
LINKS Enterprise Management Simulation

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Table of Contents

| | |
|--|-----------|
| Chapter 1: Introduction | 3 |
| Chapter 2: Decisions | 8 |
| Chapter 3: Research Studies | 20 |
| Chapter 4: Decision Forms | 30 |
| Chapter 5: Financial Reports | 35 |
| Chapter 6: Performance Evaluation | 51 |
| Appendix: Web-Based LINKS Access | 54 |

Chapter 1: Introduction

"A company can outperform rivals only if it can establish a difference that it can preserve. Competitive strategy is about being different, deliberately choosing a different set of activities to deliver a unique value mix." – Michael Porter

In this simulation, your team manages a firm in the set-top box industry competing against other firms in your own simulated industry. Your goal in the LINKS Enterprise Management Simulation is to improve your firm's long-run financial performance.

As your team assumes managerial control at the end of quarter 3, your set-top box firm's product line consists of two products, a low-quality low-priced product 1 and a high-quality high-priced product 2 ("high-quality" or "higher-quality" to some customers, at least). Both products are profitable at the end of quarter 3, although profitability varies by product and market region. However, your firm's overall profitability has been declining through time. Thus, you and your LINKS management team will need to focus your collective efforts on turning around this profitability decline and, more generally, improving your firm's long-run financial performance.

All firms in your industry have been emulating each other for some time, so your competitors have exactly the same products, priced and marketed identically. While your firm and your competitors have had the identical marketing programs in place throughout quarters 1-3, there are some differences in market standing due to the normal randomness inherent in the sales generation process in the set-top box industry.

Within the LINKS Enterprise Management Simulation, your team's performance will be evaluated based on a multi-factor, balanced scorecard evaluation system (described in Chapter 6). Your instructor may require a written report of your strategies, tactics, and performance and/or a post-event public presentation of your team's actions, performance, and learnings in this simulation. Details about your particular post-simulation deliverables will be provided by your instructor.

Why Use Simulations?

"I hear and I forget; I see and I remember; I do and I understand." – Confucius

Why use simulations in management education? Why not use traditional classroom lectures, perhaps combined with case studies? Adults learn best by doing. "Doing" involves taking responsibility for one's actions, receiving feedback, and having an opportunity to improve through time. In management education and training settings, management simulations support learning in a non-threatening but competitive environment of the kind that real managers face every day.

Like an airline pilot flight simulator, a management simulator allows rapid time compression, quick feedback to the learner, and is a low-risk process (except to one's ego). A well-designed management simulator can provide the student with a realistic education and training experience in the relative safety of the simulation's operating environment. And, perhaps more

importantly, the lessons learned in the management simulator environment occur within hours or days, not the months, quarters, or years associated with real life.

Here are the classic reasons to favor management simulations in adult-learning environments. Compared to traditional lecture/case/discussion educational events, simulations:

- Reflect active not passive participation, enhancing learning motivation.
- Apply key management concepts, especially coordination and planning.
- Demand analysis and decisions in the context of market-based feedback in the presence of thoughtful, vigilant competitors.
- Provide rapid feedback, encouraging participants to learn from their successes and failures within a relatively low-risk competitive environment.
- Provide learning variety through novel learning environments.

The specific learning theme emphasized throughout the LINKS Enterprise Management Simulation exercise is **profitable enterprise management** (i.e., managing the whole enterprise for long-run profitability). Key sub-themes include:

- Strategy selection, planning, and execution
- Managing risk and uncertainty in a dynamic marketplace
- Matching demand and supply in the presence of vigilant competition
- Innovation management (and product development)
- Fact-based analysis and decision making.

Some General Advice About LINKS

"Predicting rain doesn't count; building arks does." – Warren Buffett

Based on extensive observations of the performance of thousands of past LINKS participants, these general suggestions and summary-advice nuggets are of well-proven value:

- Read and re-read this LINKS participant's manual (there's lots of good stuff in it).
- Regularly think about general business and management principles and how they might relate to and work within LINKS.
- You don't have to know everything about the LINKS set-top box industry at the beginning of the exercise, but you must consistently increase your knowledge-base through time.
- "Share toys" (i.e., work hard at sharing your useful fact-based analyses and important insights with all members of your LINKS team). "Knowing" something important personally is only a part of the LINKS management challenge. Exploiting that knowledge effectively throughout all of your LINKS team's deliberations, with and through your whole LINKS team, is the key to harvesting the maximum ROI from your data, facts, analysis methodologies, insights, and knowledge.
- Get the facts and base your decisions on the facts, not on wishes, hopes, and dreams.
- Continually strive to see the whole demand-supply chain within the LINKS set-top box industry. Don't focus myopically on a single part of the LINKS demand-supply chain without regard for how it relates to, and is influenced by, other LINKS parts and to the "whole" of LINKS. The source of the "LINKS" name is the simulation's focus on managing the interrelationships, the linkages, among all demand-supply chain elements.
- Remember the Klingon proverb (for Star Trek fans): "There is no honor in volume without profit." Volume, sales, and market share are easy to obtain, if there are no constraints on profitability. Profitable volume is the "holy grail" in business and in LINKS.

Completion of the LINKS Enterprise Management Simulation involves the following elements:

- (1) **Pre-Simulation:** Read/study the background information in this document. This will require several hours of time. You'll be working as part of a team in the LINKS Enterprise Management Simulation. While there's no need to meet with your teammates prior to the commencement of the simulation, it's important that you be personally prepared when the simulation begins.
- (2) **Within-Simulation:** In each LINKS decision round:
 - Review your financial and research studies reports with your team.
 - Analyze your firm's performance. How can you improve your firm's long-run financial performance? What research studies do you need?
 - One team member inputs your decision variable changes and research studies orders for the next quarter into the LINKS student software. This takes about 10 minutes; plan your team meeting time accordingly.
 - Submit your decision inputs for the next quarter by the scheduled time.
- (3) **Post-Simulation:** Within the LINKS Enterprise Management Simulation, your team's performance will be evaluated based on performance on a range of financial, operational, and customer-facing indicators (described later in the LINKS participant's manual). Your LINKS instructor may require a written report of your strategies, tactics, and performance and/or a post-event public presentation of your team's actions, performance, and learnings in this simulation. Details about your particular post-simulation deliverables will be provided by your LINKS instructor.

The suggested reading strategy for this LINKS Enterprise Management Simulation participant's manual is to:

- browse through the whole document to get a general feel for this simulation
- read this document once from beginning to end
- re-read parts of this document as necessary during the simulation exercise.

The Marketplace

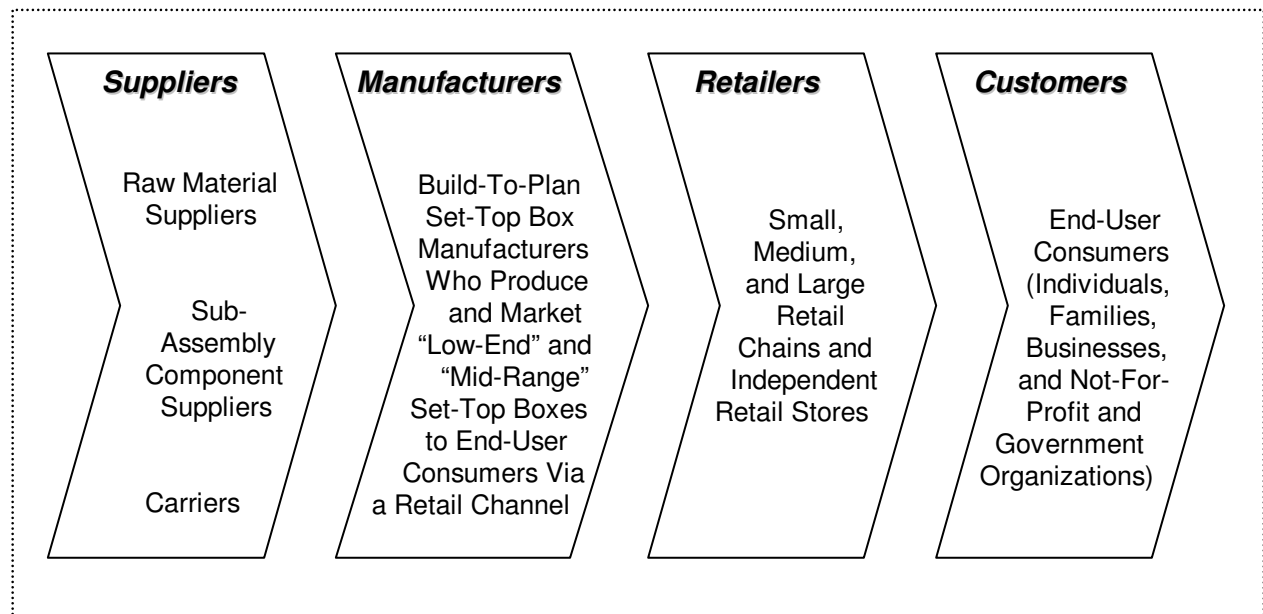
LINKS firms manufacture and market set-top boxes. A set-top box is a high-tech electronics product purchased by individual consumers for home use and by a wide range of businesses for office and manufacturing/operations environment uses. LINKS set-top boxes are "fourth generation" versions which include telephony applications (such as internet-based long-distance calling, interactive video conferencing, and interactive TV), local-area wireless networking, control/monitoring of a wide range of within-area electrical appliances and devices, digital media server, basic virtual reality, and teleportation enhancement capabilities.

Your particular set-top box sub-category is hyperware. Your firm has two products, referenced as "f-p" (for firm "f" and product "p"). For example, product 4-1 refers to product 1 of firm 4. Your manufacturing plant in market region 1 produces finished set-top boxes that are shipped to customers in all market regions served by your firm.

There is one sales channel in each LINKS market region: a retail (dealer./distributor) channel. The retail sales channel in each market region serves individual consumers who purchase set-top boxes for home use and businesses with set-top box needs. Retailers stock set-top boxes, along with an array of other similar and complementary electronic products. Retailers provide point-of-purchase support for in-person shoppers. In all regions, order processing costs of

\$4/unit accrue for sales in the retail channel.

The demand-supply chain architecture in the LINKS set-top box industry is described in the following graphic:



Your LINKS firm is a set-top box manufacturer. Your manufacturing firm distributes your products via retailers in each of your market regions. End-user customers (consumers) purchase set-top boxes from retailers.

Each LINKS decision round is one calendar quarter. There is no known time-of-year seasonality within the hyperware product sub-category of interest in LINKS.

The LINKS currency unit is the LCU, the "LINKS Currency Unit." The LCU is abbreviated "\$" and pronounced Ldollar ("el-dollar"). The "LINKS Currency Unit" (LCU) is a Euro-like multi-country currency.



Decision Environment

"Success doesn't come to you. You go to it." – Marva Collins

In the LINKS Enterprise Management Simulation, you'll be responsible for these decisions each decision round (quarter):

- **Product Development:** Product configuration/reconfiguration decisions.
- **Manufacturing:** Production and emergency production limit decisions.
- **Service:** Service outsourcing level in each region.
- **Generate Demand:** Price, marketing spending, and introduction/drop decisions for each product and region.
- **Forecasting:** Next-quarter sales volume forecasts for each product and region.
- **Other Decisions:** Firm name.
- **Research Studies:** Ordering specific research studies.

All decisions (except research studies decisions) are permanent standing orders in LINKS. If you're happy with a current decision, no explicit decision change is required.

Excel Spreadsheet Access To This Manual's Exhibits

This participant's manual for the LINKS Enterprise Management Simulation includes a large number of tabular exhibits. To facilitate convenient access to these exhibits for on-going referencing during your LINKS exercise, these exhibits have been included in an Excel spreadsheet. To access/download this Excel spreadsheet, point your favorite browser to this case-sensitive URL:

<http://www.LINKS-simulations.com/EM/ExhibitsEM.xls>

Chapter 2: Decisions

"Project Phases in All Organizations: (1) enthusiasm; (2) disillusionment; (3) panic; (4) search for the guilty; (5) punishment of the innocent; and, (6) praise and honors for the uninvolved." – Unknown

Set-Top Box Configurations

Each of your two set-top box products is defined by a configuration that is expressed as a six-character code with the following elements and interpretations:

- (1) Product form: "H" for hyperware
- (2) Raw material Alpha: 0-9 (number of kilograms)
- (3) Raw material Beta: 0-9 (number of kilograms)
- (4) Bandwidth: 1-7 (terahertz)
- (5) Warranty: 0, 1, 2, 3, or 4 (length of warranty in quarters)
- (6) Packaging: "1" (standard), "2" (premium), or "3" (environmentally sensitive premium packaging).

For example, H55321 is a hyperware set-top box with 5 kg of raw material Alpha, 5 kg of raw material Beta, bandwidth of 3 terahertz, warranty of 2 quarters, and standard packaging. Product configuration influences manufacturing and post-sale costs in known fashions (detailed below).

Hyperware set-top boxes require one Gamma sub-assembly component and one Epsilon sub-assembly component. A variety of suppliers provide sub-assembly components and alternative suppliers' offerings are fully interchangeable in manufacturing. Thus, since their particular "value" (supplier) doesn't impact configuration, sub-assembly components are not a formal part of the set-top box configuration.

You'll need to conduct appropriate research to assess customers' preferences for Alpha and Beta in set-top boxes. For bandwidth, warranty, and packaging, "more-is-always-better" for all customers and all markets. However, larger or smaller Alpha and Beta levels could be preferred by customers in particular market regions. Larger Alpha and larger Beta values are not necessarily preferred. Set-top box customers may prefer particular Alpha and Beta levels (not necessarily equal, of course), with deviations from preferred Alpha and Beta levels resulting in lower-quality customer perceptions.

