (for example, Quality Initiative Training). If your company is competing in the high technology segments, with high material costs, you might consider initiatives that reduce material costs (for example, Continuous Process Improvement).

The effects of the investments are cumulative, offering returns in the round they are made and each of the following rounds. To maximize the effect, companies should find complementary initiatives and invest in each of them. For example, to reduce material costs, companies should consider investing in both CPI Systems and GEMI TQEM Sustainability.

### 7.2.1 PROCESS MANAGEMENT INITIATIVES

These areas improve business procedures, resulting in improved efficiencies and cost structures:

- CPI (Continuous Process Improvement) Systems: Reduces material cost and to a lesser degree labor costs;
- Vendor/JIT (Just in Time [Inventory]): Reduces Material costs and Administrative overhead;
- QIT (Quality Initiative Training): Reduces labor costs;
- Channel Support Systems: Increases the effectiveness of the sales budget, and therefore demand;
- Concurrent Engineering: Reduces R&D cycle time, the time needed to move sensors on the Perceptual Map and to change MTBF specifications. R&D costs are determined by the length of time they require, therefore Concurrent Engineering also lowers R&D costs;
- UNEP Green Program: The United Nations Environment Program increases the effectiveness of the sales budget (customers prefer products made by socially responsible manufacturers), and therefore increases demand. Green programs also reduce waste and therefore material costs.

### 7.2.2 TQM INITIATIVES

These initiatives improve product quality while reducing the time and resources required to design, manufacture, warehouse and ship products.

- Benchmarking: Reduces Administrative overhead;
- Quality Function Deployment Effort: Reduces R&D cycle time and enhances the effectiveness of the Promotion and Sales Budgets;
- CCE (Concurrent Engineering)/6 Sigma Training: Reduces material costs and labor costs;
- GEMI TQEM Sustainability: The Global Environmental Management Initiative Total Quality Environmental Management initiative reduces labor costs as it minimizes environmental risks. These include production methods which protect employee health and redesign of products to have fewer toxic by-products. The initiative also reduces material costs, as it promotes recycling and other material use efficiencies.

### 7.2.3 S-SHAPED CURVE

For each initiative, returns for investments follow the shape of an S-curve (Figure 7.8 on page 25). That is, if you spend too little or too much, returns are modest.

If you spend less than \$500,000 between complementary initiatives in a single round, chances are you will see little return. An investment of \$1,500,000 between complementary initiatives in a single round produces a cost-effective cumulative impact: The slope at this point is at its steepest.

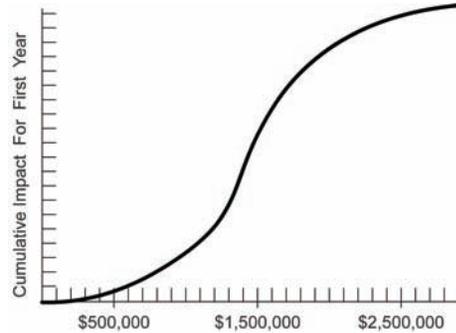


Figure 7.8 S- Shaped Curve

If you spend more than \$2,000,000 between complementary initiatives in a single round, the return on the investment over \$1,500,000 offers decreasing returns.

For example, an investment of \$1,700,000 in a single round produces a greater cumulative impact than a \$1,500,000 investment. However the slope begins to flatten at this point, and additional investment yields less and less additional impact.

Companies that invest in the same initiatives over two or three rounds (depending on the amount of money) will experience decreasing and eventually no returns for their investments.

Expenditures beyond \$5,000,000 over two or three years in complementary initiatives push well into diminishing returns.

For example, suppose a company wants to reduce the time required to complete R&D projects by investing in Concurrent Engineering and Quality Function Deployment. The most aggressive schedule would be \$2,000,000 this year (staying within acceptable diminishing returns); \$2,000,000 next year (which would not produce as much benefit, but would continue to improve R&D cycle time); and \$1,000,000 in the third year (which would reach the maximum possible benefit).

The projected impacts for the current year display in the TQM spreadsheet. As companies make decisions, worst-case/best-case sets of outcomes are predicted. These are also carried into the proformas. The spreadsheet can only offer a range of possible savings. Actual results appear the following round on page 12 of The Capstone® Courier in the HR/TQM Report.

### 7.3 LABOR NEGOTIATIONS

Labor negotiations are entered on the Human Resources spreadsheet. Negotiations can be viewed as exception events— sudden changes in the operating environment. Labor opens the contract offers from all of the companies, picks the most favorable terms, and uses them as a standard for negotiation with every company. This creates an opportunity for a low labor-cost company (due to automation and other investments) to impose higher labor costs upon other firms.

Labor and management negotiate over four separate categories:

- Hourly Wage
- Benefits
- Profit Sharing Percent
- Annual Raise

If the current contract expires during the year, your company establishes a bargaining position that is bounded by a Starting Position and Negotiation Ceiling.

The Starting Position (first) wage offer cannot be less than 80% or more than 150% of your current contract. The Starting Position for Benefits, Profit Sharing, and Annual Raise can be between 0% and 150% of your current contract.

The spreadsheet automatically enters a Negotiation Ceiling that is 10% above each Starting Position.

