

IMPROVING PROFITABILITY VIA COST CONTROL WITH THE COST OF PRODUCTION PERFORMANCE PACKAGE

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ABSTRACT

The Web-based Cost of Production Performance Package enables competing participant teams to improve company profitability through cost control. They assess the underlying reasons for any increase in the cost of production for each product within their brand portfolio during each decision period. This decision support package (a) extracts and presents industry R&D expenditures on cost of production reduction through process improvement, company market share, company and industry shipments, and company ending inventory and overtime production in units for each product from the simulation results, and (b) identifies the antecedents of the cost of production for each product. Competing participant teams use this package to exercise marketing control. They set cost of production goals, monitor performance, identify deviations, understand the underlying reasons, take corrective action and thereby exercise marketing control.

INTRODUCTION

The Cost of Production Performance Package is a decision support system that enables competing participant teams in the marketing simulation COMPETE (Faria, 1994, 2006) to learn, identify and assess the underlying reasons for any increase in the cost of production within their brand portfolio during each decision period. This Excel-based Cost of Production Performance Package automatically extracts relevant data on cost of production antecedents via external links from the Excel-version of the COMPETE simulation results. The Excel-version of the simulation results are generated by the instructor/administrator from the original dos-text based COMPETE simulation results. Later, the Excel-version of the simulation results are uploaded to the COMPETE Online Decision Entry System (CODES) repository for subsequent access by competing participant teams. Only relevant data on the antecedents of cost of production are extracted from the simulation results. This decision support package saves substantial time needed to identify and enter the relevant data and reduces the potential for data entry error.

DECISION SUPPORT SYSTEMS

Several scholars have commented on the value of including decision support software/systems in computer simulations (Keys & Biggs, 1990; Teach, 1990; Gold & Pray, 1990; Wolfe & Gregg, 1989). In addition, the literature is replete with refer-

ences to the use and impact of decision support systems with computer simulations (Affisco & Chanin, 1989, 1990; Burns & Bush, 1991; Cannon et al., 1993; Fritzsche et al., 1987; Grove et al., 1986; Halpin, 2006; Honaiser & Sauaia, 2006; Markulis & Strang, 1985; Mitri et al., 1998; Muhs & Callen, 1984; Nulsen et al., 1993, 1994; Palia, 1989, 1991, 2006; Peach, 1996; Schellenberger, 1983; Shane & Bailes, 1986; Sherrell et al., 1986; Wingender & Wurster, 1987; Woodruff, 1992).

Decision support systems (DSSs) are defined as ...a collection of data, systems, tools, and techniques with supporting software and hardware by which an organization gathers and interprets relevant information from business and environment and turns it into a basis for...action (Little, 1979; Burns & Bush, 1991). In addition, they are defined as computer-based information systems that support the process of structuring problems, evaluating alternatives, and selecting actions for more effective management (Forgionne, 1988). Further, they are described as the hardware and software that permit decision-makers to deal with a specific set of related problems by providing tools that amplify a manager's judgment (Sprague, 1980).

DSSs used with business simulations yield several benefits. These include greater depth of understanding of simulation activity with resulting increase in planning (Keys et al., 1986), in-depth understanding of quantitative techniques as students visualize the results of their applications, sensitivity to weaknesses in techniques used, and experience in capitalizing on their strengths (Fritzsche et al., 1987). Other benefits include minimization of paperwork and errors, error-free graphical representation of output, a competitive tool with increasing value as simulation progresses, and potential for participants to create their own DSSs (Burns & Bush, 1991). In addition, DSSs enhance understanding of complex business relationships and provide additional value over time (Halpin, 2006). Further, DSSs provide realism, relevance, literacy, flexibility and opportunity for refinement (Sherrell et al., 1986).

Some authors contend that combining an active student generated database in the form of a simulation game with a DSS will result in improved decision making, lead to improved proactive rather than re-active strategic planning, and result in improved simulation game performance and enhanced learning (Muhs & Callen, 1984). Others have reported no support for the premise that DSS usage improves small group decision making effectiveness (Affisco & Chanin, 1989), and that DSS usage to support manufacturing function decisions resulted in decreased manufacturing costs and increased "earnings/cost of goods sold" ratio in the second year of play (Affisco & Chanin, 1990).

Given the inconsistent findings with regard to the efficacy of DSSs reported in the literature, does DSS usage increase de-

cision effectiveness and/or enhance learning? One scholar notes that while the DSS assists the decision maker, it does not make decisions, nor can it substitute for intelligent analysis and synthesis (Schellenberger, 1983). In addition, as with other computer-based or experiential learning techniques, the effectiveness of DSSs or the decisions made are less important than the insights they generate. The level of insight generated depends heavily on the clear explanation of the purpose, significance, assumptions, usage, and limitations of the DSS and underlying concepts applied, by the instructor. In addition, the level of insight generated depends heavily on the debriefing process used by the instructor to crystallize student learning (Cannon et al., 1993).

SIMULATION PERFORMANCE & COST OF PRODUCTION ANALYSIS

Several authors have investigated the relationship between game performance and use of DSSs (Keys & Wolfe, 1990) as well as other predictor variables such as (a) past academic performance (GPA) and academic ability of participants, and degree of planning and formal decision making by teams (Faria, 2000), (b) GPA and the use of DSSs (Keys & Wolfe, 1990), (c) age, gender, GPA and expected course grade (Badgett, Brenenstuhl & Marshall, 1978), (d) university GPA and academic major (Gosenpud & Washbush, 1991), (e) gender, GPA and course grade (Hornaday, 2001; Hornaday & Wheatley, 1986), (f) gender (Johnson, Johnson & Golden, 1997; Wood, 1987), (g) GPA, previous course grades, and course grade (Lynch & Michael, 1989), with conflicting results. These conflicting results led to the conclusion that no predictor variable consistently predicts simulation performance (Gosenpud, 1987).

The primary purpose of this paper is to present a new user-centered learning tool that provides participant teams the opportunity to assess the underlying reasons for any increase in the cost of production for each product within their brand portfolio during each decision period, and thereby apply the Iceberg Principle in exercising Marketing Control.

MARKETING CONTROL

Marketing managers are charged with the responsibility of planning, organizing, implementing, and controlling marketing plans and programs that are designed to achieve a specific set of objectives (Bagozzi et al., 1998; Churchill & Peter, 1995; Kotler, 2003, 1988; Lehman & Winer, 1988; Lilien, 1993; Lilien & Rangaswamy, 2003; McCarthy & Perreault, 1984, 1987; Perreault & McCarthy, 1996). In performing their responsibilities, marketing managers are faced with scarce resources (discretionary marketing dollars) and unlimited wants to deploy these limited resources (sales force and advertising expenditures) in order to achieve their objectives. Consequently, they need to allocate the scarce resources at their disposal both effectively and efficiently. The efficient allocation of scarce marketing resources is facilitated through marketing control in order to keep performance in line with objectives.

Marketing control involves setting standards, monitoring performance, identifying deviations from standards, understanding the underlying reasons for the deviations, and taking corrective action when necessary (Bagozzi, et al., 1998; Churchill & Peter, 1995; Cravens, 2000; Cravens et al., 1987; Czinkota & Kotabe, 2001; Dalrymple & Parsons, 1995; Kotler & Keller, 2007; Lamb et al., 2004; Peter & Donnelly, 1994). First, marketing managers decide which aspects of marketing strategy

(such as price, salesforce, advertising, quality) to monitor. Next, marketing managers set standards based on objectives in order to monitor and gauge performance. These standards may include sales targets, market share, profit contribution, as well as behavioral standards such as level of customer awareness. Then, marketing managers design feedback mechanisms where useful, relevant and timely information are used to evaluate the effectiveness of marketing activities. They use these feedback mechanisms to interpret the results of marketing programs, identify gaps between objectives and performance, understand the underlying reasons for the deviations in performance, and change strategy or tactics to eliminate or reduce the performance gaps.

Marketing managers identify which products' sales are highest and why, which products are profitable, what is selling where, and how much the marketing process costs. They need to know what's happening in detail in order to improve the bottom line. Traditional accounting reports such as income statements and balance sheets are too general to be of much help to marketing managers. For instance, a company may be profitable while 80 percent of its business comes from 20 percent of its customers or products. The other relatively less profitable 80 percent may remain undetected unless each product, region, or customer segment is analyzed in order to determine its profitability. This 80/20 relationship is fairly common and is often referred to as the 80/20 rule or principle (McCarthy & Perreault, 1984, 1987; Perreault & McCarthy 1996).