FAQ

"Is it possible to have region-specific product configurations?" No, a product's configuration is the same in all LINKS markets. Each product may have only one configuration at a time. With varying regional customer preferences, the implication is that trade-offs may be required in meeting customers' heterogeneous preferences. It is, of course, possible to target a product's configuration toward the preferences of particular customers. But, that might be to the detriment of customers in other regions who prefer alternate configurations.

Product Costs

The goal of your management efforts in LINKS is to improve your firm's long-run performance. Product repositionings influence both revenues and costs. Costs are obviously easier to forecast than sales volumes and revenues, since costs arise from within-firm manufacturing

functions using existing technology. The following paragraphs provide relevant cost-related information that you'll need to take into account in your efforts to manage your LINKS firm.

Your input and manufacturing costs for hyperware set-top box products are as follows:

- **Raw Materials:** Raw materials Alpha and Beta are single-grade commodities purchased at common world prices. In-bound transportation costs are covered by raw material suppliers. All raw materials are always delivered for use within the current quarter's production activities. The current prices of raw materials are \$3/kg for Alpha and \$4/kg for Beta. Raw materials vendors provide inbound just-in-time transportation as part of their bundled prices, so you never have any raw materials inventory.
- **Sub-Assembly Components:** Gamma and Epsilon sub-assemblies cost \$17 and \$24 per unit, respectively. Customers (e.g., your firm) arrange and pay for the transportation associated with in-bound sub-assembly components. Gamma and Epsilon sub-assembly components cost \$4/unit and \$6/unit, respectively, for transportation. Sub-assembly component suppliers provide just-in-time service, so you never have to carry any inventory. Gamma and Epsilon sub-assembly have failure rates of 5.1% and 4.8% per quarter, respectively. These failure rates refer to in-field failure faced by customers. Note that a 1% failure rate is interpreted as a probability of 0.01 that a specific sub-assembly component fails in any quarter. These failure rates are especially relevant during your products' warranty periods when your firm must bear any costs associated with sub-assembly component failure.
- **Labor and Production:** Labor and production costs (per unit) for hyperware products are \$30 and \$20, respectively. There is a fixed cost per order (\$67,500) associated with setting up each production run at your firm's manufacturing plant.
- **Outbound Transportation Costs:** Customer shipment transportation costs per-unit for hyperware products sourced from your manufacturing plant in market region 1 are as follows: \$4, \$18, and \$26 per-unit for sales in market regions 1, 2, and 3, respectively.
- **Replacement Parts:** Sub-assembly components may fail as customers use their set-top boxes. Within each product's warranty period, replacement parts are provided without cost by set-top box firms. The cost of shipping replacement parts to end-users is 50% of the cost associated with shipping finished products to customers.
- **Bandwidth:** $\$10 + 0.5(T * T * T)$ where T is a product's terahertz rating. Bandwidth of 1 terahertz costs \$10.50 while bandwidth of 6 terahertz costs \$118. You have the engineering capability to include any level of bandwidth in your set-top box products, within the technology range 1-7. Bandwidth is a "more-is-better" attribute. Terahertz is just an industry-specific, generally-accepted metric describing the bandwidth performance of a set-top box. Customers will always prefer more bandwidth, but they might or might not prefer it enough to offset the additional bandwidth costs. You'd need to conduct appropriate research to assess customer preferences for higher bandwidth levels and then compare that preference to your input costs of providing higher bandwidth.
- **Warranty:** Set-top boxes may be configured with a warranty or with no warranty. With no warranty, there are no associated warranty costs. If you choose to offer a warranty, then the associated cost is $\$8 + 3(W * W)$, where W is the warranty length in quarters. For example, a one-quarter warranty costs \$11, a two-quarter warranty costs \$20, a three-quarter warranty costs \$35, and a four-quarter warranty costs \$56. Warranty coverage is outsourced to a reputable service provider in each market region. These warranty costs are paid directly to the outsourced warranty provider at the time the product is manufactured. Warranty costs do not depend on the failure rates of the sub-assembly components. Set-top box manufacturers are responsible for the costs associated with replacing sub-assembly components that fail in the field during the warranty period

associated with a set-top box product. **Warranties are honored in the original calendar quarter of sale plus the additional number of quarters of the warranty associated with a product's configuration.**

- **Packaging:** "1" (standard) packaging costs \$10 per unit, "2" (premium) packaging costs \$14 per unit, and "3" (environmentally sensitive premium) packaging costs \$28 per unit. More expensive, premium packaging presumably has positive generate demand implications and provides greater physical protection during shipping, resulting in somewhat reduced failure rates in the field (i.e., lower failure rates to customers). "3" packaging denotes premium packaging with environmentally sensitive design, construction, and materials.

Reconfigurations

Any change in the configuration of a set-top box is a product reconfiguration. **A reconfiguration involves a change in one or more of Alpha, Beta, bandwidth, warranty, and packaging.** Any configuration change incurs charges of \$1,000,000, plus an additional \$100,000 per configuration element that is changed. These costs cover all of the necessary engineering, retooling, testing, and administrative activities related to implementing the reconfiguration request. If you reconfigure a set-top box by changing three of its elements simultaneously, the total associated reconfiguration cost is \$1,300,000. **Reconfiguration occurs immediately, so the next quarter's production involves the reconfigured product.**

If you reconfigure a product, all of its current finished goods inventory is immediately sold off at a disposal sale with your receipts equaling 80% of the value of the finished goods inventory, as reported on your last quarter's balance sheet. The 20% loss is recorded as "Disposal Sales" on your financial statements. With no current finished goods inventory of a reconfigured product anywhere in your supply chain, you will obviously have to adjust your supply chain decisions to fill your supply chain with reconfigured product inventory. Note that dealers are responsible for their own inventories, once purchased. Thus, you do not have to pay dealers anything for their old inventories of just-reconfigured products.

Due to the workload associated with a reconfiguration, **you are limited to reconfiguring at most one product per quarter.** This single product reconfiguration may involve changing more than one element of a product's existing configuration.

Patents

"The best defense is to stay out of range." – Military Wisdom During Combat

Patent royalties are payable whenever a reconfigured product lies within the pre-existing protected patent zone for another hyperware set-top box product. In the quarter of reconfiguration, the protected patent zone is the sum of the absolute values of the Alpha, Beta, bandwidth, warranty, and packaging differences in two product configurations. For example, the product configurations H32111 and H45212 have a patent zone difference of $(4-3) + (5-2) + (2-1) + (1-1) + (2-1) = 6$.

Patent royalties are as follows: patent zone differentials of 0, 1, 2, 3, 4, 5, 6, and 7 points involve patent royalties of \$1,000,000, \$500,000, \$250,000, \$125,000, \$62,500, \$31,250,

\$15,625, and \$7,812. No patent royalties are payable for patent zone differentials of eight or more.

Patent royalties are one-time payments made by manufacturers of patent-violating reconfigured products. Patent royalties are only payable in the quarter in which a patent-violating reconfiguration occurs. Royalties are paid by patent-violating reconfigurations to competitors whose patents are violated. That is, one firm's "royalties paid" are another firm's "royalties received."

Some additional considerations about patent royalties follow:

- (1) No patent royalties are paid by or paid to original quarter-1 product configurations by other firms' quarter-1 product configurations. However, any reconfigurations violating still-existing patents of quarter-1 product configurations are subject to patent royalty payments according to the schedule described above.
- (2) Patent royalties are payable only to pre-existing patents, not to competitors' products reconfigured simultaneously with your reconfiguration (i.e., in the same quarter that you reconfigure a product).
- (3) Multiple patent zone violations are possible on any reconfiguration. The patent royalty payments described above are payable for each patent zone violation.
- (4) Patent royalties (receipts and disbursements) are reported on your "Corporate P&L Statement."

FAQ

"If we reconfigure immediately by just one 'unit' (e.g., change Bandwidth by 1), what are the patent royalty implications?" Such a minor reconfiguration would violate all other firms' existing patent protection (in that set-top box category), since all firms' products are initially configured identically in each set-top box category. Thus, there would be some fairly substantial patent royalties to pay with such a minor reconfiguration.

Manufacturing Decisions

"Nobody wants to have inventory, but everybody wants a product there when they want it." – Joe Chernay, Vice-President of Manufacturing and Technology, Bayer Corporation, <http://www.industry.net/discussions/supplychain.htm>

In the LINKS Enterprise Management Simulation, you're responsible for production and emergency production limit decisions for each of your products in each quarter.

Production of each product can change by a maximum of 25,000 units from the previous quarter's value. Production may be changed to 0 units at any time, but you'd be limited to a maximum production of 25,000 units in the following quarter due to load balancing requirements associated with long-term capacity utilization and labor force overtime scheduling requirements.

In addition to order-related and unit-related costs, your firm absorbs costs associated with depreciation and maintenance of your set-top box plant capacity. These costs are \$300,000/quarter for each production "shift" and they are recorded as "Plant Capacity FC" (plant capacity fixed costs) on your "Corporate Current P&L Statement." These costs are

allocated equally among your products.

A production "shift" can accommodate up to 50,000 production units. If total production across all products (including regular and emergency production) is less than 50,000 units per quarter, then only one production shift is needed that quarter, and the associated costs are \$300,000. If total production across all products (including regular and emergency production) is 50,001 to 100,000 units, then two production "shifts" are needed in that quarter, with associated costs of \$600,000. The LINKS software automatically schedules the appropriate number of production "shifts" based on total production. There must always be at least one production "shift" capability at all times, even if total production is zero units.

Emergency production is a maximum of 25,000 units per product. If end-user demand exceeds available inventory plus your emergency production limit, additional end-user demand becomes unfilled orders. There is a \$2/unit cost for standby charges associated with all emergency production limits for hyperware. These standby charges are levied regardless of whether you use the specified emergency production limits. Emergency production costs are recorded under "Emergency Production" on the "Corporate P&L Statement."

If finished goods inventory is insufficient to meet demand, an emergency production order is executed automatically up to the product's specified emergency production limit. Emergency production orders have a 50% cost premium associated with them (i.e., labor and production costs are 50% higher than standard) for emergency production volumes up to the limit of the product's specified emergency production limit. For emergency production for any product in excess of 12,500 units, the production and labor costs premiums are 100% above standard rates.

You have complete control over whether you wish to use emergency production for any product. If you set a product's emergency production limit to 0, then unfilled orders result. You'll need to assess the relevant trade-offs between emergency production and unfilled orders.

Unfilled Orders

Unfilled orders can exist in your set-top box industry. If demand for any product exceeds the product's emergency production limit, customer sales and scheduled product shipments to other DCs must be reduced (proportionately) by the amount that orders exceed the product's emergency production limit. The difference between potential customer sales (orders) and

FYI: Why Hold Inventory?

Cost considerations argue for low inventory. But, there are reasons for holding inventory:

- *To create buffers again the uncertainties of supply and demand.*
- *To take advantage of lower purchasing and transportation costs associated with high volumes.*
- *To take advantage of economies of scale associated with manufacturing products in batches.*
- *To build up reserves for seasonal demands or promotional sales.*
- *To accommodate products flowing from one location to another (work in progress or in transit).*
- *To exploit speculative opportunities for buying and selling commodities.*

Source: Jeremy F. Shapiro, *Modeling The Supply Chain* (Pacific Grove, CA: Duxbury, 2001), p. 477.

actual customer sales due to inadequate on-hand finished goods inventory (after accounting for a product's emergency production limit) is "unfilled orders" in LINKS.

Unfilled orders are not backlogged orders. Unfilled orders are not guaranteed (i.e., contracted, pre-paid) future sales. Unfilled orders occur at a particular moment in time due to inventory shortages relative to potential customer demand (orders), given competitive conditions at that particular moment in time.

Unfilled orders incur additional processing and handling costs of \$25/unit.

Past experience suggests that current unfilled orders reflect three types of set-top box customers. Some customers immediately defect to another competitor's (available) product. Other customers decide not to buy any set-top product now or in the near-term future. A third segment of customers are inclined to wait and attempt to repurchase the preferred product having these unfilled orders again in the future when supply (i.e., inventory availability) is more favorable. The size of these three types of unfilled-orders customers is unknown. In all cases, however, it should be expected that unfilled orders negatively impacting downstream demand to some extent.

If competitive conditions change (e.g., if you raise your unfilled-orders product's price dramatically or competitors substantially improve their own product offerings and marketing programs), then the share of customers with unfilled orders who would have been inclined to attempt to repurchase your unfilled-orders product in the future can decrease. Additionally:

- If you drop a product with unfilled orders from active distribution in a particular region, the unfilled orders associated with that product in that particular region are completely lost. They will not shift to another product.
- If you reconfigure a product with outstanding unfilled orders, those unfilled orders are lost.

Unfilled orders represent additional potential demand that might have been realized beyond "filled orders" (i.e., sales) if sufficient product supply had been available to meet all customer purchase requests. A high level of unfilled orders could also reflect industry-wide double-counting if multiple firms' products simultaneously have unfilled orders. If two products simultaneously have unfilled orders, then some customers might have wished to purchase first one of the products and then the other product when the stockout situation for the first product was encountered. In such a situation, a single customer would have been counted as an unfilled order by both stocked-out products.

For an indirect (retail) channel, inventory buffer stock routinely maintained by retailers complicates the interpretation of unfilled orders. If retailers order 1,000 units from a manufacturer but that manufacturer is only able to fill 600 units of that order, this represents 400 units of unfilled orders to the manufacturer. However, this doesn't necessarily mean that retailers have unfilled orders from end-user customers. If the 600 units of the retailers' manufacturer-order yield sufficient on-hand retailer inventory to permit all end-user customer orders to be filled, then there are no unfilled orders as far as retailers are concerned. (In this case, retailers' ending inventory level would be below the desired level, which presumably would lead to increased orders in the following quarter to meet expected end-user customer demand plus inventory restocking targets.) With the buffering nature of retailer inventory, there could be no industry-wide unfilled orders but individual manufacturers could still have unfilled orders.