Each company will have its own Starting Position and Negotiation Ceiling for the four categories. The example below shows Hourly Wages Starting Positions and Negotiation Ceilings for three companies (illustrated in Figure 7.9):

- Company 1 has a Starting Position of \$16.00 and a Ceiling of \$17.60;
- Company 2 has a Starting Position of \$23.00 and a Ceiling of \$25.30;
- Company 3 has a Starting Position of \$24.00 and a Ceiling of \$26.40.



Figure 7.9 Labor Negotiation Ranges

Labor will ask for a 10% across the board wage and benefit increase. For example, if the wage were currently \$20.00 per hour, labor demands \$22.00 per hour.

However, if any of the Starting Position offers is higher than the 10% increase, labor will adjust its demand upward to match it. Company 3's Starting Position for wages is \$24.00, therefore labor now demands \$24.00 from all companies. Labor accepts Company 3's offer of \$24.00 per hour (Figure 7.10).



Figure 7.10 Company 3 Agreement: Labor ups its industry-wide hourly demand to \$24.00, and accepts Company 3's Starting Position of \$24.00.

If labor's demand is within the company's Starting Position and

Login to the Capstone Spreadsheet and click the Decisions menu. Select TQM/Sustainability. Investments are entered in the green cells. Projected impacts also display.

Process Management Initiatives		Budget (000)	Projected Cumulative Impacts	
CPI Systems	\$1,500	Total Current Expenditures: \$3,500 (000)	Material Cost Reduction	8.2% 8.2%
Vendor/JIT	\$8		Labor Cost Reduction	8.8% 8.1%
Quality Initiative Training	\$8		Reduction R&D Cycle Time	3.8% 3.9%
Channel Support Systems	\$8		Reduction in Admin Costs	8.8% 8.8%
Concurrent Engineering	\$8		Demand Increase	8.2% 8.3%
UNEP Green Programs	\$8			
TQM Initiatives				
Benchmarking	\$8			
Quality Function Deployment Effort	\$2,000			
CCE® Sigma Training	\$8			
GEMI TQEM Sustainability Initiatives	\$8			

## 7.4 Advanced Marketing

Negotiation Ceiling, negotiations lead to an agreement. Company 2's negotiators have instructions to issue a Starting Position of \$23.00 and a Negotiation Ceiling is \$25.30. Company 2's negotiation range brackets labor's demand. They will agree at \$23.50, halfway between the \$23.00 Starting Position and labor's demand of \$24.00 (Figure 7.11).

Company 1's Negotiation Ceiling is \$17.60. If the top of the Negotiation Ceiling is below labor's demand, labor strikes. At the end of the strike the two sides will settle halfway between the company's Negotiation Ceiling and labor's demand, or at \$20.80 (Figure 7.12). Strike lengths depend on the spread between positions.

The maximum length of a strike is 84 days, at which point both sides accept arbitration. Workers will strike approximately seven days for every:

- \$1.00 difference in wages
- \$300.00 difference in benefit package
- Percentage point difference in Profit Sharing
- Percentage point difference in Annual Raise



Figure 7.11 Company 2 Agreement: Company 2's Starting Position (\$23.00) and Negotiation Ceiling (\$25.30) bracket Labor's demand of \$24.00. Negotiators settle at a wage of \$23.50, halfway between \$23.00 and \$24.00— there is no strike.



Figure 7.12 Company 1 Strike Settlement: Company 1's Negotiation Ceiling of \$17.60 is less than Labor's demand of \$24.00. The workers strike (see Table 7.1). Eventually, a settlement is reached for at a wage of \$20.80.

Table 7.1 Example of a Negotiation Position and Resulting Strike Time: Note that the Annual Raise is 0% to 0%, this is because 110% of 0 is 0.

	Starting Position	Negotiation Ceiling	Demand	Contract	Approximate Strike Days
Hourly Wage	\$18.00	\$19.80	\$22.00	\$20.90	15
Benefits	\$2,500	\$2,750	\$2,750	\$2,625	0
Profit Sharing	1.5%	1.7%	2.2%	1.95%	4
Annual Raise	0.0%	0.0%	7.2%	3.6%	50
Total Days of Strike					69

Table 7.1 illustrates a strike example. Strikes always occur at the end of the year. If a strike is 46 days long, workers would picket from the middle of November to the end of December.

If you have inventory on hand during the strike, sales continue. R&D projects also continue.

### 7.3.1 TACTICS

You will need to determine which negotiation tactics best serves your purposes. Companies with low automation will want to control labor costs. They could offer the lowest acceptable wage, which is 80% of the current contract and eliminate all benefits. Companies with high automation might choose to be extremely generous with their workers, which will impose higher costs on their competitors (remember, labor looks at all offers and makes the highest offer part of their demand).

If a low wage/benefit tactic is employed, the labor turnover rate (and therefore recruiting costs) will increase. Also, if the Human Resource Module is activated, gains to the productivity index might be erased (see 7.1 Human Resources on page 21).

Login to the Capstone® Spreadsheet and click the Decisions menu. Select Human Resources to enter Negotiation Starting Positions for Wages, Benefits, Profit Sharing and Annual Raise.

The Human Resources area automatically calculates Negotiation Ceilings that are 10% above the Starting Positions.

	LABOR NEGOTIATION			
	Current Contract	Labor Demands	Negotiation Starting	Position Ceiling
Hourly Wage	\$21.00	\$23.10	\$20.00	\$22.00
Benefits	\$2,500	\$2,750	\$2,500	\$2,750
Profit Sharing %	2.0%	2.2%	2.0%	2.2%
Annual Raise	5.0%	5.5%	5.0%	5.5%

## 7.4 ADVANCED MARKETING

The Advanced Marketing Module allows companies to have greater control over their marketing budgets.