Marketing control consists of sales analysis, performance analysis and marketing cost analysis. Sales analysis involves a detailed breakdown of the company's sales records by geographic region, product, package size, customer size, type or class of trade, price or discount class, method of sale (mail, telephone, or direct sales), terms of payment (cash or charge), size of order, and or commission class. The purpose of sales analysis is to keep marketing managers in touch with their markets and to enable them to check their assumptions and hypotheses. Performance analysis identifies exceptions or variations in planned performance.

Marketing cost analysis (Kerin & Peterson, 2004; McCarthy & Perreault, 1984, 1987; Perreault & McCarthy, 1996) enables the marketing manager to calculate the profitability of individual profit centers rather than total company profit. Marketing managers use sales analysis, performance analysis and marketing cost analysis in order to exercise marketing control. They assess the sales, profitability and marketing costs of each SBU in order to improve the bottom line. In this regard, they are aware of the significance of both the 80/20 Principle and the Iceberg Principle.

THE ICEBERG PRINCIPLE

The Iceberg Principle or the 90/10 Principle states that much good information is hidden in summary data (McCarthy & Perreault 1984, 1987; Palia 2007; Perreault & McCarthy, 1996; Pride & Ferrell, 1995). Icebergs reveal only about 10 percent of their mass above water level. The remaining 90 percent is concealed and non-uniformly distributed below water level, and can sink ships such as the Titanic that venture too near.

Much business and marketing data exhibit the same characteristics. While the Income Statement may reflect substantial sales revenue and profits, and/or the Balance Sheet may indicate substantial amounts of cash, investments and retained income, these financial statements may conceal problems in specific SBUs. Based on a review of these financial statements, every-

thing may appear to be calm and peaceful on the surface. Yet, closer analysis may reveal jagged edges in one or more SBUs that can sink the business. While summary data and averages simplify and facilitate understanding, managers need to ensure that data summaries don't conceal more than they reveal.

A seemingly healthy person may suffer from a hidden cancer in the cardiac, circulatory, digestive, lymphatic, nervous or other system that could seriously impair overall long-term health. Similarly, a seemingly healthy business with adequate sales, assets, profits, and cash flow, may suffer from hidden losses or other problems in one or more SBUs that could seriously impair overall long-term performance. Effective health maintenance requires periodic screening tests in order to determine whether there are any indicators of malfunctioning systems. Effective marketing managers monitor their results, identify SBUs that exhibit sub-par performance, understand the underlying reasons for sub-par performance, and take corrective action. The Cost of Production Performance package enables competing participant teams to operationalize the Iceberg Principle and exercise marketing control.

PROFITABILITY, MARKET SHARE AND COST DYNAMICS

Market share is one of the primary determinants of profitability. The PIMS (Profit Impact of Marketing Strategy) Program, based on pooled business experience, found that, on average, a difference of 10 percentage points in market share is accompanied by a difference of about 5 points in pretax ROI. Profitable firms with large market share usually have lower costs due to the scale effect and the experience effect.

First, the scale effect, often referred to as "economies of scale" refers to the potential ability of large businesses to operate at lower unit costs than smaller firms. Large manufacturing plants can be constructed at a lower cost per unit of capacity and can be operated more efficiently than smaller ones. While the scale effect is substantial in manufacturing, it is also significant in marketing, sales, distribution, administration, R&D, and service. Scale economies are also achieved through volume discounts with purchased items such as raw materials and shipping. Long-run economies of scale result from building larger and more efficient plants. Short-run economies of scale result from a fuller utilization of existing plant-, sales force-, or service-capacity. Large size provides an opportunity for scale economies. Yet, strategies and actions are needed in order to achieve scale economies with operating costs (Aaker, 2014; Abell & Hammond, 1979).

Economies of scale are referred to in the simulation literature in context with product-mix strategies (Andrews et al., 2009; Cannon et al., 2006, 2010; Cannon & Cannon, 2008), relationship marketing strategies and corporate social responsibility (Cannon et al., 2013, 2014), company reputation (Cannon & Schwaiger, 2003), economic development (Cannon & Smith, 2005; Cannon et al., 1999, 2000), cross-national, international and/or global marketing simulations (Cannon & Yaprak, 2001; Sanvincente et al., 1993; Thavikulwat & Chang, 2014), management decision making (Dennis & Pray, 1982), business economics & production function modeling (Gold, 1990, 1991, 2009; Gold & Pray, 1989; Golden, 1988; Perotti et al., 2007), system-dynamics based interactive simulation design (Gold, 2003), linear programming approach to simulation design (Patz, 1993), location-based strategies (Prause, et al., 2014).

Second, the experience effect, empirically verified in hundreds of studies, suggests that as a firm accumulates experience in building a product, its costs in real dollars will decline at a

predictable rate (Aaker, 2014). The Boston Consulting Group (BCG) demonstrated that each time cumulative production of a product doubled, total value-added costs – including administrative, sales, marketing, distribution, etc. in addition to manufacturing – decreased by a constant and predictable percentage. The relationship between costs and experience is called the experience curve (Aaker, 2014; Abell & Hammond, 1979). Based on the learning or experience curve, the experience effect refers to the 10 to 30 percent decline in cost of many (if not most) products, with a doubling of experience, which is defined as the cumulative number of units produced to date (Abell & Hammond, 1979).

The experience curve is referred to in the simulation literature in context with PIMS (Dickinson, 2006), simulation external validity (House & Taylor, 1991), management principles exercise (Nichols, 2009), forecasting stock value (Pillutla & Thavikulwat, 2005), company profitability (Thavikulwat, 2005), and shared experience through horizontal integration via merger or acquisition (Thavikulwat et al., 2008).

Third, improved profits through lower operating costs can be achieved through accurate demand forecasts. Over-estimates of demand result in higher operating costs through excessive ending inventories, inventory carrying costs, storage charges, and subsequent clearance sales at reduced prices. Under-estimates of demand result in higher operating costs through stockouts, lost sales, consequent expensive overtime production, and lost customers.

Forecasting accuracy has been proposed and/or used to assess management performance in business simulation games with mixed results (Anderson & Lawton, 1990; de Souza et al., 2010; Gosenpud et al., 1984; Hand & Sims 1975; Newgren et al., 1981; Palia, 2004, 2011; Peach & Platt, 2001; Teach, 1989, 2006, 2007; Washbush, 2003; Washbush & Gosen, 2002). Hand and Sims (1975) used path analysis to investigate the relationships among thirteen performance criteria (Swanson, 1977). They were able to reduce the number of performance criteria from thirteen to two – sales forecasting error (the primary "driving variable") and profits (the primary "end result"). Gosenpud et al. (1984) used multiple regression to ascertain the influence of eleven independent variables on organizational effectiveness, and performed factor analysis to determine the relationship among the independent variables. They found that forecast accuracy with the largest regression coefficient ($\text{Beta} = 0.32$) affected ROE significantly. Teach (1989) investigated the relationship between forecasting accuracy and simulation performance. He concluded that market share, unit sales, net cash flow and profit/loss forecast accuracy were directly related to simulation performance. Further, his ongoing research (Teach 1987, 1989, 1990, 1993a, 1993b, 2007) suggests that there is a positive correlation between forecast accuracy and simulation performance.

Washbush & Gosen (2002) examined the relationship between learning and forecast accuracy but did not find a consistent correlation between the two variables. They suggest that forecast accuracy may be a proxy for other simulation performance measures. In a follow-up study, Washbush (2003) evaluated the proposition that there is a correlation between forecast accuracy and total enterprise simulation performance. The major findings of this study were consistent with Teach's findings that forecast accuracy correlates with simulation performance. Most recently, deSouza, Bernard & Cannon (2010) used multiple regression to evaluate whether reduction in forecast error can be used as a predictor of team performance. They found that forecast accuracy explained 40.75% of the variance in company performance, and that forecast accuracy for high-level

functions (general management) had the greatest predictive impact and low-level functions (sales, human resources, and finance) the lowest. In addition, several scholars have discussed forecasting techniques (Harmon et al., 2009; Kamath & Roy, 2005; Wei & Wang, 2007), forecast accuracy (Dong & Zhu, 2008; Makatosoris & Chang, 2008; Piirainen et al., 2009) and forecast error (Ahlert & Block, 2010) in industry.