If dealers stockout, they will reorder in anticipation of future (continuing) rising demand above current sales levels, as well as having to account for their (i.e., dealers') future desired inventory levels. These are the total unfilled orders that manufacturers see arising from industry-wide unfilled orders, as reported in Research Study #12, reference actual final end-user customer stockouts now (not in the future). Since industry-wide unfilled orders are customer-based, industry-wide unfilled order estimates presumably are based on customer surveys. Such survey-based estimates contain some statistical noise as well as reflecting the potential for biases in customer surveys, especially if there are lots of customers who encountered stockout situations. Thus, even a thoughtful/rational survey respondent might claim to have wanted to buy and encountered a stockout situation, to encourage manufacturers to have more plentiful inventory, especially when no contractual purchase commitment is required within the survey.

Price Decisions

You set prices for each actively distributed product in each market region. The dealer/retail channel price is the bulk-rate price for all units purchased for resale by dealers/retailers. The custom in the set-top box industry is to quote a single price regardless of order volume.

You do not control final selling prices in the retail channel. Rather, your manufacturer price is marked up by some percentage amount by retailers in the various market regions. You will need to consult current research studies to determine average dealer prices for your products in the various market regions.

Prices affect customer demand in the usual fashion within the set-top box industry. Higher prices are normally associated with lower customer demand. The specific price sensitivities in the markets in LINKS are unknown. You will need to learn about the markets' responsiveness to price through your experience in LINKS and by exploiting available research studies.

In addition to the physical costs of producing and distributing updated price sheets, lists, and databases that accrue when a manufacturer changes price (so-called "menu costs"), a range of indirect and non-obvious costs arise with price adjustments.¹

- **Managerial Costs:** A manufacturer must gather information, analyze, assess, and ultimately communicate the logic associated with price changes throughout their firm. Managerial costs presumably increase with larger price changes, since there is more to assess/analyze and more organizational members become involved with larger price changes.
- **Customer-Facing Costs:** When implementing price changes, a communications program must be created and executed to portray a price change in the most favorable light to

¹ Recent published research documents the range of direct and indirect costs associated with price adjustments for a large U.S. industrial manufacturer (more than one billion USD\$ revenues selling 8,000 products [used to maintain machinery] through OEMs and distributors). The authors found that managerial costs are more than 6 times, and customer-facing costs are more than 20 times, the so-called "menu costs" (physical costs) associated with price adjustments. In total, price adjustment costs comprise 1.22% of the company's revenue and 20.03% of the company's net margin. {Source: Mark J. Zbaracki, Mark Ritson, Daniel Levy, Shantanu Dutta, and Mark Bergen, "Managerial and Customer Costs of Price Adjustment: Direct Evidence From Industrial Markets," *The Review of Economics and Statistics*, Volume 86, Number 2 (May 2004), pp. 514-533.}

customers. In a B2B environment, price adjustments potentially involve (re)negotiation with those customers who are resistant to new (higher) prices.

In LINKS, each price change by your manufacturing firm for a product in a market region results in \$10,000 in costs **plus** \$200 in costs per-dollar change in price (increase or decrease in price) **plus** costs of 0.25% of current-quarter revenues.² For example, a \$75 change in price on a product with revenues of \$4,500,000 in a particular region incurs price change costs of $\$10,000 + (\$200)(75) + (0.0025)(\$4,500,000) = \$10,000 + \$15,000 + \$11,250 = \$36,250$. These price change costs are recorded as "Price Changes" in the "Fixed and Other Costs" section of your firm's profit-and-loss statements in the quarter in which the price change occurs.

It's very easy to drop price to attempt to increase demand. However, it's always an interesting question whether that increased demand actually increases profits. Remember, **the price decrease that generates increased demand also reduces your margin on each unit sold**. More importantly, it's easy for competitors to see and feel threatened by a price change.

Price wars are often initiated by thoughtless price manipulations of naive managers who assume that competitors won't notice, won't respond, or respond ineptly. To provide a fact-based approach for making pricing decisions, please refer to the "Pricing Worksheet" on the following page. Complete this "Pricing Worksheet" anytime you're planning to reduce prices. Review the worksheet details with your teammates. After this review, go ahead with the price decrease if you really think that it's appropriate. Review this "Pricing Worksheet" again after you receive next quarter's financial results to verify whether your assumptions/predictions were reasonable.

Marketing Spending Decisions

A marketing spending budget is required for each set-top box product in each market region. This budget is managed by your firm's relevant region managers and is used for advertising, promotion, and sales force efforts associated with your products. You are free to allocate funds to marketing spending as you see fit. Marketing spending does not have to be equal in all regions.

Marketing spending is thought to increase customer demand for set-top boxes. Past industry practice has been to budget at least \$50,000/quarter in marketing spending in all regions within which a set-top box product is actively distributed. It is thought that marketing spending's impact on customer demand declines at higher expenditure levels, but the precise relationship between marketing spending and sales is unknown. You will have to learn about marketing spending's influence on sales through your experience within the set-top box industry.

If you drop a product from a region, you must change marketing spending to \$0. Otherwise, marketing spending continues to occur, in anticipation of a future relaunch.

² Price change costs only accrue for products that are already actively being sold in a region. No price change costs accrue for price changes for a product as it is being introduced into region (i.e., it was inactive in that region in the last quarter).

Pricing Worksheet

This pricing worksheet is designed to provide an analysis framework anytime you are contemplating decreasing prices within LINKS.

Complete the "Before" columns and review the "Before" columns with your team members. Complete the "After" column with actual data from the next quarter, after the results are available. Review the before-after comparison with your team members.

| | |
|------|--|
| Firm | |
|------|--|

| | |
|---------|--|
| Product | |
|---------|--|

| | |
|--------|--|
| Region | |
|--------|--|

| | |
|---------|--|
| Quarter | |
|---------|--|

| | Before Action Analysis, Review, and Forecast | | After Action Review |
|-------------------------------|---|-------------------------------|-------------------------|
| | Last Quarter, Actual | Next Quarter, Predicted | Next Quarter, Actual |
| Industry Sales Volume [units] | | | |
| * Volume Market Share [%s] | | | |
| = Sales Volume [units] | | | |
| * Manufacturer Price [\$] | | | |
| = Revenue [\$] | | | |
| - Variable Costs [\$] | | | |
| = Gross Margin [\$] | | | |
| - Fixed Costs [\$] | | | |
| = Operating Income [\$] | | | |

Introduction/Drop Decisions

You may introduce products into regions not currently active or drop products from regions as you wish. Introduction incurs a one-time cost of \$750,000 in any region. Dropping a product from active distribution in a region incurs no special costs. Introduction costs are recorded under "Introductions" on your financial statements.

- To "activate" a product in a region, issue a specific introduction decision. Change the "Active Product?" status to "Yes" to introduce a product into a specific region. To drop a product from active status in a region, change its "Active Product?" status to "No." **You only introduce a product into a region once. Once a product is active in a region, it continues to be active until you make an explicit drop ("No") decision.**
- You must explicitly introduce or drop a product from a region, regardless of your marketing spending and your sales volume forecasts. Setting marketing spending to zero does not result in the associated product being dropped from that region.
- If you drop a product from a region, you must change marketing spending to \$0. Otherwise, marketing spending continues to occur, in anticipation of a future relaunch.

Your firm has a policy of limiting simultaneous new product-region launches to a maximum of three in any quarter. A reconfiguration isn't a launch if that product is already actively distributed in a region.

Service Decisions

Service is outsourced in the LINKS Enterprise Management Simulation. Service outsourcing is provided by reputable call-center service providers in each LINKS region. You may choose from among the four available service outsourcing options/levels in each region, in addition to level "0" ("None" which implies no service is provided). Their per-call costs and associated guaranteed service quality performance levels ("SQ Guarantee") are detailed below:

| Service Outsourcing Level | | Region 1 | Region 2 | Region 3 |
|---------------------------|--------------|----------|----------|----------|
| "Minimum" [1] | Cost/Call | \$6 | \$7 | \$8 |
| | SQ Guarantee | 10% | 10% | 10% |
| "Standard" [2] | Cost/Call | \$10 | \$12 | \$13 |
| | SQ Guarantee | 20% | 20% | 20% |
| "Enhanced" [3] | Cost/Call | \$16 | \$18 | \$21 |
| | SQ Guarantee | 30% | 30% | 30% |
| "Premium" [4] | Cost/Call | \$24 | \$27 | \$32 |
| | SQ Guarantee | 40% | 40% | 40% |

Service-center outsourcers guarantee that perceived service quality won't vary by more than 3% from these long-run averages in any quarter. Costs for call-center service outsourcing are reported as "Service Outsourcing" on your financial and operating reports.

Sales Volume Forecasting Decisions

Forecasting prowess reflects understanding of the generate demand drivers of any business.

In LINKS, region-specific quarterly sales volume forecasts are required for each product.

Administrative overhead costs increase by 1% for every 1% inaccuracy in your sales volume forecasts. For example, a forecast error of 10% (whether positive or negative) increases the associated administrative costs for that product in that region by 10%. The maximum penalty associated with sales forecasting inaccuracy is a doubling of current administrative overhead.

Forecasting accuracy equals $100 \times (1 - (\text{abs}(\text{Forecast} - \text{Actual}) / \text{Actual}))$ expressed in percentage terms, where "abs" is the absolute value function. Thus, a forecast value of 11,000 and an actual value of 8,000 results in a forecast accuracy of $100 \times (1 - (\text{abs}(11,000 - 8,000) / 8,000)) = 100 \times (1 - (3,000 / 8,000)) = 100 \times (1 - 0.375) = 62.5\%$. The minimum possible value of forecasting accuracy is 0.0%. For example, with an Actual sales volume of 8,000, a Forecast above 16,000 results in a forecasting accuracy score of 0.0%.

Given the importance of forecasting in running your LINKS business, you might find that reading the following article has a positive return on your reading-time investment:

- J. Scott Armstrong, "The Forecasting Canon: Generalizations To Improve Forecast Accuracy," **FORESIGHT: The International Journal of Applied Forecasting**, Volume 1, Issue 1 (June 2005), pp. 29-35.
http://www.forecastingprinciples.com/paperpdf/The_Forecasting_Canon.pdf

The following page contains a judgmental sales forecasting worksheet that provides a template for systematically approaching the sales forecasting process. Judgmental adjustments are challenging, but at least you're explicitly taking into account that your generate demand program changes, and those of your competitors, influence your sales.

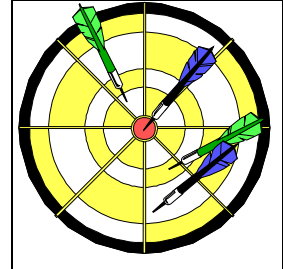
Firm Name

Your firm may choose a firm name (a maximum of 40 characters). This firm name is printed on the top of all financial, operating, and research reports. Firm names have no cost or known demand-side implications, so you are free to choose (or change) your firm's name as you wish.

Judgmental Sales Forecasting Worksheet

Sales forecasting drives everything in demand and supply chains. Unfortunately, sales forecasting is extraordinarily challenging due to the many factors influencing your sales (your current and recent generate demand programs, current and recent competitors' generate demand programs, and exogenous market forces).

Here's a judgmental sales forecasting process that, at a minimum, provides an organizational template to systematically approach the sales forecasting process. Judgmental adjustments are challenging, but at least you're explicitly taking into account that your generate demand program changes, and those of your competitors, influence your sales.



- **Step 1** (the "easy" part): Construct a trend-line extrapolation of past sales realizations based on a crucial assumption: future market and environmental forces will continue as they have existed in the recent past. Be watchful for structural considerations like channel loading (forward buying), unfilled orders, and backlogged orders.
- **Step 2** (the "hard" part): Make adjustments for planned changes in your generate demand programs. The potential impacts of changes in product, price, distribution, communications, and service on your sales must be quantified.
- **Step 3** (the "subtle" part): Account for foreseeable competitors' changes in their generate demand programs. It's easy to overlook competitors in forecasting. Assume that competitors are vigilant and thoughtful and present.

| | | |
|-------------------------|---|--|
| 1 | Trend-Line Extrapolation of Past Sales Realizations (Base-Line Forecast) | |
| 2 | Adjustments For Planned Changes In Generate Demand Program (list specifics, with judgmental estimates of sales impacts [<i>expressed in +/- %s</i>]) Product Changes Price Changes Distribution Changes Communications Changes Service Changes | |
| 3 | Adjustments For Foreseeable Changes In Competitors' Generate Demand Programs (list specifics, with judgmental estimates of sales impacts [<i>expressed in +/- %s</i>]) Product Changes Price Changes Distribution Changes Communications Changes Service Changes | |
| Adjusted Sales Forecast | | |

Chapter 3: Research Studies

"Time spent in reconnaissance is seldom wasted." – Sun Tzu, 4BC

Research studies requests are submitted along with your other decision variable changes. Although LINKS research studies are ordered prior to the beginning of the next quarter, research studies are executed during and after the next quarter, as appropriate. Thus, research studies reports always reflect the just-completed quarter's experience.

- The following research study descriptions include sample output to illustrate the style and formatting of research study output. The output should not be viewed as providing any specific insight into your particular set-top box industry.
- The existence of any particular LINKS research study is not an endorsement that such a research study is important, relevant, or even useful to the management of your LINKS firm. Rather, the inclusion of these research studies in LINKS reflects their real-world existence in a wide variety of industries and product/service categories. You must form your own opinion about the relative merits of these LINKS research studies and, in particular, whether each research study's potential value exceeds its monetary cost.

Which research studies should you purchase and when? Snappy but uninformative responses would be "purchase only research that you really need" and "it depends." Unfortunately, these responses are not very constructive. There are no universal answers about appropriate, needed, and desirable research studies, other than the principle that research is about uncertainty reduction. What don't you know? How important is it to "know" these things? Is there any research that might be conducted in a timely fashion to reduce this uncertainty?