The website's Online Guide includes complete documentation for the Advanced Marketing Module.

Each product can be promoted via:

- Print Media
- Direct Mail
- Web Media
- Email
- Trade Shows

Sales budgets for each segment can be split among:

- Outside Sales
- Inside Sales
- Distributors

When the module is on, the awareness and accessibility numbers outlined on pages 13 and 14 do not apply.

Login to the Capstone® Spreadsheet and click the Decisions menu. When the Marketing module is activated an arrow appears to the right of Marketing. A submenu expands when the cursor passes over the arrow. Prices and Sales Forecasts for each product are entered on the Pricing & Forecasting spreadsheet. Selecting Promo Sales in the Marketing submenu opens the Marketing Budget Detail spreadsheet (alternatively, click the gray Promo Budget or Sales Budget buttons from the Pricing & Forecasting area).

## 8 SITUATION ANALYSIS

The Situation Analysis will help your company understand the current market conditions and how the industry will evolve over the next eight years.

An interactive version of the Situation Analysis is available in the Online Guide.

The analysis can be done as a group or you can assign parts to individuals and then report back to the rest of the company. These exercises require The Capstone Courier industry newsletter for Round 0. The Courier is available from two locations:

- On the website, login to your simulation then click the Reports link;
- From the Capstone Spreadsheet, click Courier in the menu bar.

The Courier available at the start of Round 1 displays the results for Round 0, when all companies are equal. If you access the report from the website, use the Round 0 Courier for the Situation Analysis.

The Situation Analysis has five parts:

- Perceptual Map
- Industry Demand Analysis
- Capacity Analysis
- Margin Analysis
- Consumer Report

### 8.1 PERCEPTUAL MAP

The Research & Development Department can use the Perceptual Map exercise to plan revision and invention projects that meet customers' shifting size and performance expectations. The Marketing Department can use the results during forecasting as they compare competing products and when determining prices (in general, better positioned products can command higher prices).

Each segment has a set of circles. The inner fine cut circles have a radius of 2.5 units. They represent the heart of the segments where demand is strong. In addition, each inner circle has an ideal spot, a location where demand is strongest. The larger outer

rough cut circles have a radius of 4.0 units. They represent the outer fringe of the segments where demand is weak (see Figure 3.1 on page 8).

#### 8.1.1 SEGMENT CENTERS AND SEGMENT DRIFT

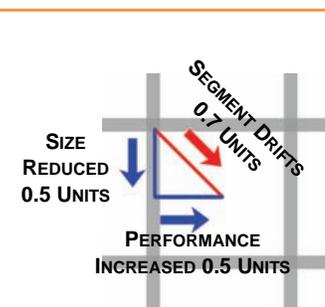
Table 8.1 shows the yearly drift rates for each segment. For example, the center of the Traditional segment ends Round 0 (the year before the start of the simulation) with a performance of 5.0 and a size of 15.0.

To these coordinates, add the performance coordinate drift rate of +0.7 (customers want better performing products) and subtract the size coordinate drift rate of -0.7 (customers want smaller products). At the end of Round 1 the center of the Traditional segment will have a performance of 5.7 and a size of 14.3.

The center of the High End segment ends Round 0 (last year) with a performance of 7.5 and a size of 12.5. The High End performance drift rate is +0.9 and the size drift rate is -0.9. At the end of Round 1 the center of the High End segment will have a performance of 8.4 and a size of 11.6 ( $7.5 + 0.9 = 8.4$  and  $12.5 - 0.9 = 11.6$ ). The segment center locations at the end of each round display in Table 8.2 on page 28.

Table 8.1 Segment Circle Drift Rates: Every year, customers prefer increased performance and decreased size.

Segment	Performance	Size
Traditional	+0.7	-0.7
Low End	+0.5	-0.5
High End	+0.9	-0.9
Performance	+1.0	-0.7
Size	+0.7	-1.0



Each year, the segments drift the length of the hypotenuse of the triangle formed by customers' desire for smaller and faster sensors.

In the Low End segment, size decreases and performance increases by 0.5 units, moving the segment center 0.7 units across the map.

## 8.1 Perceptual Map

Form 1 Segment Drift: The segment fine cut circles and centers for Round 0 are shown below. Using the information in Table 8.2, mark the Round 8 centers for each segment. Next, sketch fine cut circles with radiuses of 2.5 units around the Round 8 segment centers.

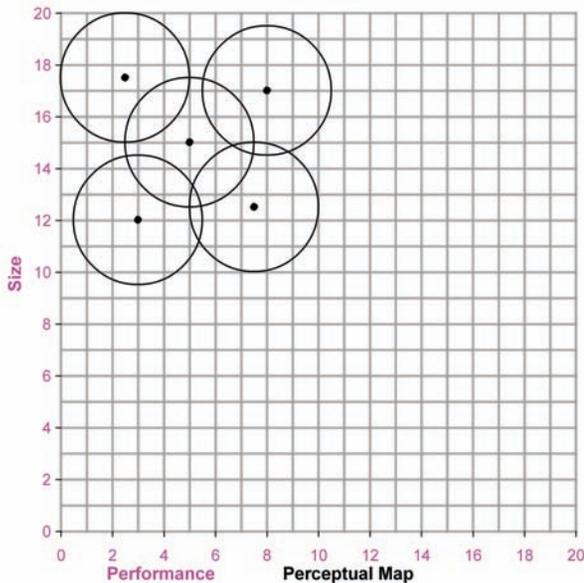


Table 8.2 Segment Centers at the End of Each Round: Note the drift rates vary for each segment. For example, the Performance segment is more interested in improved performance than decreased size and the Size segment is more interested in decreased size than improved performance.