Stockouts are referred to in context with market demand systems (Dickinson, 2013, 2014; Gold & Pray, 1983; Pray & Gold, 1982), inventory systems and control (Ferguson, 1977; Ferguson & Foust, 1981; Frazier, 1975; Gentry, 1977; Gentry & McGinnis, 2008; Goosen, 1981; Hammond, 1985; Jackson & Taylor, 1998; Millers, 1986) and learning outcomes (Peach, 1996).

Supply-side factors that affect the cost of production include the landed cost of raw materials, component parts, labor, and supplies. Further, several authors refer to the cost of production in context with game complexity (Cannon, 1995), simulation modeling/design (Dickinson, 2002; Gold, 1993; Jordan, 2006; Mergen & Pray, 1992; Patz, 2001; Perotti & Pray, 2000; Pray, 1984), budgeting (Goosen, 1998), simulation evaluation (Kenkel et al., 1993; Whitney, 1984), performance (Keys & Keys, 2011; McLaughlin, 1980, 1981; Thavikulwat, 2004), expert systems (Sackson & Varanelli, Jr., 1988) and TQM (Teach, 1992).

The importance of cost control is stressed in context with management training (Bielecki & Wardaszko, 2010), forecasting (Napier et al., 1977; Teach, 2006, 2007), simulation evaluation (Summers, 1981; Windsor, 1984), and financial analysis (Washbush, 2005). The Cost of Production Performance package extracts and identifies the above antecedents of the cost of production for each product from the COMPETE simulation results for each decision period. Competing participant teams use this package to identify and better understand the underlying reasons for deviant cost-of-production performance and to take corrective action.

COMPETE MARKETING SIMULATION

COMPETE (Faria, 2006) is a marketing simulation designed to provide students with marketing strategy development and decision-making experience. Competing student teams are placed in a complex, dynamic, and uncertain environment. The participants experience the excitement and uncertainty of competitive events and are motivated to be active seekers of knowledge. They learn the need for and usefulness of mastering an underlying set of decision-making principles.

Competing student teams plan, implement, and control a marketing program for three high-tech products in three regions Region 1 (R1), Region 2 (R2) and Region 3 (R3) within the United States. These three products are a Total Spectrum Television (TST), a Computerized DVD/Video Editor (CVE) and a Safe Shot Laser (SSL). The features and benefits of each product and the characteristics of consumers in each region are described in the student manual. Based on a marketing opportunity analysis, a mission statement is generated, specific and measurable company goals are set, and marketing strategies are formulated to achieve these goals. Constant monitoring and analysis of their own and competitive performance helps the teams better understand their markets and improve their decisions.

Each decision period (quarter), the competing teams make a total of 74 marketing decisions with regard to marketing their three brands in the three regional markets. These decisions include nine pricing decisions, nine shipment decisions, three sales force size decisions, nine sales force time allocation deci-

sions, one sales force salary decision, one sales force commission decision, twenty-seven advertising media decisions, nine advertising content decisions, three quality-improvement R&D decisions, and three cost-reduction R&D decisions. Successful planning, implementation, and control of their respective marketing programs require that each company constantly monitor trends in its own and competitive decision variables and resulting performance. The teams use the COMPETE Online Decision Entry System (CODES) (Palia & Mak, 2001; Palia et al., 2000) to enter their decisions, retrieve their results, and download and use a wide array of marketing dss packages.

The comprehensive Online Cumulative Simulation Team Performance Package provides competing participant teams with feedback on their cumulative company profitability, market share by product, quality by product, cost of production by product, and efficiency with the simulation results for each decision period (Palia 2005). The Cost of Production Performance package extracts and identifies the antecedents of the cost of production for each product from the COMPETE simulation results for each decision period in order to help understand the underlying reasons for deviant performance.

COMPETE PRODUCTION, UNIT COST, AND INVENTORY FACTORS

Competing participant teams consider current and future production costs, overtime versus carrying costs, and inventory policies in addition to estimated demand as they make their production/shipment decisions. The initial costs of production (\$3400, \$350 and \$39 for the TST, CVE, and SSL respectively) are set to provide reasonable costs and margins for all teams. These initial costs may be changed by the game administrator. As the competition progresses, the unit costs vary as a function of R&D effects, Learning/Experience effects, Inflation/Deflation effects, and Volume/Scale effects.

First, competing teams can reduce their unit costs by allocating a share of their R&D dollars to the improvement of production efficiency. They decide during each decision period on the total R&D budget for each product and the percent of R&D dollars to be allocated to improvement of product "quality" (benefits, features, quality levels, etc.). The percent of R&D dollars not allocated to quality improvement is automatically allocated to improve production efficiency and lower unit costs. Unit costs are a function of the cumulative amounts invested in R&D to improve production efficiency.

Second, the COMPETE model assumes that costs will decrease as companies gain experience or learn how to produce more efficiently as a function of cumulative volume over time, regardless and independent of R&D investment decisions. This "learning/experience" effect varies by product. The reduction in unit costs due to experience occurs automatically and independently of any other cost-affecting factor.

Third, there is strong downward pressure on unit costs due to R&D and learning/experience effects. However, the game administrator can, if desired, set an economic environment, where there is either strong inflationary pressure or additional deflationary effect on unit costs.

Fourth, unit costs increase or decrease depending on whether the level of production is "optimum" with respect to the most efficient level of production. The most efficient quarterly level of production for TST, CVE and SSL is equal to the average quarterly demand for the year. Competing firms face a U-shaped cost-of-production function and are penalized for too low or too high per-period production levels. They are encour-

aged to use buffer stocks of inventory to smooth out variation in quarterly levels of production.

Fifth, limited overtime production automatically commences in the event of a stock-out when a team significantly under-orders production/shipment of any product in any region. Units produced in overtime (the grave-yard shift) cost 15 percent more than units produced during the regular day shift. Further, overtime production is limited to the lesser of 50 percent of the stock-out or 20% of the current shipping request, under the assumption that the firm may not be able to obtain large increments in component parts, raw materials, labor, etc., that deviated from original planned production levels at such short notice. In addition, no overtime production of less than 100 units is permitted.

Lastly, unsold inventory is carried forward to the next decision period at the old production cost up to a maximum of one decision period. The cost of goods sold for the new period reflects production costs for both the old and new production (Faria et al., 1994).

THE COST OF PRODUCTION PERFORMANCE PACKAGE

The Web-based Cost of Production Performance Package is accessible online to competing participant teams in the marketing simulation COMPETE. It enables competing participant teams to learn, identify and assess the underlying reasons for change in the cost of production for each product within their brand portfolio during each decision period. Competing participant teams can use this package to monitor performance, identify deviations, understand the underlying reasons, take corrective action and thereby exercise marketing control.

The Cost of Production Performance package extracts relevant antecedents of the cost of production for each of the products in the brand portfolio. This package is a zipped folder "Performance Cost of Production.zip" which consists of an Excel workbook "Cost of Production.xls" (with external links to the COMPETE results (output) files 1.xls, 2.xls,...,12.xls) and Excel version of sample COMPETE output files for decision periods 1 to 12. This Cost of Production.xls workbook consists of three product worksheets, Cost of Production – TST (see