Excellent strategy can only be developed based on excellent analysis. Since research provides the raw data for excellent analysis, research should be an important component of your decision-making process. Do not relegate your research studies pre-ordering decisions to the last five minutes of team meetings. Rather, treat research studies ordering decisions as a fundamental part of your whole LINKS decision-making process.

Research Study #1: Benchmarking - Earnings

Purpose: This research study provides earnings benchmarks for your industry. The current-quarter earnings, cumulative-to-date earnings, and current-quarter dividends of each firm in your industry are reported. In addition, a variety of financial market statistics are reported.

Information Source: These data are based on public information.

Cost: \$500.

Sample Output

```
=====
RESEARCH STUDY # 1 (Benchmarking - Earnings)
=====
```

| | Current Net Income | Cumulative Net Income | Current Dividends |
|--------|-----------------------|--------------------------|----------------------|
| Firm 1 | 2,974,292 | 5,788,265 | 892,287 |
| Firm 2 | 3,472,461 | 6,234,171 | 1,041,738 |
| ... | | | |

Financial Market Statistics [stock price, shares outstanding (millions), earnings per share, dividends per share, market capitalization (\$millions)]

| | Firm 1 | Firm 2 | Firm 3 | Firm 4 |
|------------|--------|--------|--------|--------|
| StockPrice | 120.00 | 131.80 | 117.63 | 123.96 |
| Shares | 2.0M | 2.0M | 2.0M | 2.0M |
| ... | | | | |

Research Study #2: Benchmarking - Balance Sheets

Purpose: This research study provides summary balance sheet benchmarks for your industry. These balance sheets must be requested for specific firms in your industry.

Information Source: These summary balance sheets are provided by your research supplier based on public information.

Cost: \$1,000 per firm.

Additional Information: These summary balance sheets contain the level of information available from public sources. For example, aggregate inventory levels are reported, but there is no disaggregation of aggregate inventory information by product.

Sample Output

```

=====
RESEARCH STUDY # 2 (Benchmarking - Balance Sheets )
=====
-----
FIRM 2 BALANCE SHEET
-----
ASSETS:
Cash 1,686,016
Marketable Securities 24,186,533
Finished Goods and Postponed Production Inventory 25,661,228
Plant Investment 50,000,000
Procurement Inventories 1,398,909
Total Assets 102,932,686
LIABILITIES AND EQUITIES:
Corporate Capitalization 100,000,000
...
    
```

Research Study #3: Benchmarking - Product Development

Purpose: Current configurations are reported for all actively-sold products. The last quarter in which each product was reconfigured is reported, with quarter "0" referencing reconfigurations which occurred prior to quarter 1.

Information Source: These research study results are based on reverse engineering efforts by your research supplier.

Cost: \$1,500 per competitor product.

Sample Output

```

=====
RESEARCH STUDY # 3 (Benchmarking - Product Development )
=====
Product 1-1H Configuration: H35112 [reconfigured in quarter 3]
Product 1-2H Configuration: H73212 [reconfigured in quarter 8]
Product 2-1H Configuration: H11111 [reconfigured in quarter 0]
...
    
```

Research Study #9: Benchmarking - Generate Demand

Purpose: This research study provides generate demand benchmarks for your industry. Price and marketing statistics (minimum, average, and maximum) for each product category and market region are provided.

Information Source: This research study is based on information sharing and pooling agreements among all firms in the set-top box industry administered by the Set-Top Box Industry Trade Association.

Sample Output

```

=====
RESEARCH STUDY # 9 (Benchmarking - Generate Demand )
=====
Quarter 55 Quarter 56 Quarter 57 Quarter 58
-----
HYPERWARE
REGION 1
min/ave/max
Price [$] 435 520 657 431 554 689 437 542 662 429 542 662
Mktg [$K] 100 161 300 0 183 300 0 157 300 0 181 326
...
    
```

Cost: \$5,000.

Research Study #11: Benchmarking - Operating Statistics

Purpose: This research study provides a variety of operating statistics benchmarks for your industry. Various "Corporate P&L Statement" figures are reported as percentages of revenues for your firm and for three industry aggregates (minimum, average, and maximum). Average CSR monthly salary in all regions is reported. In addition, industry-wide call center statistics are reported.

Information Source: This research study is based on information sharing and pooling agreements among all firms in the set-top box industry administered by the Set-Top Box Industry Trade Association.

Cost: \$2,500.

Sample Output

| RESEARCH STUDY #11 (Benchmarking - Operating Statistics) | | | | |
|--|--------|---------|---------|---------|
| | Firm 8 | Minimum | Average | Maximum |
| P&L OPERATING STATISTICS | | | | |
| Revenues | 100.0% | 100.0% | 100.0% | 100.0% |
| Product Costs | 50.7% | 44.3% | 49.1% | 50.7% |
| Replacement Parts | .6% | .5% | .6% | .7% |
| Transportation Costs | 10.2% | 8.0% | 9.7% | 10.5% |
| Duties & Tariffs | 7.9% | 7.0% | 8.0% | 8.9% |
| Gross Margin | 30.5% | 30.5% | 32.6% | 38.2% |
| Administrative O/H | 5.7% | 4.7% | 5.6% | 6.0% |
| Marketing | 4.5% | 3.8% | 4.7% | 6.0% |
| Research Studies | .0% | .0% | .0% | .1% |
| Service | 4.7% | 3.6% | 4.5% | 4.9% |
| Total Fixed Costs | 25.7% | 22.0% | 24.9% | 27.2% |
| Operating Income | 4.8% | 4.8% | 7.8% | 13.7% |
| Net Income | 2.9% | 2.9% | 4.4% | 7.3% |
| CSR CALLS STATISTICS | | | | |
| Region 1 | 21,059 | 19,107 | 19,964 | 21,059 |
| Region 2 | 18,485 | 17,339 | 18,171 | 18,930 |
| Region 3 | 29,680 | 25,487 | 27,747 | 30,611 |
| CSR \$/CALL STATISTICS | | | | |
| Region 1 | 10.73 | 10.73 | 11.57 | 12.99 |
| ... | | | | |

Research Study #12: Market Statistics

Purpose: This research study provides a variety of market statistics for each region for the last four quarters:

- Industry demand (final customer purchases) is reported for the hyperware set-top box category.
- Overall market shares for each firm are provided for each of the last four quarters. These market shares are based on end-user customer purchase volumes and not on manufacturer orders.
- End-of-quarter retail-channel (channel 1) inventory holdings for active products are reported in two ways: units and quarters of inventory (expressed relative to the current quarter's retail-channel sales volume).
- Estimates of dealer-channel margins for active products are reported. "Margin" is dealer-channel volume times the dealer-channel markup.

Information Source: This research study is compiled by your research vendor using a variety of sources.

Cost: \$2,500.

Sample Output

| RESEARCH STUDY #12 (Market Statistics) | | | | |
|--|------------|------------|------------|------------|
| | Quarter 11 | Quarter 12 | Quarter 13 | Quarter 14 |
| ----- | | | | |
| INDUSTRY DEMAND | | | | |
| Region 1 Demand | 60,231 | 59,075 | 59,244 | 59,165 |
| Region 2 Demand | 21,988 | 23,306 | 23,136 | 22,930 |
| ... | | | | |
| ----- | | | | |
| OVERALL MARKET SHARES | | | | |
| Firm 1 | 18.0 | 26.6 | 25.3 | 20.7 |
| Firm 2 | 19.5 | 17.4 | 18.8 | 17.9 |
| ... | | | | |
| ----- | | | | |
| DEALER CHANNEL INVENTORY [Units] | | | | |
| Region 1: | | | | |
| Product 1-1H | 2,128 | 2,260 | 2,257 | 2,653 |
| Product 2-1H | 2,178 | 2,377 | 2,345 | 2,266 |
| ... | | | | |
| Region 2: | | | | |
| Product 1-1H | 3,853 | 3,943 | 3,383 | 3,818 |
| ... | | | | |
| ... | | | | |
| ----- | | | | |
| RETAIL CHANNEL INVENTORY [Quarters of Inventory at Current Sales Volume] | | | | |
| Region 1: | | | | |
| Product 1-1H | 0.38 | 0.33 | 0.40 | 0.39 |
| Product 2-1H | 0.51 | 0.37 | 0.45 | 0.40 |
| ... | | | | |
| Region 2: | | | | |
| ... | | | | |
| ... | | | | |
| ----- | | | | |
| DEALER CHANNEL MARGIN | | | | |
| ... | | | | |

Research Study #14: Regional Summary Analysis

Purpose: This research study provides a regional summary analysis for each specified market region, including current-quarter market shares, prices, and perceptions of product quality, service quality, and availability of all active products:

- "Product Quality" is perceived product quality, reflecting customers' perceptions of a product's configuration and its reliability and performance in actual usage.
- "Service Quality" is perceived service quality, reflecting customers' perceptions of the service quality associated with a product.
- "Availability" is perceived product availability, reflecting customers' perceptions of a product's top-of-mind awareness, distribution accessibility, ease of access, convenience to purchase, and presence/prominence in the market place.

Information Source: Perceived product quality, perceived service quality, and perceived availability are based on a survey of set-top box customers. These perceptual ratings are the percentages of survey respondents rating product quality, service quality, and availability as "excellent" on a 4-point "poor"-“fair”-“good”-“excellent” rating scale.

Cost: \$10,000 per region.

Additional Information: Your set-top box manufacturing firm sells to retailers, not directly to final end-user customers. Retailers maintain inventory of your set-top box products as well as selling your products to their customers. Thus, final end-user customers sales volume and market share (for example, as reported in Research Study #14) aren't equal to your firm's sales volume and market share to the retailers due to inventory holdings of retailers.

These results reflect final end-user customer activity. Thus, the prices reported are the prices paid by final end-user customers. These prices include the retailers' markups on the manufacturers' prices.

| RESEARCH STUDY #14 (Regional Summary Analysis) | | | | | | | |
|--|--------|--------------|-------|-----|-----|-----|--|
| REGION 1 HYPERWARE | Volume | Market Share | Price | PQ | SQ | Av | |
| 1-1 | 15,906 | 9.9- | 707+ | 41 | 21- | 54+ | |
| 1-2 | 531 | 0.3 | 465 | 2 | 19 | 1 | |
| 2-1 | 9,391 | 5.9 | 439 | 9 | 29+ | 38 | |
| 2-2 | 7,291 | 4.6 | 417- | 8 | 41+ | 23- | |
| 3-1r | 32,519 | 20.3+ | 699+ | 50+ | 28 | 54+ | |
| 3-2 | 16,096 | 10.1 | 650 | 34- | 18- | 43 | |
| 4-1 | 13,238 | 8.3- | 670+ | 32- | 18- | 10- | |
| 4-2 | 6,881 | 4.3+ | 380- | 8 | 9- | 12- | |
| 5-1 | 12,162 | 7.6+ | 392 | 9 | 32+ | 23 | |
| 6-1 | 7,427 | 4.6 | 390- | 8 | 39+ | 12- | |
| 7-1r | 25,428 | 15.9+ | 650+ | 69+ | 32+ | 35+ | |
| 7-2 | 13,225 | 8.3- | 653 | 35 | 20- | 26 | |

Notes:
 (1) "Volume" is sales volume in units.
 (2) Other variables listed above are market share, end-customer price ("Price"), perceived product quality ("PQ"), perceived service Quality, ("SQ"), and perceived availability ("Av").
 (3) Changes of more than 2%, \$20, 2%, 2%, and 2%, respectively, in these variables from the previous quarter are flagged with "+" (increase) and "-" (decrease) signals after the numerical values.
 (4) "r" after a firm#-product# denotes a reconfigured product this quarter.

Research Study #20: Customer Satisfaction

Purpose: This research study provides customer satisfaction estimates of all products in all regions for the last four quarters.

Information Source: Customer satisfaction is based on a customer survey of current users. Customer satisfaction is the percentage of survey respondents rating their overall satisfaction with a product as "excellent" on a 4-point "poor"-“fair”-“good”-“excellent” rating scale.

Cost: \$10,000.

| RESEARCH STUDY #20 (Customer Satisfaction) | | | | |
|--|------------|------------|------------|------------|
| | Quarter 33 | Quarter 34 | Quarter 35 | Quarter 36 |
| REGION 1 | | | | |
| Product 1-1H | 23.0 | 18.8 | 27.2 | 25.8 |
| Product 3-1H | 16.0 | 22.8 | 26.8 | 23.4 |
| ... | | | | |

Research Study #23: Concept Test

"Do not be too timid and squeamish about your actions. All life is an experiment. The more experiments you make the better." – Ralph Waldo Emerson

Purpose: This research study provides concept test scores for a range of set-top box configurations "around" a specified configuration in a specified region.

Information Source: This research study is based on end-user customer surveys.

Study Details: These concept test scores are "top-box" scores. They represent the percentage of end-user customers surveyed assessing the hypothetical set-top box concept as being "excellent" on a 4-point "poor"- "fair"- "good"- "excellent" rating scale.

Concept test scan searches are conducted "around" the specified configuration. Here, "around" means that 243 concept tests are executed (subject to prevailing set-top box technology limits), one for each of the set-top box configuration attributes that are tested in concept tests (Alpha, Beta, bandwidth, warranty, and packaging), varying the values up and down one from the specified configuration for each attribute. **Concept test scores are reported for scanned concepts whose scores exceed that of the designated configuration by at least 1%.**

As shown in the sample output, the concept test score for the specified configuration is reported, along with all of the results for the concept test scanning search around that specified configuration. Only those scanned concept scores exceeding the specified configuration by at least 1% are reported. In this sample output, the configuration H99632 is apparently a rather unattractive configuration in market region 1, thus accounting for the generally low concept test scores for the specified configuration and for all of its scanned variants.

Cost: \$15,000 per concept test per region for up to four concept tests in a quarter. Concept tests beyond four in a quarter cost double the standard cost of \$15,000 (per concept test per region).