Traditional			Low End			High End			Performance			Size		
Round	Pfmm	Size	Round	Pfmm	Size	Round	Pfmm	Size	Round	Pfmm	Size	Round	Pfmm	Size
0	5.0	15.0	0	2.5	17.5	0	7.5	12.5	0	8.0	17.0	0	3.0	12.0
1	5.7	14.3	1	3.0	17.0	1	8.4	11.6	1	9.0	16.3	1	3.7	11.0
2	6.4	13.6	2	3.5	16.5	2	9.3	10.7	2	10.0	15.6	2	4.4	10.0
3	7.1	12.9	3	4.0	16.0	3	10.2	9.8	3	11.0	14.9	3	5.1	9.0
4	7.8	12.2	4	4.5	15.5	4	11.1	8.9	4	12.0	14.2	4	5.8	8.0
5	8.5	11.5	5	5.0	15.0	5	12.0	8.0	5	13.0	13.5	5	6.5	7.0
6	9.2	10.8	6	5.5	14.5	6	12.9	7.1	6	14.0	12.8	6	7.2	6.0
7	9.9	10.1	7	6.0	14.0	7	13.8	6.2	7	15.0	12.1	7	7.9	5.0
8	10.6	9.4	8	6.5	13.5	8	14.7	5.3	8	16.0	11.4	8	8.6	4.0

Use the information in Table 8.2 and mark the location of each segment center for Round 8 onto Form 1. Next, sketch approximate fine cut circles (they do not have to be perfect) with radiuses of 2.5 units around each Round 8 segment center.

Remember, the locations in Table 8.2 are the centers of the segment circles, not product positions. Product positions are reported on page 4 of The Capstone® Courier.

The locations reflect the segment centers at the *end* of the round. Therefore, the Round 0 positions can be seen as the Round 1 *starting* positions, Round 2 positions can be seen as the Round 3 starting position, etc. Each month during the simulation year, the segment drifts 1/12th of the distance from the starting position to the ending position.

On Form 1, draw a line connecting the Round 0 High End segment center with the Round 8 High End segment center. Draw a line connecting the Round 0 Performance segment center with the Round 8 Performance segment center. Draw a line connecting the Round 0 Size segment center with the Round 8 Size segment center.

### 8.1.2 IDEAL SPOTS

Customer positioning preferences are reported in the Segment Analyses pages of The Capstone Courier. Within each analysis, the Buying Criteria box displays the ideal performance and size as of December 31 of the previous year. This ideal position is also called the ideal spot. If all other criteria are equal, a customer will prefer a product that is located nearer the ideal spot over a product that is located farther from it.

Some segments place a higher level of importance on positioning than others (see 2.2 Buying Criteria By Segment on page 6).

Table 8.3 Ideal Spot Offsets: Customers prefer products located this distance from the center of the segment circle.

Segment	Performance	Size
Traditional	0.0	0.0
Low End	-0.8	+0.8
High End	+1.4	-1.4
Performance	+1.4	-1.0
Size	+1.0	-1.4

Form 2 Segment Ideal Spot Locations

Traditional			Low End			High End			Performance			Size		
Round	Pfmm	Size	Round	Pfmm	Size	Round	Pfmm	Size	Round	Pfmm	Size	Round	Pfmm	Size
0	5.0	15.0	0	1.7	18.3	0	8.9	11.1	0	9.4	16.0	0	4.0	10.6
1	5.7	14.3	1	2.2	17.8	1	9.8	10.2	1	10.4	15.3	1	4.7	9.6
2			2			2			2			2		
3			3			3			3			3		
4			4			4			4			4		
5			5			5			5			5		
6			6			6			6			6		
7			7			7			7			7		
8			8			8			8			8		

Within each segment, the ideal spot is at a location relative to the center of the circle. These locations display in Table 8.3 and are illustrated in Figure 3.1 on page 8. For example, High End customers prefer products that have a performance that is 1.4 units bigger and a size that is 1.4 units smaller than the center of the segment circle. The center of the High End segment at the end of Round 1 has a performance of 8.4 and a size of 11.6. Therefore, the High End ideal spot at the end of Round 1 has a performance of 9.8 (8.4 + 1.4 = 9.8) and a size of 10.2 (11.6 - 1.4 = 10.2).

Use Table 8.2 and Table 8.3 to determine each segment’s ideal spot for Rounds 2 through 8. Enter the results in Form 2.

On Form 1, mark the Round 8 ideal spot for each segment.

## 8.2 INDUSTRY DEMAND ANALYSIS

The Industry Demand Analysis will help the Marketing and Production Departments anticipate future demand. Marketing can use the total demand for each segment as it creates its forecasts (see Forecasting on page 33). Production can use the results when making capacity buy and sell decisions.

You will need the Segment Analyses pages (pages 5 - 9) of The Capstone® Courier for Round 0.