EXHIBIT 1 PERFORMANCE COST OF PRODUCTION-TST ANALYSIS WORKSHEET

Performance Analysis Cost of Production - TST											
Epiphany Company 3 Period											
R&D Effect											
Period	Company				Industry				Percent of		
	Company	NAEM	R&D Exp.	% to Cost	R&D to Cost	Cum Cost R&D	R&D to Cost	Cum. R&D to Cost	Indy. R&D		
1	\$ 3,400.00	\$ -	\$ 500,000	30%	\$ 150,000	\$ 150,000	\$ -	\$ -			
2	\$ 3,400.00	\$ 3,400.00	\$ 600,000	29%	\$ 174,000	\$ 174,000	\$ 505,000	\$ 505,000	34.46%		
3	\$ 3,458.67	\$ 3,455.15	\$ 700,000	28%	\$ 196,000	\$ 370,000	\$ 733,000	\$ 1,238,000	29.89%		
4	\$ 3,549.36	\$ 3,559.47	\$ 800,000	27%	\$ 216,000	\$ 586,000	\$ 801,000	\$ 2,039,000	28.74%		
5	\$ 3,526.35	\$ 3,549.14	\$ 900,000	26%	\$ 234,000	\$ 820,000	\$ 610,000	\$ 2,649,000	30.96%		
6	\$ 3,543.62	\$ 3,563.20	\$ 1,000,000	25%	\$ 250,000	\$ 1,070,000	\$ 725,000	\$ 3,374,000	31.71%		
7	\$ 3,566.17	\$ 3,584.78	\$ 1,100,000	24%	\$ 264,000	\$ 1,334,000	\$ 725,000	\$ 4,099,000	32.54%		
8	\$ 3,578.17	\$ 3,601.30	\$ 1,200,000	23%	\$ 276,000	\$ 1,610,000	\$ 625,000	\$ 4,724,000	34.08%		
9	\$ 3,568.39	\$ 3,607.99	\$ 1,300,000	22%	\$ 286,000	\$ 1,896,000	\$ 790,000	\$ 5,514,000	34.39%		
10	\$ 3,597.63	\$ 3,631.73	\$ 1,400,000	21%	\$ 294,000	\$ 2,190,000	\$ 1,325,000	\$ 6,839,000	32.02%		
11	\$ 3,621.11	\$ 3,656.68	\$ 1,500,000	20%	\$ 300,000	\$ 2,490,000	\$ 1,112,500	\$ 7,951,500	31.31%		
12	\$ 3,640.90	\$ 3,676.54	\$ 1,600,000	19%	\$ 304,000	\$ 2,794,000	\$ 705,000	\$ 8,656,500	32.28%		
Scale Effect											
Period	Region			Company				Industry		Percent of	
	Mkt. Share	Mkt. Share	Mkt. Share	Shipments	Cum. Shipments	Shipments	Cum. Shipments	Indy. Shipments	Ending Inventory	Overtime Production	
1	26.74%	26.07%	23.69%	4,500	4,500	-			542	-	
2	21.26%	25.64%	22.29%	1,500	1,500	8,800	8,800	17.05%	-	-	
3	22.55%	27.53%	22.37%	4,300	5,800	10,600	19,400	29.90%	354	-	
4	24.88%	32.63%	27.60%	8,800	14,600	27,000	46,400	31.47%	1,881	-	
5	24.02%	28.60%	25.51%	4,700	19,300	14,400	60,800	31.74%	1,807	-	
6	21.62%	22.75%	20.46%	800	20,100	6,600	67,400	29.82%	324	-	
7	21.22%	17.50%	18.51%	4,700	24,800	15,100	82,500	30.06%	672	-	
8	23.22%	22.86%	22.55%	9,500	34,300	29,500	112,000	30.63%	1,875	-	
9	26.24%	24.38%	30.22%	4,300	38,600	14,900	126,900	30.42%	-	-	
10	27.33%	19.39%	25.25%	1,700	40,300	8,300	135,200	29.81%	-	-	
11	23.23%	17.90%	19.92%	4,600	44,900	18,700	153,900	29.17%	-	-	
12	26.88%	26.67%	30.55%	7,600	52,500	31,400	185,300	28.33%	-	-	
LEGEND:											
	Enter data										
	Data extracted from COMPETE results										
	Calculation (Percentage)										

ex-

hibit 1), Cost of Production – CVE (see exhibit 2) and Cost of Production – SSL (see Exhibit 3).

Each of the three Cost of Production worksheets consists of external links to the Excel version of the twelve quarterly COMPETE output files 1.xls, 2.xls, ..., 12.xls. These three Cost of Production worksheets extract and display the company name and company number from the Excel version of the COMPETE results file “1.xls” (see exhibit 1). Each worksheet extracts and displays the company cost of production and the National Association of Electronics Manufacturers (NAEM) Average Industry Cost from the Product Cost Report in the COMPETE results files during each decision period. Further, in order to calculate and display the cumulative amount invested by the industry in R&D on cost reduction, each worksheet extracts the total industry R&D for cost from the NAEM Research Bulletin in the COMPETE results files during each decision period.

Next, in order to reflect the Scale Effect on the Cost of Production, each product worksheet extracts and displays the actual percentage market share in each of the three regions from the Unit Sales by Product by Region report in the COMPETE re-

sults files during each decision period. Then, in order to reflect the Experience Effect on the Cost of Production, each product worksheet extracts and displays the combined total shipments for all three regions from the Shipments and Inventory By Region By Product Report in the COMPETE results files during each decision period. In addition, each product worksheet extracts and displays the combined industry total shipments for all three regions from the Industry Unit Shipments By Region And Product Report in NAEM Bulletin 1 from the COMPETE results files during each decision period.

Lastly, in order to reflect the effect of poor forecasting on the Cost of Production, each product worksheet extracts and displays the combined ending inventory for all three regions from the Shipments and Inventory By Region By Product Report and the combined overtime production shipments from the Overtime Production / Shipments Report in the COMPETE results files during each decision period.

The relevant data are extracted from the COMPETE Results Excel workbooks 1.xls, 2.xls, ..., 12.xls to each of the Cost of Production workbooks as indicated in the Data Extraction Tables for the R&D Effect (see exhibit 4), the Scale Effect

EXHIBIT 2 PERFORMANCE COST OF PRODUCTION-CVE ANALYSIS WORKSHEET

Performance Analysis Cost of Production - CVE										
Epiphany Company 3										
Period										
R&D Effect										
Period	Company				Industry				Percent of Indy. R&D	
	Company	NAEM	R&D Exp.	% to Cost	R&D to Cost	Cum Cost R&D	R&D to Cost	Cum. R&D to Cost		
1	\$ 350.00	\$ -	\$ 500,000	30%	\$ 150,000	\$ 150,000	\$ -	\$ -		
2	\$ 350.00	\$ 350.00	\$ 600,000	29%	\$ 174,000	\$ 174,000	\$ 464,000	\$ 464,000	37.50%	
3	\$ 348.72	\$ 352.61	\$ 700,000	28%	\$ 196,000	\$ 370,000	\$ 664,000	\$ 1,128,000	32.80%	
4	\$ 353.77	\$ 355.80	\$ 800,000	27%	\$ 216,000	\$ 586,000	\$ 922,000	\$ 2,050,000	28.59%	
5	\$ 355.74	\$ 358.78	\$ 900,000	26%	\$ 234,000	\$ 820,000	\$ 825,000	\$ 2,875,000	28.52%	
6	\$ 356.28	\$ 360.97	\$ 1,000,000	25%	\$ 250,000	\$ 1,070,000	\$ 875,000	\$ 3,750,000	28.53%	
7	\$ 352.70	\$ 358.70	\$ 1,100,000	24%	\$ 264,000	\$ 1,334,000	\$ 825,000	\$ 4,575,000	29.16%	
8	\$ 351.18	\$ 356.80	\$ 1,200,000	23%	\$ 276,000	\$ 1,610,000	\$ 675,000	\$ 5,250,000	30.67%	
9	\$ 352.97	\$ 356.23	\$ 1,300,000	22%	\$ 286,000	\$ 1,896,000	\$ 870,000	\$ 6,120,000	30.98%	
10	\$ 354.79	\$ 361.20	\$ 1,400,000	21%	\$ 294,000	\$ 2,190,000	\$ 1,350,000	\$ 7,470,000	29.32%	
11	\$ 354.10	\$ 361.26	\$ 1,500,000	20%	\$ 300,000	\$ 2,490,000	\$ 887,500	\$ 8,357,500	29.79%	
12	\$ 351.28	\$ 360.12	\$ 1,600,000	19%	\$ 304,000	\$ 2,794,000	\$ 730,000	\$ 9,087,500	30.75%	