Limitations: A maximum of eight (8) research studies of this type may be executed each quarter. Each of these research study requests must reference a specific region; this research study cannot be executed for "all" regions, but only for a single region. **Concept test scans ordered for all regions (region "0") will not be executed.**

Additional Information: You need baseline concept test scores to interpret concept test scores. A concept test score of 40% is interesting, but there is no way to tell if that score is associated with a configuration that offers competitive advantage unless you have corresponding concept test scores for existing products that are already on the market. Current configurations or the configurations of leading products are obvious baselines. Of course, you would have to execute concept tests on such baseline configurations (in addition to the hypothetical concepts of interest) if you want access to such baseline-configuration concept test scores.

Sample Output

```
=====
RESEARCH STUDY #23 (Concept Test                               )
=====
Product 1-1 Current Configuration [Region 1]
H99632      .9% [Region 1]
H88521      1.9%   H88522      2.1%   H88531      2.5%   H88532      3.1%
H88621      2.3%   H88622      2.9%   H88631      3.7%   H88632      3.7%
H89521      1.9%   H89522      1.9%   H89531      2.4%   H89532      2.6%
H89621      2.3%   H89622      2.4%   H89631      3.2%   H89632      3.0%
...
=====
```

Research Study #24: Price Sensitivity Analysis

"Any sufficiently advanced technology is indistinguishable from magic." – Arthur C. Clarke

Purpose: This research study provides a price sensitivity analysis for a specific product in a specific region (or all regions). This research study permits the simultaneous testing of a reconfiguration of an existing, actively-distributed product and an associated price level of the user's choosing. Thus, Research Study #24 is a focused test marketing experiment with user-specified configurations and prices.

Information Source: This research study is based on surveys of customers, using advanced marketing research techniques.

Study Details: These price sensitivity analyses isolate the impact of price on market share, while holding other market share drivers constant (product quality, service quality, and availability perceptions).

Nine price levels are used in this research study. With no user-specified price input, these price levels are automatically centered around the current price (the "Reference Price") of the product in each region for which this research study is executed. Values of -20%, -15%, -10%, -5%, 0% (i.e., current price), +5%, +10%, 15%, and +20%, relative to the product's "Reference Price," are used.

If configuration and price are left at their default values ("?...?" and 0, respectively), then Research Study #24 is executed with the existing product centered around the current price of the specified product. Otherwise, the user-specified configurations and prices (with the specified price being the "Reference Price") are used. Market share predictions are provided for all tested prices in Research Study #24.

Research study output includes market share and gross margin estimates in research study requests with no configuration change. With a configuration change, research study output only includes estimated market shares. Users will need to calculate/estimate their own product and other variable costs (and, therefore, gross margin) associated with any configuration change.

These "prices" are the final end-user customer prices (the "market price" to final end-users customers) in each region, since final customers are the subject of this research study. For an indirect channel, retail prices are used.

Cost: \$20,000 per price sensitivity analysis (per product per region).

Case Study: Amazon.com

Amazon.com has been charging customers different prices for the same products. For example, the company has charged some users \$23.97 and others \$25.97 for a DVD version of "Men in Black." Patty Smith, an Amazon spokeswoman, said the different prices were part of a test Amazon is conducting "to measure what impacts a decision to purchase or not to purchase." Ms. Smith said Amazon test customers are selected randomly and the prices they receive aren't based on any other characteristics.

Source: "Amazon.com Varies Price of Identical Items For Test," *The Wall Street Journal* (September 7, 2000)

Sample Output With No Configuration Change:

```

=====
RESEARCH STUDY #24 (Price Sensitivity Analysis )
=====

PRODUCT 6-1H PREDICTED GROSS MARGINS IN REGION 1 [HYPERWARE]
Configuration: H35322
Reference Price: 290
    
```

| | | | | | | | | | |
|-----------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Market Price | \$ 351 | \$ 373 | \$ 395 | \$ 417 | \$ 438 | \$ 459 | \$ 481 | \$ 503 | \$ 525 |
| Your Price | \$ 232 | \$ 247 | \$ 261 | \$ 276 | \$ 290 | \$ 304 | \$ 319 | \$ 333 | \$ 348 |
| Your Cost | \$ 171 | \$ 171 | \$ 171 | \$ 171 | \$ 171 | \$ 171 | \$ 171 | \$ 171 | \$ 171 |
| Your Margin | \$ 60 | \$ 75 | \$ 89 | \$ 104 | \$ 118 | \$ 132 | \$ 147 | \$ 161 | \$ 176 |
| Sales Volume | 30,577 | 25,879 | 21,985 | 19,002 | 16,459 | 14,269 | 12,513 | 11,086 | 10,533 |
| Market Share | 9.9% | 8.4% | 7.1% | 6.2% | 5.3% | 4.6% | 4.1% | 3.6% | 3.4% |
| Margin Chang | -49.2% | -36.4% | -24.6% | -11.9% | 0.0% | 11.9% | 24.6% | 36.4% | 49.2% |
| MS Change | 85.8% | 57.2% | 33.6% | 15.4% | 0.0% | -13.3% | -24.0% | -32.6% | -36.0% |
| Net Change | -5.5% | -0.1% | 0.7% | 1.8% | 0.0% | -3.0% | -5.3% | -8.1% | -4.5% |
| Gross Margin (in \$000s) | \$1,834 | \$1,940 | \$1,956 | \$1,976 | \$1,942 | \$1,883 | \$1,839 | \$1,784 | \$1,853 |

These estimated per-unit costs of \$171.09 include these cost components:

| | |
|-------------------------|----------|
| Product Costs | \$155.47 |
| Order Processing Costs | \$ 4.00 |
| Replacement Parts Costs | \$ 11.62 |
| Bad Debts | \$ 0.00 |
| Duties & Tariffs | \$ 0.00 |

Sample Output With A Reconfiguration:

```

=====
RESEARCH STUDY #24 (Price Sensitivity Analysis )
=====

PRODUCT 8-1H PREDICTED GROSS MARGINS IN REGION 1 [HYPERWARE]
Configuration: H11111
Reference Price: 400
    
```

| | | | | | | | | | |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Market Price | \$480 | \$510 | \$540 | \$570 | \$600 | \$630 | \$660 | \$690 | \$720 |
| Your Price | \$320 | \$340 | \$380 | \$380 | \$400 | \$420 | \$440 | \$460 | \$480 |
| Sales Volume | 6,508 | 4,603 | 4,398 | 2,778 | 3,319 | 2,432 | 2,564 | 2,487 | 1,781 |
| Market Share | 10.1% | 7.2% | 6.8% | 4.3% | 5.2% | 3.8% | 4.0% | 3.9% | 2.8% |

This price sensitivity analysis involves a product reconfiguration. Margin Estimates are not provided due to the many cost-related assumptions required To estimate variable product costs associated with a reconfigured product.

Limitations: A maximum of four (4) research studies of this type may be executed each quarter. Each of these price sensitivity analysis research study requests must reference a single product and one or all regions. This research study may only be conducted for products that are already actively distributed in a region. This research study may not be used for products prior to their introduction into a region.

Additional Information: These market share predictions and subsequent estimates of gross margins are based on the assumption that competing products don't change their generate demand programs. Obviously, large price changes will tend to evoke competitive responses.

The reported market shares in Research Study #24 are long-run estimates of market shares if you continue with all of your current customer-facing initiatives (configurations, marketing spending, service levels, etc.) as they are now and so do competitors. Market infrastructure issues (like current inventory holdings of retailers and unfilled order status) are not considered. Only your price is "manipulated" in Research Study #24. Thus, these Research Study #24 estimates of market share will not correspond exactly to your current actual market shares (as reported, for example, in Research Study #14).

Research Study #31: Self-Reported Preferences

Purpose: This research study provides self-reported importance weights for a variety of generate demand elements for each market region. In addition, self-reported attribute preferences for various levels of raw materials Alpha and Beta are provided for each market region, as well as Alpha-Beta positioning maps of customer ideal points for each market region.

Information Source: This research study is based on end-user customer surveys.

Study Details:

These self-reported importance weights are the averages across all survey respondents. Seven-point rating scales are used in this end-user customer surveying, where "1" is anchored by "Not Important" and "7" is anchored by "Very Important."

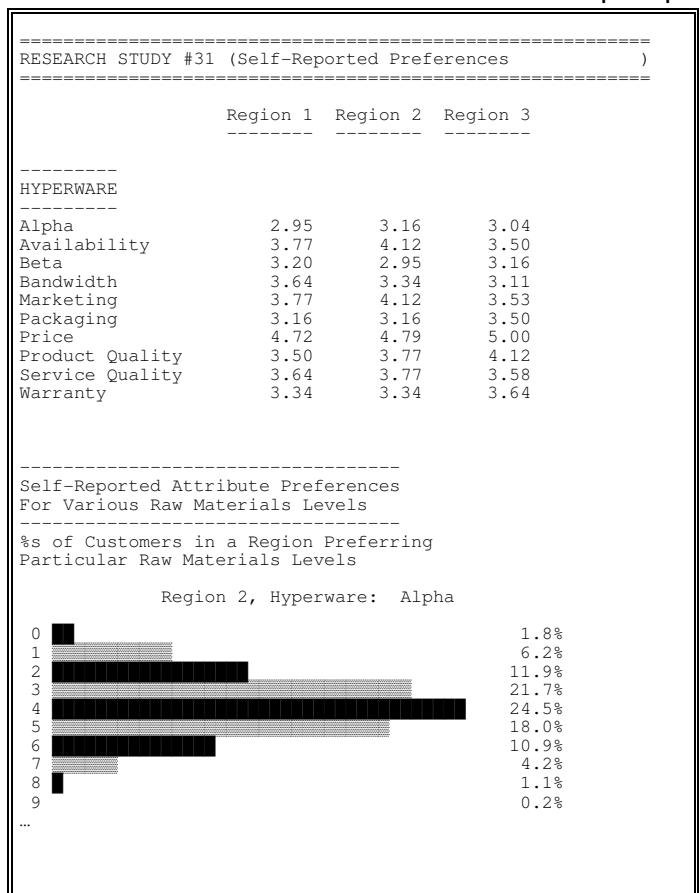
The self-reported attribute preferences reflect the distribution of customers' self-reported preferences across the range of 0-9 kg. for raw materials Alpha and Beta.

The positioning maps graphically display customer preferences for Alpha-Beta combinations for category in each market region. Current product Alpha-Beta positionings are displayed relative to the customer ideal-points in the market regions.

Cost: \$20,000.

Other Comments: Self-reported importance weights are easy things to ask survey respondents. There is, however, considerable debate about the usefulness of such measures. Customers may have trouble distinguishing low-importance and high-importance elements. Customers may report that everything is important, failing to provide the differentiation that is of interest to marketing

Sample Output



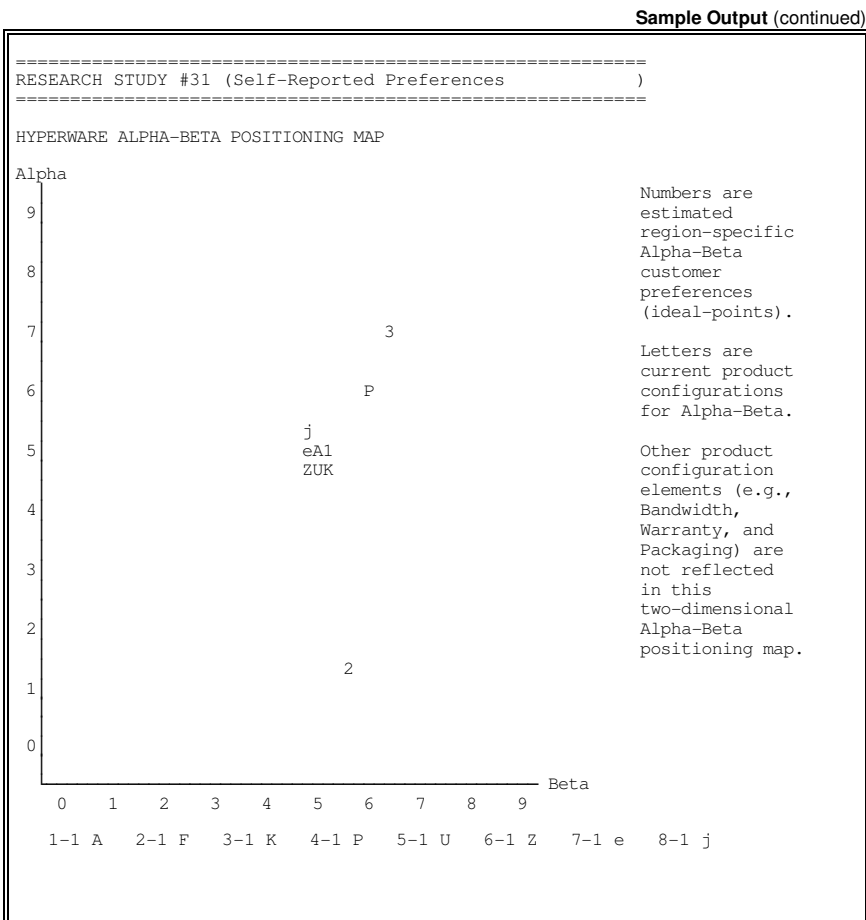
managers. It's also not clear how to use self-reported importance weights to predict future buying behavior, since self-reported importance weights aren't developed from actual behavior. Perhaps they're only meant to be directional in nature, identifying only really low and really high importance factors.

Self-reported importance weights and self-reported attribute preferences are of uncertain quality. It's easy for customers to report "what they want" on such survey instruments, but the statistical veracity of these self-reported weights and self-reported attribute preferences has been questioned by many professional marketing researchers.

Additional Information: In this research study, self-reported attribute preferences are reported only for Alpha and Beta and not for bandwidth, warranty, and packaging. Bandwidth, warranty, and packaging are "more-is-better" product attributes. There's no doubt as to the "best" (most preferred) level of each of these product attributes. Rational end-user customers should naturally always prefer the highest possible level of bandwidth, warranty, and packaging.