At the top of each Segment Analysis page you will find a box called Statistics. Copy the Total Industry Unit Demand number into the Round 0 column of Form 3. Next, for each segment, multiply the Round 0 demand by the growth rate and add the result to the Round 0 demand. This

will give you a close approximation of Round 1 demand. Repeat this process for all eight rounds and enter the information in Form 3.

If you prefer, you can use the following shortcut. First, convert the growth rate percentage to a decimal:

$$\text{Traditional Segment Growth Rate} = 9.2\% = 0.092$$

Add 1 to the decimal:

$$1 + 0.092 = 1.092$$

Multiply the Round 0 Traditional demand by 1.092. This will give you a close approximation of Total Industry Demand for Round 1. Multiplying the Round 1 demand by 1.092 will give the Round 2 Total Industry Unit Demand, etc.

Remember, the demand numbers are in thousands! For example, if the Round 0 Total Industry Unit Demand for the Traditional segment reads 7,387, the Traditional Segment demanded 7,387,000 units.

Form 3 Industry Demand Analysis

Segment	Round 0	Growth Rate	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8
Traditional		9.2%								
Low End		11.7%								
High End		16.2%								
Pfmm		19.8%								
Size		18.3%								

### 8.3 Capacity Analysis

Form 4 Capacity Analysis

Segment	Product Name	First Shift Capacity		First & Second Shift Capacity		Automation Level	Cost to Double Capacity	Cost to Raise Automation to 10.0
		Company	Industry	Company	Industry			
Traditional		1,800		3,600		4.0	\$39,600,000	\$43,200,000
Low End								
High End								
Pfmm								
Size								

### 8.3 CAPACITY ANALYSIS

The Industry Demand Analysis indicates the sensor market is growing. The Capacity Analysis will help the Production and Finance Departments anticipate the cost of adding capacity and automation.

Enter the name of your company's product for each segment in the Product Name column of Form 4. You will find this information in the Production Analysis, page 4 of The Capstone® Courier for Round 0. The names of your products start with the first letter of your company's name. If you are not yet assigned to a company, use the Andrews Company information.

Next, find each product's First Shift Capacity in the Capacity Next Round column of the Production Analysis. This number (in thousands) indicates the number of sensors that can be built over the course of a year using a single, eight-hour shift. In Form 4, enter the Capacity Next Round into the column under First Shift Capacity, Company. Multiply the First Shift Capacity, Company by the number of active companies in your simulation (page 1 of the Courier displays each company name). This indicates the number of sensors that can be built for the segment by the entire industry using a single shift over the course of a year. Place the result in the First Shift Capacity, Industry column.

Production schedules that exceed the First Shift Capacity require hiring a second shift. Multiply the First Shift Capacity, Company by 2 and place the result in the First & Second Shift, Company column.

Multiply the First Shift Capacity, Industry by 2 and place the result in the First & Second Shift, Industry column. Copy the value for Automation Next Round from the Production Analysis into the Automation Level column.

Use the formulas below to calculate the cost to double capacity and the cost to raise automation to 10.0.

$$\text{Cost to Double Capacity} = \text{First Shift Capacity} * [\$6 + (\$4 * \text{Automation Level})]$$

$$\text{Cost to Increase Automation to 10.0} = \text{First Shift Capacity} * [\$4 * (10 - \text{Automation Level})]$$

---

Increases in capacity and changes in automation require a year to implement.

---

### 8.4 MARGIN ANALYSIS

Healthy margins, the difference between a product's manufacturing cost and its price, are critical to company success. The Margin Analysis will help the Research & Development Department understand the cost of material, and the Production Department understand the effect automation has on labor costs. It will also demonstrate to the Marketing Department the importance of adequate pricing, and to the Finance Department the upper limits of profitability.

Enter the name of your company's product for each segment in the Product Name column in the top part of Form 5 on page 31. You will find this information in the Production Analysis, page 4 of The Capstone Courier for Round 0. The names of your products start with the first letter of your company's name. If you are not yet assigned to a company, use the Andrews Company information.

Next, enter each product's price, material cost, labor cost, and note whether or not (Y/N) a second shift was used.

Calculate the Contribution Margin:

$$\text{Contribution Margin} = \text{Price} - (\text{Material Cost} + \text{Labor Cost})$$

Calculate the Margin Percentage:

$$\text{Margin Percentage} = \text{Contribution Margin} / \text{Price}$$

Enter the results from the above equations into the top part of Form 5 on page 31.

---

As a simplifying measure, the Margin Analysis does not include Inventory Carrying Costs in the Contribution Margin equation.

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**8.4.1 MARGIN POTENTIAL**

Use the bottom part of Form 5 to determine the margin potential. Go to the Buying Criteria on the Segment Analyses pages of The Capstone® Courier for Round 0 to find the maximum permitted price and the minimum acceptable MTBF (Mean Time Before Failure) for each segment (lowering the MTBF decreases material cost).

Determine the minimum Material Cost per segment using the following equation (see Table 8.5 for an example):

$$\text{Minimum Material Cost} = [(\text{Lowest Acceptable MTBF} * 0.30) / 1000] + \text{Trailing Edge Positioning Cost in Table 8.4}$$

Determine the minimum Labor Cost for each segment. Assume a base labor cost of \$11.20.

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\$11.20 is a rough estimate of the labor cost, it is used solely to illustrate the Margin Potential concept.