Period	Scale Effect			Experience Effect				Cost of Production Effect		
	Region 1 Mkt. Share	Region 2 Mkt. Share	Region 3 Mkt. Share	Company		Industry		Percent of Indy. Shipments	Ending Inventory	Overtime Production
1	22.32%	22.52%	22.87%	33,800	33,800	-	-		726	-
2	28.30%	26.52%	27.93%	51,100	51,100	160,321	160,321	31.87%	13,530	-
3	32.98%	29.65%	32.31%	63,200	114,300	240,400	400,721	28.52%	12,027	-
4	14.57%	16.37%	14.74%	48,411	162,711	145,985	546,706	29.76%	-	3,711
5	14.69%	15.55%	15.28%	40,604	203,315	97,056	643,762	31.58%	-	704
6	19.44%	22.27%	24.72%	65,400	268,715	182,162	825,924	32.54%	14,195	-
7	26.02%	27.54%	28.08%	71,600	340,315	242,512	1,068,436	31.85%	10,499	-
8	21.52%	23.03%	20.98%	57,647	397,962	326,710	1,395,146	28.52%	1,536	1,847
9	23.49%	21.29%	14.16%	44,800	442,762	129,593	1,524,739	29.04%	-	-
10	28.86%	29.31%	22.52%	55,300	498,062	498,062	1,705,828	29.20%	-	-
11	32.39%	31.60%	29.35%	80,600	578,662	247,394	1,953,222	29.63%	-	-
12	20.76%	26.84%	17.17%	58,614	637,276	201,668	2,154,890	29.57%	-	-

LEGEND:

- Enter data
- Data extracted from COMPETE results
- Calculation (Percentage)

(see exhibit 5), the Experience Effect (see exhibit 6), and the Cost of Production Effect (see exhibit 7). In each of the Data Extraction Tables, the Excel worksheet (tab), page number in the Excel-version of the COMPETE results printout, and cell references for each account are shown in the COMPETE Results Workbook table (on the right). The corresponding cell references for each account are shown in the Cost of Production worksheet table (on the left) in the Data Extraction Tables.

For instance, in the Data Extraction Table for the Cost of Production - TST (R&D Effect) worksheet (see exhibit 4), the Company Cost of Production in period 1 in cell B11 on the "Performance Cost of Production - TST Analysis Worksheet" (see exhibit 1) is extracted from cell I10 in the "Product Cost Report" table on the "Quality, Cost, OT, Shipments" worksheet of the COMPETE results workbook 1.xls. Similarly, the NAEM Average - Period 1 in cell C11 on the "Performance Cost of Production - TST Analysis Worksheet" (see exhibit 1) is extracted from cell J10 in the "Product Cost Report" table on the "Quality, Cost, OT, Shipments" worksheet of the COMPETE results workbook 1.xls. In addition, the Industry R&D to Cost - Period 1 in cell H11 on the "Performance Cost of Production - TST Analysis Worksheet" (see exhibit 1) is extracted from cell E38 in the Indy R&D for Cost - TST table on the NAEM Bulletin 2 worksheet of the COMPETE results workbook 1.xls.

In addition, in the "Data Extraction Table for Cost of Production - TST (Scale Effect) Worksheet" (see exhibit 5), the Region 1 Market Share - Period 1 in cell B28 on the "Performance Cost of Production - TST Analysis worksheet

(see exhibit 1) is extracted from cell G10 in the "Unit Sales By Product By Region" table on the "Unit Sales" worksheet of the COMPETE results workbook 1.xls. Similarly, the Region 2 Market Share - Period 2 in cell C29 on the "Cost of Production - TST Analysis Worksheet" (see exhibit 1) is extracted from cell G11 in the "Unit Sales By Product By Region" table on the "Unit Sales" worksheet of the COMPETE results workbook 2.xls. Further, the Region 3 Market Share - Period 3 in cell D30 on the "Cost of Production - TST Analysis Worksheet" (see exhibit 1) is extracted from cell G12 in the "Unit Sales By Product By Region" table on the "Unit Sales" worksheet of the COMPETE results workbook 3.xls.

Further, in the "Data Extraction Table for Cost of Production - TST (Experience Effect) Worksheet" (see exhibit 6), the Company Shipments - Period 1 in cell E28 on the "Performance Cost of Production - TST Analysis Worksheet" (see exhibit 1) is the combined sum of Company Shipments in Regions 1,2 and 3 extracted from cells E27, E28 and E29 in the "Shipments and Inventory By Region By Product" table on the "Quality, Cost, OT, Shipments" worksheet of the COMPETE results workbook 1.xls. Similarly, the Industry Shipments - Period 2 in cell G29 on the "Performance Cost of Production - TST Analysis Worksheet" (see exhibit 1) is extracted from cell D40 in the "Industry Unit Shipments By Region And Product" table on the "NAEM Bulletin 1" worksheet of the COMPETE results workbook 2.xls.

Lastly, in the "Data Extraction Table for Cost of Production - TST (Cost of Production Effect) Worksheet" (see exhibit 7), the Ending Inventory - Period 1 in cell J28 on the "Performance

EXHIBIT 3 PERFORMANCE COST OF PRODUCTION-SSL ANALYSIS WORKSHEET

Performance Analysis Cost of Production - SSL										
Epiphany Company 3										
Period										
R&D Effect										
Company										
Period	Company	NAEM	R&D Exp.	% to Cost	R&D to Cost	Cum Cost R&D	R&D to Cost	Cum. R&D to Cost	Percent of Indy. R&D	
1	\$ 39.00	\$ -	\$ 500,000	30%	\$ 150,000	\$ 150,000	\$ -	\$ -		
2	\$ 38.85	\$ 38.85	\$ 600,000	29%	\$ 174,000	\$ 174,000	\$ 698,000	\$ 698,000	24.93%	
3	\$ 37.69	\$ 38.11	\$ 700,000	28%	\$ 196,000	\$ 370,000	\$ 2,102,000	\$ 2,800,000	13.21%	
4	\$ 37.94	\$ 39.05	\$ 800,000	27%	\$ 216,000	\$ 586,000	\$ 726,000	\$ 3,526,000	16.62%	
5	\$ 37.98	\$ 38.03	\$ 900,000	26%	\$ 234,000	\$ 820,000	\$ 915,000	\$ 4,441,000	18.46%	
6	\$ 36.75	\$ 38.19	\$ 1,000,000	25%	\$ 250,000	\$ 1,070,000	\$ 875,000	\$ 5,316,000	20.13%	
7	\$ 36.55	\$ 37.88	\$ 1,100,000	24%	\$ 264,000	\$ 1,334,000	\$ 1,000,000	\$ 6,316,000	21.12%	
8	\$ 36.85	\$ 38.11	\$ 1,200,000	23%	\$ 276,000	\$ 1,610,000	\$ 980,000	\$ 7,296,000	22.07%	
9	\$ 37.41	\$ 37.90	\$ 1,300,000	22%	\$ 286,000	\$ 1,896,000	\$ 1,075,000	\$ 8,371,000	22.65%	
10	\$ 36.89	\$ 38.08	\$ 1,400,000	21%	\$ 294,000	\$ 2,190,000	\$ 1,392,500	\$ 9,763,500	22.43%	
11	\$ 36.86	\$ 37.81	\$ 1,500,000	20%	\$ 300,000	\$ 2,490,000	\$ 1,347,500	\$ 11,111,000	22.41%	
12	\$ 37.11	\$ 38.06	\$ 1,600,000	19%	\$ 304,000	\$ 2,794,000	\$ 927,500	\$ 12,038,500	23.21%	

Scale Effect										
Experience Effect										
Cost of Production Effect										
Period	Region 1 Mkt. Share	Region 2 Mkt. Share	Region 3 Mkt. Share	Company		Industry		Percent of Indy. Shipments	Ending Inventory	Overtime Production
				Shipments	Cum. Shipments	Shipments	Cum. Shipments			
1	21.65%	23.25%	24.98%	411,000	411,000	-	-		111,754	-
2	22.76%	23.64%	26.09%	178,100	178,100	812,963	812,963	21.91%	11,530	-
3	17.82%	17.82%	20.41%	240,025	418,125	609,208	1,422,171	29.40%	3,801	6,925
4	26.95%	27.19%	28.26%	563,900	982,025	1,714,100	3,136,271	31.31%	74,862	-
5	25.72%	25.67%	25.66%	253,000	1,235,025	647,192	3,783,463	32.64%	37,032	-
6	22.49%	23.80%	25.21%	252,400	1,487,425	925,738	4,709,201	31.59%	45,055	-
7	11.91%	11.95%	14.00%	215,199	1,702,624	731,411	5,440,612	31.29%	9,222	2,299
8	20.69%	20.08%	22.38%	557,800	2,260,424	1,778,800	7,219,412	31.31%	96,179	-
9	27.17%	27.46%	32.04%	201,800	2,462,224	687,083	7,906,495	31.14%	-	-
10	27.95%	27.54%	36.77%	233,665	2,695,889	919,971	8,826,466	30.54%	-	-
11	20.30%	23.48%	35.88%	204,600	2,900,489	790,469	9,616,935	30.16%	-	-
12	26.68%	22.79%	38.61%	442,400	3,342,889	1,724,787	11,341,722	29.47%	-	-