The self-reported attribute preferences reported in this research study represent one approach to assessing customer preferences for specific possible Alpha and Beta levels in set-top box products' configurations. These self-reported attribute preferences provide a general scan of customer preferences across the full range of set-top box technology for raw materials Alpha and Beta. Based on the results of this research study, other research studies should be executed to refine reconfiguration options and possibilities. For example, after reviewing the results of this research study, one or more research study #23 ("Concept Test") reports might be executed.

Relatively sharp preference distributions for Alpha and Beta are indicative of homogeneous customers (who all want about the same raw material level) or strong preferences (they are quite insistent about their requirements for raw materials). Relatively flat preference distributions for raw materials signal heterogeneous customers (wide variations in customer preferences for raw material levels) or weak preferences (tolerance for raw materials variations).



Chapter 4: Decision Forms

"The secret of getting ahead is getting started. The secret of getting started is breaking your complex, overwhelming tasks into small manageable tasks, and then starting on the first one." – Mark Twain

Use the LINKS decision forms on the following four pages during your team deliberations to record your decisions in each simulation quarter. Then, input these decisions into LINKS via the LINKS simulation software.

With the exception of research studies orders (which must be made every quarter), all LINKS decisions are standing orders. (i.e., permanent until explicitly changed). You only need to enter decision changes. If you are satisfied with a current decision, there is no need to change it.

Product Development Decisions

| | |
|------|--|
| Firm | |
|------|--|

| | |
|---------|--|
| Quarter | |
|---------|--|

| | | Product 1 | Product 2 |
|---|--|-----------|-----------|
| 1 | Category {"H"}=hyperware} | H | H |
| 2 | Alpha {0-9 kilograms} | | |
| 3 | Beta {0-9 kilograms} | | |
| 4 | Bandwidth {1-7 terahertz} | | |
| 5 | Warranty {0-4 quarters} | | |
| 6 | Packaging {"1"}=stnd, "2"}=prem, "3"}=ES prem) | | |

Notes:

- (1) You may reconfigure, at most, one product per quarter.
- (2) To reconfigure a product, enter new values for Alpha, Beta, bandwidth, warranty, and packaging.

Reminders

Only input changes. If you're happy with the current values of these decisions, leave the appropriate decision entries blank.

All decision inputs change the existing values to the values that you specify. Do not enter "+" or "-" values. Rather, enter new values only (new values replace the existing value of the decision variable with your designated value).

Manufacturing Decisions

| | |
|------|--|
| Firm | |
|------|--|

| | |
|---------|--|
| Quarter | |
|---------|--|

| Manufacturing Decisions | Product 1 | Product 2 |
|----------------------------|-----------|-----------|
| Production | | |
| Emergency Production Limit | | |

Note: Each production volume may change by a maximum of 25,000 units from the preceding quarter's value. You may, however, change production to 0 at any time. However, note that with a production value of 0 units, the following quarter's production volume would be limited to a maximum of 25,000 units.

Reminders

Only input changes. If you're happy with the current values of these decisions, leave the appropriate decision entries blank.

Don't forget to zero-out prior production decisions if you don't wish them to continue on into the next quarter.

All decision inputs change the existing values to the values that you specify. Do not enter "+" or "-" values. Rather, enter new values only (new values replace the existing value of the decision variable with your designated value).

Generate Demand Decisions

| | |
|------|--|
| Firm | |
|------|--|

| | |
|---------|--|
| Quarter | |
|---------|--|

| Product 1 | Region 1 | Region 2 | Region 3 |
|--|----------|----------|----------|
| Active Product? { Yes No } | | | |
| Manufacturer Price | | | |
| Marketing Spending | | | |
| Sales Volume Forecast | | | |

| Product 2 | Region 1 | Region 2 | Region 3 |
|--|----------|----------|----------|
| Active Product? { Yes No } | | | |
| Manufacturer Price | | | |
| Marketing Spending | | | |
| Sales Volume Forecast | | | |

Reminders

Only input changes. If you're happy with the current values of these decisions, leave the appropriate decision entries blank.

All decision inputs change the existing values to the values that you specify. Do not enter "+" or "-" values. Rather, enter new values only (new values replace the existing value of the decision variable with your designated value).

Other Decisions

| | |
|------|--|
| Firm | |
|------|--|

| | |
|---------|--|
| Quarter | |
|---------|--|

| Service Decisions | Region 1 | Region 2 | Region 3 |
|---------------------|----------|----------|----------|
| Service Outsourcing | | | |

| | |
|---|--|
| Firm Name {maximum of 40 characters} | |
|---|--|

Research Studies Decisions

| | | |
|----|-------------------------------------|--|
| 1 | Benchmarking - Earnings | |
| 2 | Benchmarking - Balance Sheets | Firm(s)? |
| 3 | Benchmarking - Product Development | |
| 9 | Benchmarking - Generate Demand | |
| 11 | Benchmarking - Operating Statistics | |
| 12 | Market Statistics | |
| 14 | Regional Summary Analysis | Region(s)? |
| 20 | Customer Satisfaction | |
| 23 | Concept Test | Region? Configuration? |
| | | Region? Configuration? |
| | | Region? Configuration? |
| | | Region? Configuration? |
| | | Region? Configuration? |
| | | Region? Configuration? |
| | | Region? Configuration? |
| | | Region? Configuration? |
| 24 | Price Sensitivity Analysis | Product? Region? Configuration? Price? |
| | | Product? Region? Configuration? Price? |
| | | Product? Region? Configuration? Price? |
| | | Product? Region? Configuration? Price? |
| 31 | Self-Reported Preferences | |

Reminders:

- (1) Circle the number of each research study that you wish to order. If additional information is required for a research study, provide that information in the designated space(s).
- (2) Research requests are for one quarter only; reorder research studies each quarter, as desired.

Chapter 5: Financial Reports

"In a good wind, even turkeys can fly." – Chinese saying

The LINKS Enterprise Management Simulation begins in quarter 1 with all firms in the identical position (same products, configurations, prices, marketing spending levels, capital structure, etc.). Since there is no randomness in the simulation in quarter 1, all firms are identical as the simulation begins. This starting position obviously facilitates evaluation, since all firms start at the same place. After quarter 1, the decisions of the competing firms in your industry and natural statistical randomness will lead to differences in competitive positions and results.

To provide an overall roadmap for thinking about the drivers of profitability in LINKS, the charts in Exhibits 1-3 decompose net income into its underlying components. In Exhibit 1, the principal drivers of net income are revenues and costs. Taxes and non-operating income play lesser roles. Exhibit 2 provides a breakdown of the drivers of volume, one of the two key drivers of revenues. Exhibit 3 provides a roadmap to the drivers of variable costs. Collectively, these exhibits provide a sense of the DNA of net income in LINKS.

The "Corporate P&L Statement" aggregates product-specific profit-and-loss statements into an overall corporate P&L statement. Some line-items appear on the "Corporate P&L Statement" only, because it isn't possible to unambiguously allocate those costs to specific products in specific regions. Definitions of non-obvious line-items on the "Corporate P&L Statement" follow:

- Administrative overhead ("Administrative O/H") is \$240,000 per quarter per product per region. As noted earlier, forecasting accuracy influences administrative overhead.
- "Consulting Fees" are positive or negative adjustments to income or expenses. Conversations with your instructor/coach are normally without charge, so don't worry about "Consulting Fees" associated with these consultations. In LINKS, the "Consulting Fees" line item represents a convenient mechanism for making adjustments to income or expenses. For example, a research billing problem can be corrected via an "Consulting Fee" adjustment.
- Corporate overhead ("Corporate O/H") is \$750,000 per product per quarter. This per-product charge is incurred if a product is actively distributed in one or more regions.
- "Disposal Sales" reflect costs associated with finished goods inventory disposal sales associated with reconfigurations. Note that disposal sales due to reconfigurations do not generate sales revenues. Rather, disposal sales are asset-side transactions on your firm's balance sheet, with finished goods inventory being exchanged for cash. The loss associated with such disposal sales is recorded as an expense on your "Corporate P&L Statement" under "Disposal Sales."
- "Distribution FC" is the per-quarter fixed costs of \$25,000 associated with your firm's distribution center. Your firm's distribution center is located adjacent to your manufacturing plant in region 1.
- "Duties & Tariffs" are a percentage of the average selling price for finished goods that are imported into any region. If a firm has a manufacturing plant in a region, there are no duties and tariffs payable. The current duties and tariffs rates are 0%, 8%, and 12%, respectively, for regions 1, 2, and 3. By definition, all finished goods sold in market region 1 are "local," since your firm's manufacturing plant is located in market region 1. "Duties & Tariffs" are levied on sales in a market region (orders from customers).