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$$\text{Minimum Labor Cost} = [\$11.20 - (1.12 * \text{Automation Ratings below})] + 1.12$$

- Traditional Automation: 8.0
- Low End Automation: 10.0
- High End Automation: 5.0
- Performance Automation: 6.0
- Size Automation: 6.0

Find the Contribution Margin dollars and Contribution Margin percent:

$$\text{Contribution Margin} = \text{Price} - (\text{Material Cost} + \text{Labor Cost})$$

$$\text{Margin Percentage} = \text{Contribution Margin} / \text{Price}$$

---

As a simplifying measure, the Margin Analysis does not include Inventory Carrying costs in the Margin Potential equation.

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Table 8.4 Material Positioning Component Costs: These costs are for the beginning of Round 1. They are used solely to illustrate the Margin Potential concept.

	Trailing Edge Cost	Leading Edge Cost
Traditional	\$3.80	\$7.80
Low End	\$1.00	\$5.00
High End	\$6.00	\$10.00
Performance	\$4.50	\$8.50
Size	\$4.50	\$8.50

Table 8.5 Minimum Material Costs For The Traditional Segment

Minimum Reliability Component Cost	$[(14,000 * 0.30) / 1000] =$ \$4.20
Trailing Edge Positioning Component Cost	\$3.80
<b>Total</b>	<b>\$8.00</b>

Form 5 Margin Analysis

	Product Name	Price	Material Cost	Labor Cost	Second Shift (Y/N)	Contribution Margin	
						\$	%
Traditional					N		
Low End					Y		
High End					N		
Performance					N		
Size					N		
Margin Potential		Maximum Price	Minimum Material	Minimum Labor		Contribution Margin	
						\$	%
Traditional		\$30.00	\$8.00	\$3.36	N	\$18.64	62%
Low End					N		
High End					N		
Performance					N		
Size					N		

---

The Trailing Edge Positioning Cost indicates the cost of material for products placed in the upper-left quadrant of the fine cut circle, where products are larger in size and slower in performance. Consequently, the material cost is less than for products at the Leading Edge (the lower-right quadrant), where size is smaller and performance is faster. These costs drift with the segments. See Figure 4.1 on page 12.

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## 8.5 Consumer Report

### 8.5 CONSUMER REPORT

The Consumer Report will help the Research & Development Department understand the need to design quality products and the Marketing Department the importance of adequate pricing, sales budget and promotion budget decisions.

You will need the Buying Criteria from the Segment Analyses pages and the Production Analysis in the Round 0 Courier.

Enter your ratings to the categories in Form 6.

**Price:** Award an A if your product's price is in the bottom third of the expected price range, B if it is in the middle third and C if it is in the top third. You can find the price in the Production Analysis.

**Reliability:** Award an A if the MTBF specification is in the top third of the range, B if it is in the middle third and C if it is in the bottom third.

**Age:** Award an A if the age on December 31 is within 0.5 years of the ideal age, B if the age is 0.6 to 1 year and C if the age is beyond 1 year.

**Positioning:** Award an A if your product is within 0.5 units of the segment's ideal spot, B if it is 0.6 to 1.5 units away and C if it is beyond 1.5 units.

**Awareness:** Award an A if your product's awareness exceeds 80%, B if it is 50% to 80% and C if it is below 50%.

**Accessibility:** Award an A if your product's accessibility exceeds 80%, B if it is 50% to 80% and C if it is below 50%.

In the Overall row, give your products an A only if the top two attributes in the Buying Criteria were rated A, and if the awareness and accessibility were rated at least a B.

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Form 6 analyzes the criteria that drive the Customer Survey scores (see The Customer Survey Score on page 7).

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Form 6 Consumer Report

Traditional		Low End		High End		Performance		Size	
Price	C	Price	B	Price	C	Price	C	Price	C
Reliability		Reliability		Reliability		Reliability		Reliability	
Age		Age		Age		Age		Age	
Positioning		Positioning		Positioning		Positioning		Positioning	
Awareness		Awareness		Awareness		Awareness		Awareness	
Accessibility		Accessibility		Accessibility		Accessibility		Accessibility	
Overall		Overall		Overall		Overall		Overall	

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## 9 FORECASTING

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Forecasting requires a little math and a little logic. For example, does your forecast predict your product will acquire half a segment's sales when there are four or five products in the segment? Unless your product's positioning, age and MTBF are significantly superior to the other products – and your price is at the low end of the range – it is not likely that you will acquire half the sales. Does your forecast predict you will take only one tenth of the sales when there are four or five products in the segment? Unless your product's positioning, age and MTBF are significantly inferior – and your price is at the high end of the range or above – chances are you can sell more.

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Forecasts are used by the proformas to calculate financial projections (see Proformas and Annual Reports on page 20). If you enter a forecast that is unrealistically high, the proformas will take that forecast and project unrealistic revenue.

If you do not enter values in the Your Sales Forecast cells, the proformas will use the Computer Prediction to project financial results.

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### 9.1 BASIC FORECASTING METHOD

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Last year's sales can be a good starting point for this year's forecasts. For example, if in the previous year your Traditional product sold 1,100,000 units without stocking out, you can look at the segment's growth rate and say "all things being equal, we can expect to sell 9.2% more units this year than last year."

$$1,100,000 * 0.092 = 101,200$$

Adding 101,200 to last year's sales of 1,100,000 units gives you a starting forecast for the upcoming year of 1,201,200 units.