Cost of Production – TST Analysis Worksheet” (see exhibit 1) is the combined sum of Ending Inventory in Regions 1, 2 and 3 extracted from cells F27, F28 and F29 in the “Shipments and Inventory By Region By Product” table on the “Quality, Cost, OT, Shipments” worksheet of the COMPETE results workbook 1.xls. Similarly, the Overtime Production – Period 2 in cell K29 on the “Performance Cost of Production – TST Analysis Worksheet” (see exhibit 1) is the combined sum of Overtime Production in Regions 1, 2 and 3 extracted from cells G18, G19 and G20 in the “Overtime Production / Shipments” table on the “Quality, Cost, OT, Shipments” worksheet of the COMPETE results workbook 2.xls.

In summary, the Performance Cost of Production – Analysis Worksheets for the TST (see exhibit 1), CVE (see exhibit 2) and SSL (see exhibit 3) extract (a) the current cost of production for the company, the NAEM Industry Average Cost of Production, and the Industry R&D for cost reduction to assess the R&D effect, (b) the regional market share to assess the Scale effect, (c) the company shipments for all three regions and total industry shipments to assess the Experience effect, and (d) the company ending inventory, and overtime production to assess the Cost of Production effect, during each decision period. In

addition, the Performance Cost of Production Analysis Worksheets (b) calculate and present the combined company shipments for all three regions to assess the Experience effect, and the combined ending inventory and overtime production for all three regions to assess the Cost of Production effect in all three regions.

Each Performance Cost of Production – Analysis Worksheet focuses user attention on relevant information that affect the unit cost of production for a specific period. When a specific period for analysis is selected from a dropdown menu list of 12 periods, all rows with data for subsequent periods are hidden. This facilitates analysis of the relevant data for prior periods only and reduces clutter during the team presentation.

COST OF PRODUCTION PERFORMANCE PACKAGE USE

The Web-based Cost of Production Performance Package is accessible online to competing participant teams in the marketing simulation COMPETE. The Web-based Cost of Production Performance Package is a zipped folder Performance Cost of

EXHIBIT 4 DATA EXTRACTION TABLE FOR COST OF PRODUCTION-TST (R&D EFFECT) WORKSHEET

Data Extraction from COMPETE Results Workbooks (1.xls to 12.xls) To Cost of Production - TST Worksheet							
Cost of Production - TST Worksheet			COMPETE Results Workbook Period.xls				
Account	Cell		Workbook	Tab	Page #	Account	Cell Ref.
Company Name	A4	from ==>	1.xls	Title	Title Page		C15
Company Number	A5	from ==>	1.xls	Title	Title Page		C14
Company Cost Of Production - Period 1	B11	from ==>	1.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #1	I10
Company Cost Of Production - Period 2	B12	from ==>	2.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #2	I10
Company Cost Of Production - Period 3	B13	from ==>	3.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #3	I10
Company Cost Of Production - Period 4	B14	from ==>	4.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #4	I10
Company Cost Of Production - Period 5	B15	from ==>	5.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #5	I10
Company Cost Of Production - Period 6	B16	from ==>	6.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #6	I10
Company Cost Of Production - Period 7	B17	from ==>	7.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #7	I10
Company Cost Of Production - Period 8	B18	from ==>	8.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #8	I10
Company Cost Of Production - Period 9	B19	from ==>	9.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #9	I10
Company Cost Of Production - Period 10	B20	from ==>	10.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #10	I10
Company Cost Of Production - Period 11	B21	from ==>	11.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #11	I10
Company Cost Of Production - Period 12	B22	from ==>	12.xls	Quality, Cost, OT, Shipments	7	Co. Value Period #12	I10
NAEM Average - Period 1	C11	from ==>	1.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #1	J10
NAEM Average - Period 2	C12	from ==>	2.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #2	J10
NAEM Average - Period 3	C13	from ==>	3.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #3	J10
NAEM Average - Period 4	C14	from ==>	4.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #4	J10
NAEM Average - Period 5	C15	from ==>	5.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #5	J10
NAEM Average - Period 6	C16	from ==>	6.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #6	J10
NAEM Average - Period 7	C17	from ==>	7.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #7	J10
NAEM Average - Period 8	C18	from ==>	8.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #8	J10
NAEM Average - Period 9	C19	from ==>	9.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #9	J10
NAEM Average - Period 10	C20	from ==>	10.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #10	J10
NAEM Average - Period 11	C21	from ==>	11.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #11	J10
NAEM Average - Period 12	C22	from ==>	12.xls	Quality, Cost, OT, Shipments	7	NAEM Avg. Period #12	J10
Industry R&D to Cost - Period 1	H11	from ==>	1.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 2	H11	from ==>	2.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 3	H11	from ==>	3.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 4	H11	from ==>	4.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 5	H11	from ==>	5.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 6	H11	from ==>	6.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 7	H11	from ==>	7.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 8	H11	from ==>	8.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 9	H11	from ==>	9.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 10	H11	from ==>	10.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 11	H11	from ==>	11.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38
Industry R&D to Cost - Period 12	H11	from ==>	12.xls	NAEM Bulletin 2	17	Indy R&D for Cost - TST	E38

Production.zip that consists of one program file Cost of Production.xls and twelve COMPETE result files 1.xls, 2.xls, ..., 12.xls. The Excel workbook file Cost of Production.xls consists of three worksheets Cost of Production – TST, Cost of Production – CVE, and Cost of Production – SSL. Each of these three worksheets has external links to twelve Excel version of sample COMPETE results (output) files.

The updated Cost of Production – TST, Cost of Production – CVE, and Cost of Production – SSL worksheets (see Exhibits 1, 2 & 3) in the Cost of Production.xls workbook are used to monitor and assess the cost of production performance and to understand the primary reasons for high cost of production during any specific decision period (quarter). The user can assess each of the primary determinants of the R&D effect, the Scale effect, the Experience effect and the Cost of Production effect on the cost of production of each product.

Each of the three product-specific Cost of Production worksheets (see exhibits 1, 2 & 3) can be used in a similar manner to

monitor the cost of production relative to the NAEM industry average and to understand the primary reasons for low or high cost of production during a specific decision period (quarter). The user can assess each of the primary determinants of the unit cost of production. First, the user can assess the R&D effect by comparing the cumulative company investment in R&D with the cumulative industry R&D investment till the assessment period. Next, the user can assess the scale effect by monitoring the regional market share for each decision period till the assessment period. Then, the user can assess the experience effect by comparing the cumulative company shipments with the cumulative industry shipments till the assessment period. Finally, the user can assess the Cost of Production effect by monitoring the ending inventory and overtime production till the assessment period.