Exhibit 1: Net Income Drivers in LINKS

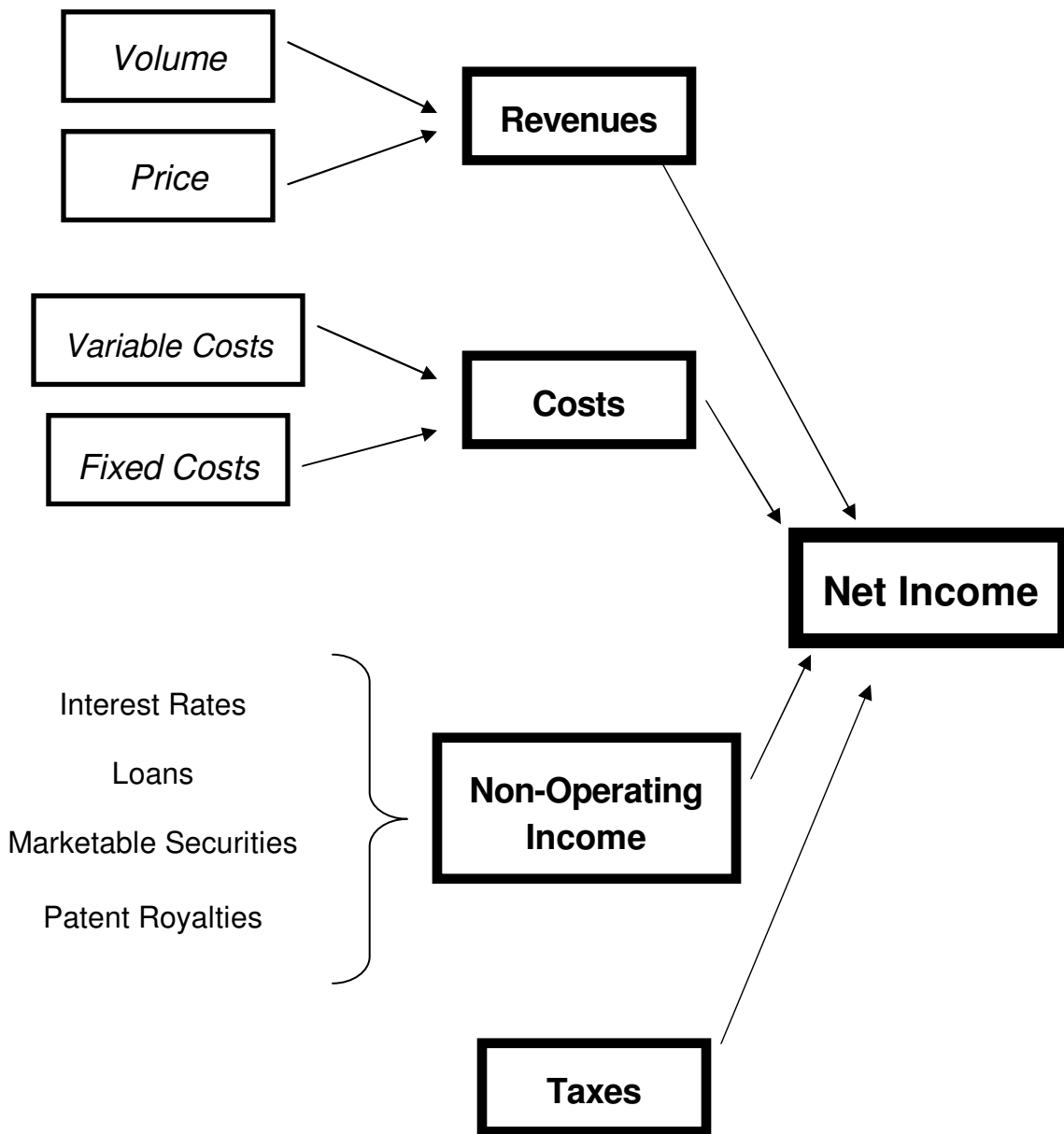


Exhibit 2: Volume Drivers in LINKS

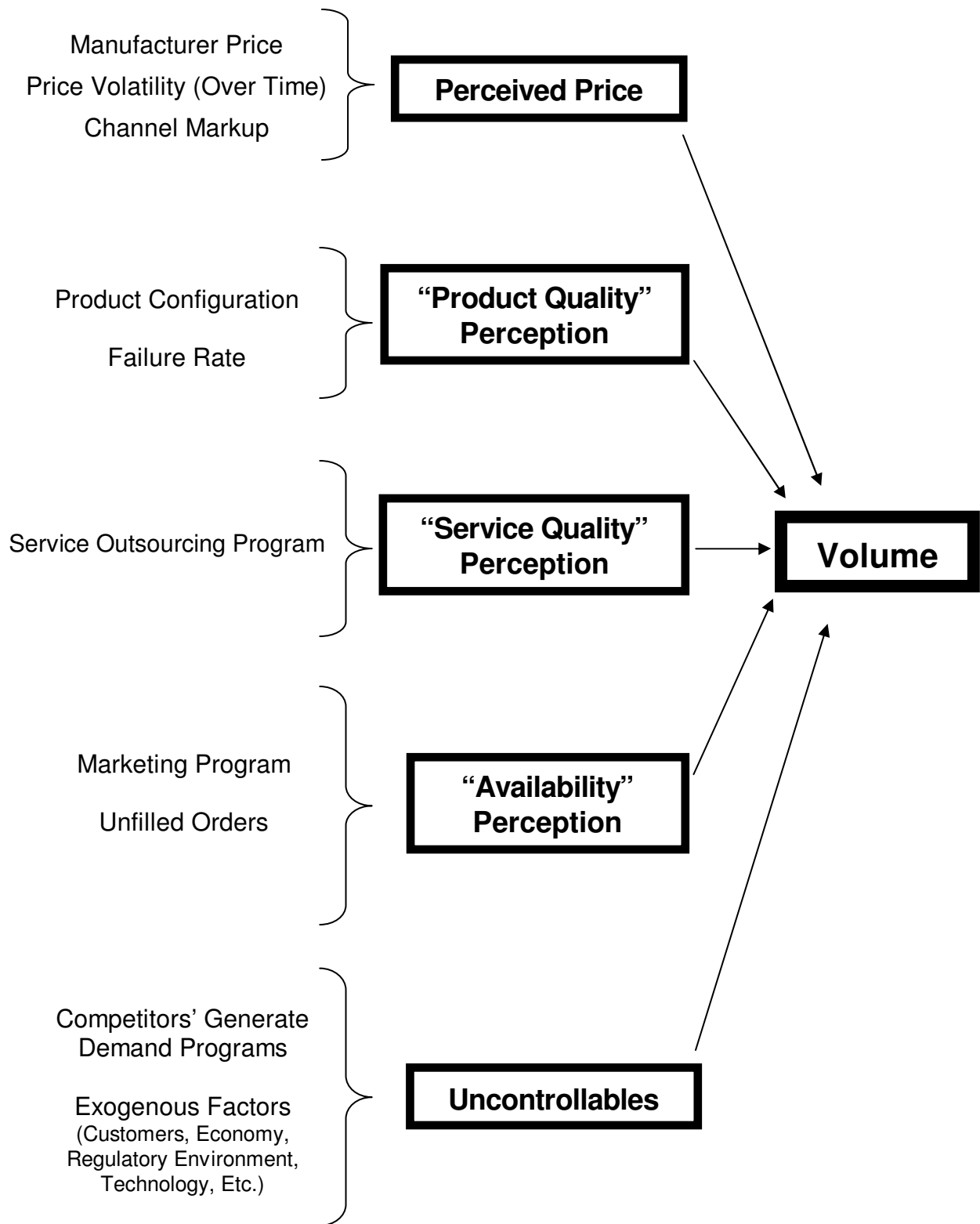
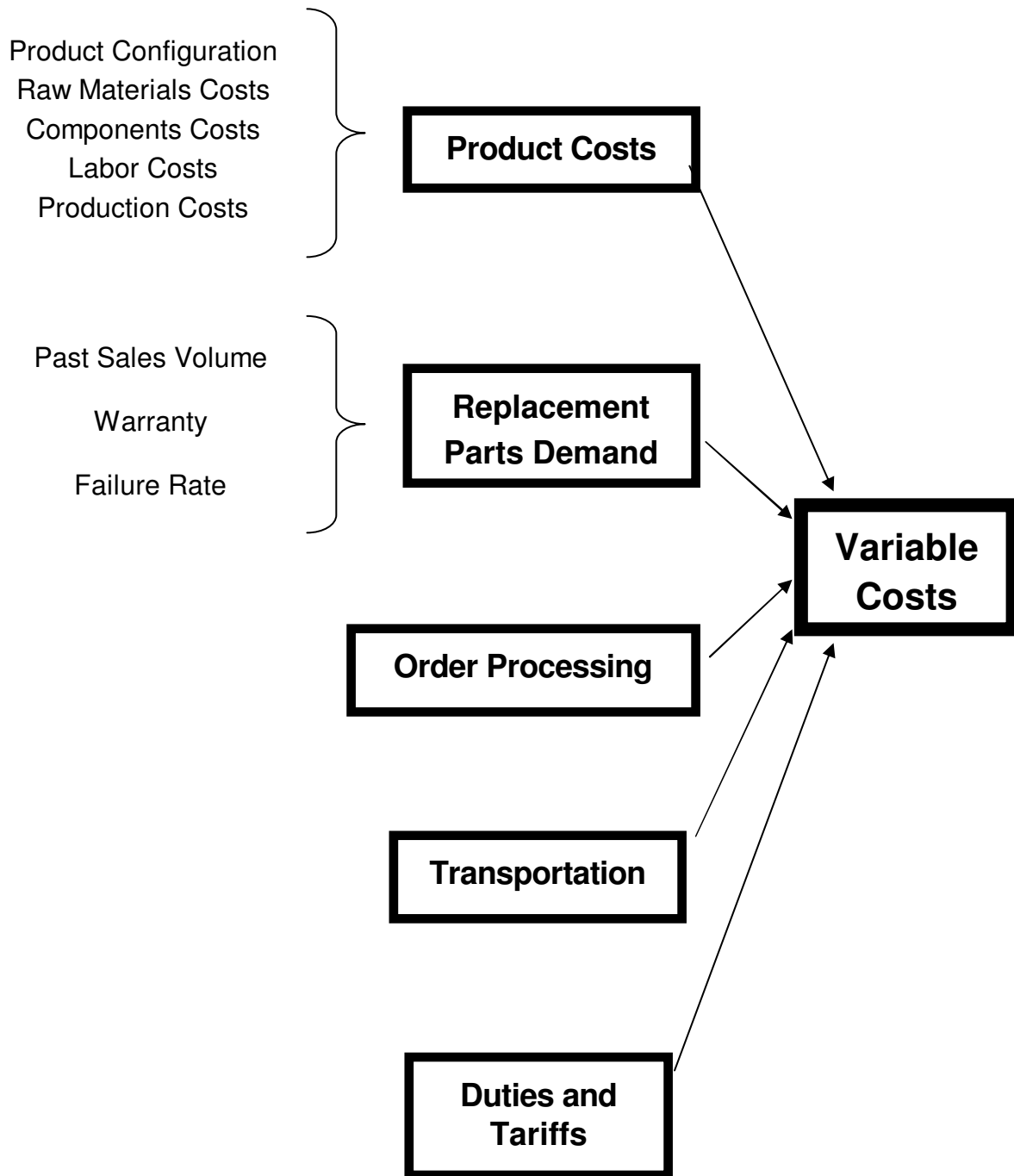


Exhibit 3: Variable Cost Drivers in LINKS



- "Emergency Production" reflects all emergency production costs, including standby emergency production charges plus any actual emergency-related excess costs (above regular production) associated with actual realized emergency production.
- "Information Technology" records all IT charges including a \$1,000/page charge for all financial/operating reports plus research studies. This charge is per-firm and is not related to the number of team members. Each quarter's charge is based on the previous quarter's actual page counts.
- Inventory charges for finished goods are recorded under the heading "Inventory Charges" on the "Corporate P&L Statement." This inventory charge is equal to 3% per quarter for owned distribution centers (such as your distribution center in market region 1, adjacent to your firm's manufacturing plant) based on the value of inventory as recorded on your firm's balance sheet. Inventory charges are levied on the sum of beginning-of-quarter and end-of-quarter inventory values, and include all costs related to storage, handling, waster, and insurance.
- "Non-Operating Income" derives either from interest earned on "Marketable Securities" (from the previous quarter's "Balance Sheet") or from interest paid on "Loans" (from the previous quarter's "Balance Sheet").
- "Order Processing" records order processing costs of \$4/unit in all regions.
- "Patent Royalties" include patent royalties that your firm pays to other firms, as well as patent royalties received from other firms.
- "Plant Capacity FC" represents the costs associated with production "shifts" in your manufacturing plant. These costs cover all depreciation and maintenance associated with your plant capacity. These costs are allocated equally among your products.
- "Production FC" includes the fixed costs associated with production orders. Fixed costs for production are included in the "Production FC" line item.
- "Research Studies" reflects the total costs associated with last quarter's research study requests. The current quarter's research studies are executed after the current quarter's financial reports are prepared so research study billings are lagged a quarter.
- "Taxes" represents the corporate taxes payable in the market region in which your firm has its manufacturing plant. Your manufacturing plant is located in market region 1, which has a corporate tax rate of 50%.
- "Total Fixed Costs" is the sum of all fixed costs. "Total Fixed Costs" does not sum correctly down and across since some fixed costs aren't allocated to specific products.
- "Unfilled Handling" costs are the unfilled orders handling costs.

On the "Balance Sheet":

- "Cash" represents your cash balance. Cash in excess of 10% of revenues is automatically invested in short-term "Marketable Securities" which earn 1.5% per quarter in "Non-Operating Income" on the "Corporate P&L Statement" in the following quarter. If cash falls below 5% of revenues, a loan is automatically arranged to increase cash to 5% of revenues. You pay interest of 3% per quarter on "Loans" and this interest payment is recorded as "Non-Operating Income" (a negative value of "Non-Operating Income") in the following quarter's "Corporate P&L Statement."
- "Corporate Capitalization" is the dollar-value of the original capital invested by your shareholders to start your firm.
- "Dividends" are cash payments to shareholders. In any quarter in which "Net Income" is positive, 30% of the "Net Income" is allocated to "Dividends."
- "Plant Investment" represents the dollar-value of your firm's investment in a manufacturing plant to produce set-top box products. The normal per-unit production charges that you pay for producing set-top boxes includes a component to cover the

maintenance and depreciation of your plant. Thus, your "Plant Investment" value will also be the same through time.

Sources and uses of cash are reported in your firm's "Cash Flow Analysis Report." The most important source of cash within any on-going business is revenues derived from sales, but you have lots of costs to pay to earn those revenues. Recent experience with "dot.com" businesses notwithstanding, margin management (revenues less costs) is still the fundamental management challenge for all for-profit businesses.

Cash sources include profits from operations and reductions in inventory holdings. Uses of cash include funding operating losses, increases in inventory holdings, and payment of dividends. Obviously, you require cash to run your set-top box business. You can't run out of cash within LINKS. As necessary, loans are automatically issued to bring your cash requirement up to minimum acceptable. Of course, you do have to pay interest on loans. Each quarter in which your firm is profitable, corporate policy is to allocate 30% of net income to dividends.

The "Forecasting Accuracy Report" provides details of the forecasting accuracy associated with each of your forecasts. Recall that sales volume forecasting accuracy also influences the "Administrative O/H" cost for each of your products in each region.

The "Set-Top Box Industry Bulletin" provides current-quarter industry-related information. Information reported in the "Bulletin" includes things that an actual manager in the set-top box industry could easily observe without additional cost or with nominal effort during the course of events that comprise a normal quarter's work.

The following pages provide samples of the standard LINKS financial and operating reports. In addition to these financial and operating reports, you'll receive the results of any research studies that you order after the last page of your financial and operating reports.



These samples are provided to familiarize you with the style and format of the reports that are provided to your firm after each LINKS round. The data reported in these sample reports are only illustrative of reports formatting. These data aren't specific to your particular LINKS industry. Please do not interpret these samples as suggested guidelines or benchmarks for good decisions and performance within LINKS.

If you'd like some further background on interpreting LINKS financial statements, please access Tutorial #1 ("P&L Statements") on the LINKS website and spend 45 minutes or so working through it prior to (or close to) the beginning of your LINKS event.

FAQ

"Are costs expensed at the beginning of the quarter or the end of the quarter? The answer influences our spending decisions, since we obviously don't want to spend money before we have it." Assume that all revenues and costs happen uniformly throughout the quarter. That is, with a 90-day quarter, about 1/90 of the quarter's revenues and costs are attributable to each day's operations. Thus, you do have revenue coming in regularly throughout the quarter to pay for your various within-quarter operating costs. There's no need to worry about within-quarter cash flow issues with regard to covering your operating costs and within-quarter spending. Also, note that you do have access to loans, as necessary, to cover shortages in cash.

| | Firm 3 | Worst | Industry Average | Best |
|-----------------------------------|--------|-------|------------------|-------|
| FINANCIAL | | | | |
| Net Income to Revenues | 2.2% | 1.8% | 2.8% | 4.0% |
| Change in Net Income to Revenues | -1.0% | -1.0% | -0.6% | -0.1% |
| Return on Assets | 2.2% | 1.8% | 2.9% | 4.1% |
| Net Asset Turns | 1.2 | 1.2 | 1.2 | 1.3 |
| OPERATIONAL | | | | |
| Inventory Turnover | 0.4 | 0.4 | 0.5 | 0.5 |
| Fill Rate | 60.1% | 57.6% | 61.0% | 66.0% |
| Unplanned Production | 9.1% | 9.1% | 9.1% | 9.1% |
| Forecasting Accuracy | 74.4% | 71.2% | 75.7% | 81.1% |
| (Marketing + Service) to Revenues | 8.6% | 8.7% | 8.6% | 8.4% |
| CUSTOMER | | | | |
| Change in Market Share | 0.2% | -1.0% | 0.0% | 0.4% |
| Customer Satisfaction | 18.1% | 17.0% | 17.5% | 18.1% |

For Your Information

You receive the LINKS scorecard (shown above) automatically each quarter as the first page of your financial and operating reports. This scorecard provides comparatives to assess how your firm's data compares to the industry averages and industry bests on every Key Performance Indicator (KPI).

Historical plots of all KPIs are provided in your firm's supplementary results Excel spreadsheet ("KPIcharts" worksheet), accessible within the LINKS Simulation Database on the LINKS website. Data from the past six quarters are displayed, to the extent available in your industry's historical archives, to create quarter-by-quarter plots for each of the LINKS performance evaluation metrics (KPIs) compared to the relevant quarter-specific industry best, industry average, and industry worst for your LINKS industry.