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Each Statistics box on the Segment Analyses pages (pages 5 - 9) of The Capstone® Courier publish last year's demand and the segment growth rate. Multiplying last year's demand by the growth rate then adding the result to last year's demand will determine this year's demand.

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At the beginning of Round 1, the sale numbers from the previous year (Round 0) are equal for all companies. At the beginning of Round 2, the sale numbers from Round 1 will not be equal due to differences in product positioning, revision dates, prices, etc.

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If your product stocked out, calculate what it could have sold by multiplying the segment demand by the potential sales percentage reported on page 10 of the Courier, the Market Share Report. Next, multiply that by the segment growth rate.

Is this number valid? It is highly unlikely that the market in the upcoming year will be identical to the previous year. Prices will adjust, revision projects will complete– the

playing field will change. Still, this number can be a good departure point as you assess your product offer and speculate what your competitors will offer.

Keep in mind the possibility that your products sold because competitors who otherwise would have made sales under produced and stocked out. Page 10 of the Courier displays actual and potential sales as a percentage for each product. If your actual far exceeded your potential because your competitors under produced, you cannot count on them making the same mistake again.

### 9.2 QUALITATIVE ASSESSMENT

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Compare your product to others competing within the segment and decide whether it is better or worse than the competition. Start with the Courier Perceptual Map (page 11). It shows where products are currently placed. The Revision Dates at the bottom of the page reveal the timing of any future repositionings. Continue the comparison using the Courier's Segment Analyses (pages 5 - 9). These report each product's:

- Age– does the product satisfy customer age demands?
- MTBF– is reliability near the top of the range?
- Price– will price trends continue, or will new automation (displayed on page 4 of the Courier) facilitate a price reduction? (Remember, price ranges drop \$0.50 per year.)
- Awareness and Accessibility– are these percentages leading, keeping pace with or falling behind other products?

All these elements contribute to the monthly customer survey.

#### 9.2.1 DECEMBER CUSTOMER SURVEY SCORE

Will your product be better or worse than average? As an estimate, look at the December customer survey score in the lower part of each Segment Analysis. The Customer Survey drives demand each month. For example, if there are four products in December scoring 32, 28, 22, and 14 (for a total of 96), then the top product's December demand would be 32/96 or 33%.

$$\text{Top Product in Segment's Score} / \text{Sum of All Scores} = 32 / 32 + 28 + 22 + 14 = 32 / 96 = 33\%$$

What monthly customer survey scores will your product have during the year? The score will change from month to month because the segments drift, your product ages and it might be revised. Each monthly score is driven by how well your product satisfies the segment buying criteria, plus its awareness and accessibility levels. If the TQM/Sustainability module is on, some initiatives could increase the score. See "How is the Customer Survey Score Calculated?" in the Online Guide's FAQ|Reports section for more information on assessing your product.

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Any new products about to come to market must have a plant. Plant purchases are reported on the Production Analysis (Courier, page 4).

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### 9.3 Forecasts, Proformas And The December 31 Cash Position

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Consider whether or not the top products in the segment can meet customer demand. On the Production Analysis, examine the top products' capacities. Can they manufacture sufficient units? If not, you could have an opportunity to exploit.

8.2 Industry Demand Analysis on page 29 provides close approximations of segment demand for each round. Products can enter or leave the segments, however the demand projections will not change.

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### 9.3 FORECASTS, PROFORMAS AND THE DECEMBER 31 CASH POSITION

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On the proforma income statement, sales revenue for each product is based on its price multiplied by the lesser of either:

- The Your Sales Forecast entry (or, if none is entered, the Computer Prediction); or
- The total number of units available for sale (that is, the Production Schedule added to Inventory).

When a forecast is less than the total number of units available for sale, the proforma income statement will display an inventory carrying cost. When a forecast is equal to or greater than the number of units available, which predicts every unit will be sold, the carrying cost will be zero.

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The simulation charges a 12% inventory carrying cost.

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On the proforma balance sheet, under current assets, inventory reflects the dollar value of all unsold units. Cash reflects the amount left after all company payments are subtracted from the sum of:

- Total sales revenue reported on the proforma income statement;
- Stock, current debt and long term debt entries in the Finance spreadsheet.

The proforma balance sheet's cash position also displays as the Finance spreadsheet's December 31 Cash Position. Therefore, unrealistically high forecasts (or prices) will create cash predictions that are not likely to come true.

### 9.4 WORST CASE / BEST CASE

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If you wish, you can enter sales forecasts and production schedules that develop worst case / best case scenarios. Here is an example:

You generate a pessimistic forecast of 1,200,000 for your Traditional product, which predicts in the worst case monthly sales of 100,000 units. As a matter of policy, your management team might decide that manufacturing an additional three months worth of inventory, or 300,000 units, is an acceptable risk when compared to the potential reward of making extra sales.

In the Marketing spreadsheet, enter the worst case forecast of 1,200 in the Your Sales Forecast cell. In the Production spreadsheet, enter the best case of 1,500 in the Production Schedule cell (if inventory remains from the previous year, be sure to subtract that from the 1,500). At the end of the year, in the worst case you will have sold 1,200,000 units and have 300,000 units in inventory. In the best case you will have sold 1,500,000 units and have zero inventory.