EXHIBIT 5 DATA EXTRACTION TABLE FOR COST OF PRODUCTION-TST (SCALE EFFECT) WORKSHEET

Data Extraction from COMPETE Results Workbooks (1.xls to 12.xls) To Cost of Production - TST Worksheet							
Cost of Production - TST Worksheet		COMPETE Results Workbook Period.xls					
Account	Cell	Workbook	Tab	Page #	Account	Cell Ref.	
Region 1 Market Share - Period 1	B28	from ==>	1.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 2	B29	from ==>	2.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 3	B30	from ==>	3.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 4	B31	from ==>	4.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 5	B32	from ==>	5.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 6	B33	from ==>	6.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 7	B34	from ==>	7.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 8	B35	from ==>	8.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 9	B36	from ==>	9.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 10	B37	from ==>	10.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 11	B38	from ==>	11.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 1 Market Share - Period 12	B39	from ==>	12.xls	Unit Sales	6	Region 1 TST % Actual Sales	G10
Region 2 Market Share - Period 1	C28	from ==>	1.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 2	C29	from ==>	2.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 3	C30	from ==>	3.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 4	C31	from ==>	4.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 5	C32	from ==>	5.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 6	C33	from ==>	6.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 7	C34	from ==>	7.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 8	C35	from ==>	8.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 9	C36	from ==>	9.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 10	C37	from ==>	10.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 11	C38	from ==>	11.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 2 Market Share - Period 12	C39	from ==>	12.xls	Unit Sales	6	Region 2 TST % Actual Sales	G11
Region 3 Market Share - Period 1	D28	from ==>	1.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 2	D29	from ==>	2.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 3	D30	from ==>	3.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 4	D31	from ==>	4.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 5	D32	from ==>	5.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 6	D33	from ==>	6.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 7	D34	from ==>	7.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 8	D35	from ==>	8.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 9	D36	from ==>	9.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 10	D37	from ==>	10.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 11	D38	from ==>	11.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12
Region 3 Market Share - Period 12	D39	from ==>	12.xls	Unit Sales	6	Region 3 TST % Actual Sales	G12

COST OF PRODUCTION PERFORMANCE PACKAGE PROCESS

First, the user downloads and unzips the Performance Cost of Production.zip folder. Next, the user logs in to CODES and downloads, renames and saves the Excel version of results for each decision period (quarter) such as 1.xls, 2.xls, ... , 12.xls in the unzipped "C:\Performance Cost of Production" directory. Then, the user opens and updates the Cost of Production.xls workbook and selects the period to be analyzed.

For example, the executives of one of the four competing participant teams Tech 391 (Company 3) have used the Cost of Production Performance package to analyze the high cost of production of their TST product during period 12. The Cost of Production – TST worksheet (see exhibit 8) indicates (at the top left) that their unit cost of production of \$3662.25 is higher than NAEM industry average unit cost of production of \$3642.18 in period 12. In addition, the Cost of Production – TST worksheet indicates that their TST unit cost of production is higher than the NAEM industry average unit cost of production throughout the competition. The NAEM Bulletin does not provide industry average unit cost of production data during the first period of competition and is thus blank during period 1. As the legend at the bottom of the worksheet indicates, cells where the user is required to enter data are colored yellow, cells containing data extracted (via external links) from the COMPETE results workbooks for each period are colored turquoise, and cells with percentage calculations are colored brown.

First, the executives enter their total R&D Expenditure and the percent of the total R&D budget that is focused on process improvement (cost reduction) for each decision period. The R&D dollars invested in cost reduction is the total R&D budget multiplied by the percent to cost during each decision period. These R&D investments in cost reduction during each period are cumulated in the fourth company column. Tech 391 has

invested a cumulative amount of \$2,794,000 (see exhibit 8) in cost reduction in twelve decision periods. The industry R&D investment in cost reduction during each decision period is extracted from the NAEM Bulletin in the COMPETE results workbooks for each decision period. These industry R&D investments in cost reduction during each period are cumulated in the second industry column. The industry has invested a cumulative amount of \$18,362,000 (see exhibit 8) in cost reduction in eleven decision periods. The NAEM Bulletin does not provide industry R&D investment in cost reduction during the first period of competition and is thus blank during period 1. The last column on the right indicates that the cumulative company investment of \$2,794,000 in R&D in twelve periods is only 15.22 percent of the cumulative industry investment of \$18,362,000. This indicates that the company Tech 391 has not kept pace (25 percent as one of four firms) with industry investment in R&D during the 12 decision periods. Hence, Tech 391 has not benefited from the R&D Effect in lowering the TST unit cost of production.

Second, the regional market share in all three regions extracted from the COMPETE results workbooks during all twelve decision periods helps the executives of Tech 391 assess the Scale Effect. A cursory view of the first three columns on the lower left of exhibit 8 indicates that, except for a few outlier periods, the company Tech 391 has realized between 21 and 29 percent market share as one of four companies in the industry. Hence, the scale effect (economies of scale) has neither been responsible for substantially lowering or raising the unit cost of production.

Third, total company shipments and industry shipments during each decision period are extracted from the COMPETE results workbooks in order to assess the impact of the Experience Effect on unit cost of production. Both the company and industry shipments are cumulated over the twelve periods of competition. Tech 391 cumulative 41,540 units of TST ship-

EXHIBIT 6 DATA EXTRACTION TABLE – COST OF PRODUCTION-TST WORKSHEET (EXPERIENCE EFFECT)

Data Extraction from COMPETE Results Workbooks (1.xls to 12.xls) To Cost of Production - TST Worksheet							
Cost of Production - TST Worksheet			COMPETE Results Workbook Period.xls				
Account	Cell		Workbook	Tab	Page #	Account	Cell Ref.
Company Shipments - Period 1	E28	from ==>	1.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E29
Company Shipments - Period 2	E29	from ==>	2.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E29
Company Shipments - Period 3	E30	from ==>	3.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E30
Company Shipments - Period 4	E31	from ==>	4.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E31
Company Shipments - Period 5	E32	from ==>	5.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E32
Company Shipments - Period 6	E33	from ==>	6.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E33
Company Shipments - Period 7	E34	from ==>	7.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E34
Company Shipments - Period 8	E35	from ==>	8.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E35
Company Shipments - Period 9	E36	from ==>	9.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E36
Company Shipments - Period 10	E37	from ==>	10.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E37
Company Shipments - Period 11	E38	from ==>	11.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E38
Company Shipments - Period 12	E39	from ==>	12.xls	Quality, Cost, OT, Shipments	7	Company Shipments (R1 + R2 + R3)	E27+E28+E39
Industry Shipments - Period 1	G28	from ==>	1.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 2	G29	from ==>	2.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 3	G30	from ==>	3.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 4	G31	from ==>	4.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 5	G32	from ==>	5.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 6	G33	from ==>	6.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 7	G34	from ==>	7.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 8	G35	from ==>	8.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 9	G36	from ==>	9.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 10	G37	from ==>	10.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 11	G38	from ==>	11.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40
Industry Shipments - Period 12	G39	from ==>	12.xls	NAEM Bulletin 1	16	Industry Shipments (R1 + R2 + R3)	D40

ments are 23.13 percent (less than 25% as one of four companies) of industry cumulative 179,560 shipments (see exhibit 8). Industry shipments are cumulated over 11 decision periods (periods 2 to 12). The NAEM Bulletin does not provide industry shipment data during the first period of competition and is thus blank during period 1. Hence, Tech 391 has not benefited from the Experience Effect in lowering the TST unit cost of production.

Lastly, total company ending inventory and overtime production during each decision period is extracted from the COMPETE results workbooks. Excessive ending inventory of 4,885 and 4,192 units of high-end holographic 3-D large screen TVs during periods 6 and 7 (see exhibit 8) as well as large ending inventories in five other periods (2, 3, 5, 9 and 10) together with stockouts and resulting overtime production of 820 units in periods 8, 11 and 12 have necessitated significant variation in the levels of output giving rise to higher unit costs of production at the ends of the U-shaped cost of production function. Hence, excessive ending inventories, stockouts and overtime production have resulted in higher production costs. Tech 391 can lower TST unit cost of production through better forecasting, leading to lower levels of ending inventory, stockouts, and overtime production.

In summary, competing participant teams use the Cost of Production Performance worksheet to (a) monitor the unit cost of production of each of their products relative to industry unit costs, (b) identify instances of high unit production costs, (c) assess the impact of the R&D effect, Scale Effect, Experience Effect, and Cost of Production Effect on the unit cost of production, (d) understand the reasons for rising unit production costs, (e) take corrective action, and (f) improve performance. In so doing, they operationalize the Iceberg Principle and exercise marketing control.

STRENGTHS AND LIMITATIONS

Unit cost of production performance analysis can help management (a) identify instances when the unit cost of production of one or more of their products is above average, (b) determine the primary underlying causes for high production costs and consequent low margins, and (c) take corrective action in order to improve profitability. The cost of production performance package enables managers to assess whether the scale effect (low market share), experience effect (low cumulative shipments), cost-of-production effect (excessive ending inventory, storage charge, stockouts, and/or overtime production) and/or the R&D effect (low investment in R&D directed toward process and cost of production improvement) have led to the high unit cost of production. After they identify the product/s with high unit cost of production and understand the primary reasons for high production costs, marketing managers can use the insight derived to take corrective action.