 FIRM 2: Global Set-Top Box Pty. INDUSTRY FGH
 PRODUCT COST REPORT, QUARTER 8 PAGE 10

| ORIGINAL (PLANT) MANUFACTURING COST | Product 2-1 | Product 2-2 |
|--|----------------|----------------|
| Alpha | 12.00 | 12.00 |
| Beta | 24.00 | 28.00 |
| Bandwidth | 14.00 | 118.00 |
| Warranty | 11.00 | 56.00 |
| Packaging | 14.00 | 14.00 |
| Gamma | 17.00 | 17.00 |
| Epsilon | 24.00 | 24.00 |
| Labor Cost | 30.00 | 30.00 |
| Production Cost | 20.00 | 20.00 |
| | 166.00 | 319.00 |

 FIRM 2: Global Set-Top Box Pty. INDUSTRY FGH
 FINISHED GOODS INVENTORY REPORT, QUARTER 8 PAGE 11

| | Product 2-1 | Product 2-2 |
|------------------------|----------------|----------------|
| Beginning Inventory | 15,353 | 42,733 |
| + Regular Production | 75,000 | 25,000 |
| + Emergency Production | 153 | 17,483 |
| = Available Inventory | 90,506 | 85,216 |
| - Sales, Region 1 | -34,793 | -21,058 |
| - Sales, Other Regions | -55,713 | -64,158 |
| = Ending Inventory | 0 | 0 |

 FIRM 2: Global Set-Top Box Pty. INDUSTRY FGH
 SERVICE CENTER OPERATIONS REPORT, QUARTER 8 PAGE 12

| | All Regions | Region 1 | Region 2 | Region 3 |
|---------------|----------------|-------------|-------------|-------------|
| PRODUCT 2-1 | | | | |
| Calls | 86,806 | 32,515 | 26,244 | 28,047 |
| CSR Cost/Call | 16.41 | 16.00 | 12.00 | 21.00 |
| PRODUCT 2-2 | | | | |
| Calls | 55,858 | 17,869 | 62 | 37,927 |
| CSR Cost/Call | 19.39 | 16.00 | 12.00 | 21.00 |

 FIRM 5: XYZ Limited INDUSTRY MNO
 TRANSPORTATION COST REPORT, QUARTER 8 PAGE 13

| ===== | Surface | | Air | | Emergency | | Total Cost |
|--|---------|------------------------------|------|--------|-----------|---------|------------|
| | Cost | Volume | Cost | Volume | Cost | Volume | |
| SUB-ASSEMBLY COMPONENTS | | | | | | | |
| Plant/DC1: Gamma | 4.00 | 0 | 4.00 | 0 | 4.00 | 108,436 | 433,744 |
| Epsilon | 6.00 | 0 | 6.00 | 0 | 6.00 | 107,946 | 647,676 |
| CUSTOMER SHIPMENTS | | | | | | | |
| Region 1 | (| 40,264 units @ \$ 4.00/unit) | | | | | 161,056 |
| Region 2 | (| 26,601 units @ \$18.00/unit) | | | | | 478,818 |
| Region 3 | (| 31,278 units @ \$26.00/unit) | | | | | 813,228 |
| REPLACEMENT PARTS SHIPMENTS TO CUSTOMERS | | | | | | | |
| Region 1 | (| 10,125 units @ \$ 2.00/unit) | | | | | 20,250 |
| Region 2 | (| 2,353 units @ \$ 9.00/unit) | | | | | 21,177 |
| TOTAL TRANSPORTATION COSTS | | | | | | | 2,575,949 |

 FIRM 6: ABC Corporation INDUSTRY PQR
 OTHER DECISION VARIABLES REPORT, QUARTER 18 PAGE 14

| ===== | 6-1 | 6-2 |
|----------------------------|--------|--------|
| MANUFACTURING | | |
| Production | 70,000 | 35,000 |
| Emergency Production Limit | 10,000 | 10,000 |

Welcome to the quarter 8 issue of the Set-Top Box Industry Bulletin.
Notable set-top box industry developments are highlighted in the Bulletin.

INDUSTRY NEWS HEADLINES

Total set-top box industry EMS profits were 5,867,796 this quarter.
Firm 2 leads industry EMS in market share (29.9%).
Firm 3 has the second-highest market share in industry EMS (27.9%).

Industry EMS inventory investments decreased from 34,702,490 to
34,575,552 this quarter.

Total industry EMS research study spending was 1,023,500 this quarter.

PRODUCT LAUNCHES AND "UNLAUNCHES"

No products were introduced this quarter.

Product 1-1 has been dropped from region 3.
Product 4-1 has been dropped from region 2.
Product 4-2 has been dropped from region 2.

RECONFIGURATIONS

No products were reconfigured this quarter.

Chapter 6: Performance Evaluation

"If you're riding ahead of the herd, take a look back every now and then to make sure it's still there." – Cowboy philosophy

This chapter describes the LINKS quantitative performance evaluation mechanism. Since there are many facets of evaluation to consider in a business, a multi-dimensional scorecard is used. As you'll note, current performance and change in performance are considered in this multi-dimensional quantitative performance evaluation scorecard.

Many things matter in evaluating the performance of a business. It's hard to argue with profitability-like measures as the correct things to examine to assess the long-run performance of a business. However, in a shorter-run perspective, other things matter too. These "other things" are leading indicators of future profitability and root causes of profitability.

Multiple measures of performance evaluation obviously lead to conflicts. Short-run and long-run trade-offs are obvious. For example, by reducing inventories and product support spending (marketing and service spending), current costs will decrease and profits will tend to increase. However, in the long-run, these might be exactly the wrong things to do to maximize long-run profitability. Subtler trade-offs arise in potentially conflicting performance measures that move in opposite directions. For example, inventory reductions save costs on the inventory and manufacturing fronts but may lead to shortages to meet the levels of customer demand in the distribution centers. Balancing all of these conflicting trade-offs is the challenge for management.

The various performance measures within LINKS are designed to monitor all key elements of performance assessment: efficiency (input usage); effectiveness (output quality); productivity (conversion of inputs into output); firm-wide profitability; and, external performance (e.g., change in market share and customer satisfaction perceptions).

The LINKS scorecard is perhaps described more aptly as a boardroom-level scorecard. It focuses on top-line boardroom kinds of financial, operational, and customer performance measures and sub-measures. The LINKS scorecard includes the measures and weights described in Exhibits 4-6. Each firm in your set-top box industry submits their raw data to the Set-Top Box Trade Association, which provides your firm's personal scorecard every quarter.

The LINKS scorecard is based on a ranking of performance on each sub-measure. These rank-order comparisons across all competing firms within your industry avoid the undue influence of particularly extreme values of individual sub-measures. This LINKS scorecard is a within-industry performance evaluation system. Comparisons across industries are problematic due to variations in environmental and competitive milieu.

Your firm receives weighted points for each competitor for whom your performance on a sub-measure is better. For some of the sub-measures, "better" means a lower sub-measure value (e.g., the "Unplanned Production" is a lower-is-better sub-measure). For example, if your firm's ratio of "Net Profits" to "Revenues" is better than three other firms' ratios, your firm receives 9 points. (Of course, the top-performing firm on "Net Income" to "Revenues" ratio in a 6-firm industry would receive 15 points.) In general, the maximum available points on any sub-

measure are $W*(N-1)$ where "W" is the sub-measure's weight and "N" is the number of firms in the industry. Points accumulate each quarter throughout the LINKS exercise.

To avoid an overemphasis on minor quarter-to-quarter variations in the calculation of the ranking of firms on the performance sub-measures in the LINKS scorecard, minor differences in the sub-measures are treated as ties in the calculation of ranking points. The thresholds for differences to be treated as meaningful are listed in Exhibits 4-6 for each sub-measure. For example, differences of 0.2% or less for "Ratio of Net Income to Revenues" are considered to be statistically insignificant, and firms within 0.2% of each other would be treated as being tied. Thus, two firms with ratios of Net Income to Revenues of 4.5% and 4.6% would be treated as being tied in the calculation of ranking position and associated points received in any quarter.

You receive the LINKS scorecard each quarter as the first page of your financial and operating reports. This scorecard provides comparatives to assess how your firm's data compares to the industry averages and industry bests on every KPI. In addition, historical plots of past performance are provided. Data from the past six quarters are used, to the extent available in your industry's historical archives, to create quarter-by-quarter plots for each of the LINKS performance evaluation metrics. For each metric and quarter, the range of values the range of values across all firms in your LINKS industry is shown and your firm's position in these ranges is identified.

Exhibit 4: Scorecard Financial Measures

| Sub-Measures | Weight | Sub-Measure Details |
|---|--------|--|
| Ratio of Net Income to Revenues | 3 | Current profitability is the best overall signal of business performance, hence its high weight. Firms are "tied" if their scores are within 0.2% of each other. |
| Change in Ratio of Net Income to Revenues | 1 | Improvement in profitability is important but less important than current profitability. Firms are "tied" if their scores are within 0.2% of each other. |
| Return on Assets | 2 | Return means "Net Income" (from the "Corporate P&L Statement") and investment equals "Total Assets" (from the "Balance Sheet"). This ratio is expressed in annualized terms. Firms are "tied" if their scores are within 0.5% of each other. |
| Net Asset Turns | 1 | Ratio of revenues to net assets. Net assets are assets minus loans. This measure reflects the desirability of higher revenues relative to the assets deployed to yield these revenues. This ratio is expressed in annualized terms. Firms are "tied" if their scores are within 0.2 of each other. |

Notes: Positive "weights" are associated with sub-measures where "more is better" and negative "weights" are associated with sub-measures where "less is better." "Change" measures are based on quarter-to-quarter changes.

Exhibit 5: Scorecard Operational Measures

| Sub-Measures | Weight | Sub-Measure Details |
|---|--------|---|
| Inventory Turnover | 2 | Ratio of cost of goods sold to average inventory value. Firms are "tied" if their scores are within 0.2 of each other. |
| Fill Rate | 1 | The percentage of orders that are filled. "Unfilled orders" occur when available inventory and emergency production is less than orders in a quarter. Firms are "tied" if their scores are within 0.5% of each other. |
| Unplanned Production | -1 | The percentage of total production (postponed, regular, and emergency) that is emergency production. Firms are "tied" if their scores are within 0.5% of each other. |
| Forecasting Accuracy | 2 | Forecasting accuracy is a relatively pure signal of management skill and expertise (in this case, in the area of understanding customers and customer demand generating forces). Firms are "tied" if their scores are within 0.5% of each other. |
| Ratio of (Marketing + Service Spending) to Revenues | -1 | Service spending is service outsourcing costs. Marketing spending is an easy way to boost short-run sales volume without necessarily contributing to long-run profitability. Relative to revenues, spending less in marketing and service is desirable. Firms are "tied" if their scores are within 0.2% of each other. |

Exhibit 6: Scorecard Customer Measures

| Sub-Measures | Weight | Sub-Measure Details |
|------------------------|--------|---|
| Change in Market Share | 1 | Change in market share is an overall measure of customer reaction to the firm's offerings. ("Market share" equals customer purchases in all regions.) Firms are "tied" if their scores are within 0.1% of each other. |
| Customer Satisfaction | 2 | Customer satisfaction measures the performance of the product from the perspective of purchasers. Thus, it's a clear measure of customer performance and a long-run leading indicator of repeat purchasing behavior and customer retention. Average customer satisfaction across all products and regions is used here. Firms are "tied" if their scores are within 0.5% of each other. |

Notes: Positive "weights" are associated with sub-measures where "more is better" and negative "weights" are associated with sub-measures where "less is better." "Change" measures are based on quarter-to-quarter changes.

Appendix: Web-Based LINKS Access

LINKS has no software to download/upload/install. Point your favorite web browser at the LINKS website to interact with LINKS

<http://www.LINKS-simulations.com>

and then access the LINKS Simulation Database using your firm's case-sensitive passcode. **You'll be e-mailed your LINKS firm's passcode just before your LINKS event begins.**

LINKS uses e-mail to communicate with all LINKS participants. Please ensure that your preferred e-mail software is configured to receive e-mail messages from domains ending with:

@ChapmanRG.com @LINKS-simulations.com @LINKS-simulations.info

Your may wish to consult your personal information technology advisor to ensure that your e-mail software is configured appropriately to receive LINKS e-mail from these domains.

While the LINKS Simulation Database works with all web browsers, Microsoft's Internet Explorer is recommended. **LINKS website access requires a Java-enabled browser.**

Output Retrieval After a LINKS Round: You'll be advised via e-mail when LINKS game-run results are available. Clickable links within the LINKS Simulation Database permit you to access your Word doc and Excel results after a game run.

Inputs For the Next LINKS Round: When you're ready to input decisions for the next LINKS round, access the LINKS Simulation Database and make your input changes.

- **While any number of members of a LINKS firm may access the LINKS Simulation Database simultaneously to "browse," only one member at a time can input new decisions.** If multiple members of a LINKS firm attempt to make inputs simultaneously, problems can arise; all decision inputs might not be saved successfully on the LINKS server with simultaneous inputs from multiple LINKS firm members.
- You may make some inputs now and others later. Only your final LINKS inputs at the input submission deadline for your LINKS industry are included in the next LINKS round.
- Within the LINKS Simulation Database, current decision values are displayed on the input screens. You only need to make changes. All LINKS decision variables are "standing orders" and remain in effect until changed. However, you must input specific instructions each LINKS round for ordering research studies. Otherwise, research studies will be executed only once since "standing orders" don't exist for research studies.
- Inputs are checked for input integrity, including upper and lower bounds on permissible numeric inputs. Invalid entries result in an error message reporting valid minimums and maximums. And, informative messages are reported at the bottom of each web screen.
 - **Execute the "Submit" button after making changes on a LINKS input web screen.** Then, review new reminder, warning, and error messages reported at the bottom of the regenerated web screen after the inputs are processed by the LINKS web server.
 - **"Submit" each webpage's inputs before moving to another input screen in the LINKS Simulation Database.** After you "Submit" a webpage's input changes, check for new reminder, warning, or error messages at the bottom of the refreshed webpage (just above the "Submit" button) before moving on to other webscreens.