The spread between the positions will show up as inventory on your proforma balance sheet. Your proforma income statement will also reflect the worst case for sales. In the Finance area, if the December 31 Cash Position is negative, adjust current debt, long term debt and stock issue entries until the December 31 Cash Position becomes positive. This will help ensure against an Emergency Loan.

To see your best case, return to the Marketing spreadsheet and enter 1,500 in the Your Sales Forecast cell then review the December 31 Cash Position. The actual results should lie somewhere between the worst and best cases.

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Entering Forecasts: Log into the Capstone® Spreadsheet and select Marketing under the Decisions menu. There are two forecasts per product. The Computer Prediction assumes your competition has mediocre products, and therefore is not reliable. The Your Sales Forecast column allows you to enter forecasts of your own.

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## 10 SIX BASIC STRATEGIES

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These six basic strategies can be the starting point for your own custom strategy.

### 10.1 COST LEADER WITH PRODUCT LIFECYCLE FOCUS

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A Cost Leader with a Product Lifecycle Focus centers on the High End, Traditional and Low End segments. We will gain a competitive advantage by keeping R&D costs, production costs and material costs to a minimum, enabling us to compete on the basis of price. Our product lifecycle focus will allow us to reap sales for many years on each new product we introduce into the High End segment. Products will begin their lives in the High End, mature into Traditional and finish as Low End products.

#### SAMPLE VISION STATEMENT

Reliable products for mainstream customers: Our brands offer value. Our primary stakeholders are bondholders, stockholders, customers and management.

### 10.2 DIFFERENTIATION WITH PRODUCT LIFECYCLE FOCUS

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A Differentiation with a Product Lifecycle Focus strategy concentrates on the High End, Traditional and Low End segments. We will gain a competitive advantage by distinguishing our products with excellent design, high awareness, easy accessibility and new products. We will develop an R&D competency that keeps our designs fresh and exciting. Our products will keep pace with the market, offering improved size and performance. We will price above average. We will expand capacity as we generate higher demand.

#### SAMPLE VISION STATEMENT

Premium products for mainstream customers: Our brands withstand the tests of time. Our primary stakeholders are customers, stockholders, management and employees.

### 10.3 BROAD COST LEADER

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A Broad Cost Leader strategy maintains a presence in all segments of the market. We will gain a competitive advantage by keeping R&D costs, production costs and material costs to a minimum, enabling the company to compete on the basis of price. Prices will be below average. Automation levels will be increased to improve margins and to offset second shift/overtime costs.

#### SAMPLE VISION STATEMENT

Low-priced products for the industry: Our brands offer solid value. Our primary stakeholders are bondholders, customers, stockholders and management.

### 10.4 BROAD DIFFERENTIATION

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A Broad Differentiation strategy maintains a presence in every segment of the market. We will gain a competitive advantage by distinguishing products with an excellent design, high awareness and easy accessibility. R&D competency is developed that keeps designs fresh and exciting. Products keep pace with the market, offering improved size and performance. Prices will be above average. Capacity is expanded as higher demand is generated.

#### SAMPLE VISION STATEMENT

Premium products for the industry: Our brands withstand the tests of time. Our primary stakeholders are customers, stockholders, management and employees.

### 10.5 NICHE COST LEADER (LOW TECHNOLOGY)

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A Niche Cost Leader Strategy concentrates primarily on the Traditional and Low End segments of the market. We will gain a competitive advantage by keeping R&D costs, production costs and material costs to a minimum, enabling the company to compete on the basis of price. Prices will be below average. Automation levels will be increased to improve margins and to offset second shift/overtime costs.

#### SAMPLE VISION STATEMENT

Reliable products for low technology customers: Our brands offer value. Our primary stakeholders are bondholders, stockholders, customers and management.

### 10.6 NICHE DIFFERENTIATOR (HIGH TECHNOLOGY)

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A Niche Differentiation strategy focuses on the High technology segments (High End, Performance and Size). We will gain a competitive advantage by distinguishing our products with an excellent design, high awareness, easy accessibility and new products. We will develop an R&D competency that keeps our designs fresh and exciting. Our products will keep pace with the market, offering improved size and performance. We will price above average. We will expand capacity as we generate higher demand.

#### SAMPLE VISION STATEMENT

Premium products for technology oriented customers: Our brands define the cutting edge. Our primary stakeholders are customers, stockholders, management and employees.

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## 11 BALANCED SCORECARD

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Instructors can activate a performance measurement tool called The Balanced Scorecard. Balanced Scorecards allow companies to gauge their performance by assessing measures in four categories:

- Financial– includes profitability, leverage and stock price;
- Internal Business Process– ranks, among other measures, contribution margin, plant utilization and days of working capital;
- Customer– examines the company’s product line, including how well it satisfies buying criteria and awareness/accessibility levels;
- Learning and Growth– evaluates employee productivity.

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### 11.1 GUIDING YOUR COMPANY

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The Internal Business Process and Customer perspectives can crosscheck company performance. For example, under Internal Business Process, a low score for Contribution Margin generally indicates the company is unprofitable– the company should look at its cost and pricing structures. Under the Customer perspective, a poor Buying Criteria score suggests the company should consider R&D projects to improve the product line.

As you enter decisions in the Capstone® Spreadsheet, projections of the Balanced Scorecard results for the upcoming year are available via the proforma menu. Scores from previous years are available on the website; login to your simulation then click the Reports link.

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