Positive anecdotal student feedback was received from undergraduate students at the end of the Spring 2015 semester. Some undergraduate students reported that the decision support packages were very useful and helpful in understanding the determinants of profitability. They indicated that the automatic extraction feature saved time instead of having to identify the relevant data and enter the numbers in the cost of production performance package.

The Online Cost of Production Performance Package has some limitations. First, the National Association of Electronics Manufacturers trade association welcomes new corporate members during the first decision period, and informs them that industry and market data will be provided from the second period. Accordingly, some of the relevant data are not reported and hence cannot be extracted by the Cost of Production Performance Package from the COMPETE results printout for the first decision period. These data include (a) the Industry Aver-

EXHIBIT 7 DATA EXTRACTION TABLE – COST OF PRODUCTION-TST WORKSHEET (COST OF PRODUCTION EFFECT)

Data Extraction from COMPETE Results Workbooks (1.xls to 12.xls) To Cost of Production - TST Worksheet							
Cost of Production - TST Worksheet		COMPETE Results Workbook Period.xls					
Account	Cell	Workbook	Tab	Page #	Account	Cell Ref.	
Ending Inventory - Period 1	J28	from ==>	1.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 2	J29	from ==>	2.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 3	J30	from ==>	3.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 4	J31	from ==>	4.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 5	J32	from ==>	5.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 6	J33	from ==>	6.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 7	J34	from ==>	7.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 8	J35	from ==>	8.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 9	J36	from ==>	9.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 10	J37	from ==>	10.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 11	J38	from ==>	11.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Ending Inventory - Period 12	J39	from ==>	12.xls	Quality, Cost, OT, Shipments	7	Ending Inventory (R1 + R2 + R3)	F27+F28+F29
Overtime Production - Period 1	K28	from ==>	1.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 2	K29	from ==>	2.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 3	K30	from ==>	3.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 4	K31	from ==>	4.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 5	K32	from ==>	5.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 6	K33	from ==>	6.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 7	K34	from ==>	7.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 8	K35	from ==>	8.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 9	K36	from ==>	9.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 10	K37	from ==>	10.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 11	K38	from ==>	11.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20
Overtime Production - Period 12	K39	from ==>	12.xls	Quality, Cost, OT, Shipments	7	Overtime Production (R1 + R2 + R3)	G18+G19+G20

age Cost for each product in the Cost Report, (b) Industry R&D to Cost for each product in the NAEM Bulletin 1, and (c) Industry Shipments for each product in the NAEM Bulletin 2. In addition, if the firm does not order the necessary market research reports, the required information will be missing and not available for extraction from the Excel version of the COMPETE results files 1.xls, 2.xls, ... , 12.xls.

Despite these limitations, the Cost of Production Performance Package is a simple yet powerful web-based user-centered learning tool that extracts relevant data from the simulation results, precludes data entry error, and saves considerable time involved in identifying and entering relevant data. Yet, in order to maximize learning about the Iceberg Principle and Marketing Control, and actualize the learning potential of the Cost of Production Performance Package, the instructor needs to (a) explain the purpose, significance, assumptions, usage, and limitations of this dss package, (b) require inclusion of a sample analysis in a team report or presentation, and (c) test students on their understanding of the underlying concepts at the end of the

semester.

CONCLUSION

The Web-based Cost of Production Performance Package is a user-centered learning tool that helps to prepare students for marketing decision-making responsibilities in their future careers. The package enables users to apply the Iceberg Principle in Marketing Control and determine whether the cost of production of each product in their brand portfolio is under control. Participants use the Cost of Production Performance Package to determine if the unit cost of production of each product in their brand portfolio is under control, and to assess the primary reasons for high production costs. This Web-based Cost of Production Performance Package facilitates the integration of computers, the Internet and the World Wide Web into the marketing curriculum.

EXHIBIT 8 PERFORMANCE COST OF PRODUCTION-TST ANALYSIS WORKSHEET

Performance Analysis Cost of Production - TST									
Tech 391 Company 3									
Period									
R&D Effect									
Company									
Industry									
Percent of									
Period	Company	NAEM	R&D Exp.	% to Cost	R&D to Cost	Cum Cost R&D	R&D to Cost	Cum. R&D to Cost	Indy. R&D
1	\$ 3,400.00	\$ -	\$ 500,000	30%	\$ 150,000	\$ 150,000	\$ -	\$ -	
2	\$ 3,400.00	\$ 3,400.00	\$ 600,000	29%	\$ 174,000	\$ 174,000	\$ 3,090,000	\$ 3,090,000	5.63%
3	\$ 3,446.16	\$ 3,445.70	\$ 700,000	28%	\$ 196,000	\$ 370,000	\$ 1,805,000	\$ 4,895,000	7.56%
4	\$ 3,542.04	\$ 3,533.41	\$ 800,000	27%	\$ 216,000	\$ 586,000	\$ 1,880,000	\$ 6,775,000	8.65%
5	\$ 3,543.80	\$ 3,536.96	\$ 900,000	26%	\$ 234,000	\$ 820,000	\$ 1,535,000	\$ 8,310,000	9.87%
6	\$ 3,548.25	\$ 3,544.12	\$ 1,000,000	25%	\$ 250,000	\$ 1,070,000	\$ 1,290,000	\$ 9,600,000	11.15%
7	\$ 3,553.97	\$ 3,558.68	\$ 1,100,000	24%	\$ 264,000	\$ 1,334,000	\$ 1,162,000	\$ 10,762,000	12.40%
8	\$ 3,573.16	\$ 3,573.57	\$ 1,200,000	23%	\$ 276,000	\$ 1,610,000	\$ 1,350,000	\$ 12,112,000	13.29%
9	\$ 3,600.58	\$ 3,589.83	\$ 1,300,000	22%	\$ 286,000	\$ 1,896,000	\$ 1,600,000	\$ 13,712,000	13.83%
10	\$ 3,615.91	\$ 3,606.56	\$ 1,400,000	21%	\$ 294,000	\$ 2,190,000	\$ 1,940,000	\$ 15,652,000	13.99%
11	\$ 3,635.63	\$ 3,627.21	\$ 1,500,000	20%	\$ 300,000	\$ 2,490,000	\$ 1,535,000	\$ 17,187,000	14.49%
12	\$ 3,662.25	\$ 3,642.18	\$ 1,600,000	19%	\$ 304,000	\$ 2,794,000	\$ 1,175,000	\$ 18,362,000	15.22%

Scale Effect			Experience Effect				Cost of Production Effect			
Region			Company		Industry		Percent of			
Region 1	Region 2	Region 3	Company		Industry		Percent of			
Period	Mkt. Share	Mkt. Share	Mkt. Share	Shipments	Cum. Shipments	Shipments	Cum. Shipments	Indy. Shipments	Ending Inventory	Overtime Production
1	24.48%	20.70%	26.90%	3,400	3,400	-			-	-
2	22.17%	25.74%	22.94%	2,000	2,000	10,800	10,800	18.52%	1,141	-
3	23.74%	28.22%	25.16%	3,400	5,400	16,700	27,500	19.64%	1,423	-
4	25.11%	28.58%	25.77%	4,700	10,100	17,520	45,020	22.43%	248	-
5	21.88%	27.44%	22.91%	4,700	14,800	16,400	61,420	24.10%	1,218	-
6	21.30%	25.10%	22.95%	5,800	20,600	12,600	74,020	27.83%	4,885	-
7	22.17%	24.90%	22.60%	2,500	23,100	15,400	89,420	25.83%	4,192	-
8	12.88%	24.91%	21.01%	600	23,700	17,600	107,020	22.15%	-	100
9	23.69%	25.58%	20.88%	6,300	30,000	18,900	125,920	23.82%	2,289	-
10	50.72%	45.23%	33.95%	4,700	34,700	10,500	136,420	25.44%	2,532	-
11	28.42%	26.79%	19.53%	1,920	36,620	15,820	152,240	24.05%	405	120
12	22.36%	20.67%	13.44%	4,920	41,540	27,320	179,560	23.13%	-	820

LEGEND:

- Enter data
- Data extracted from COMPETE results
- Calculation (Percentage)

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