Chapter 1

Introduction

1.1 Objectives of study

The thesis focuses on investigating suitable statistical methods for analyzing, graphing and forecasting the sparkling beverages sales revenue. The data collected routinely in 14 provinces of Southern Thailand during years 2000 - 2006.

The objectives of this study are to model the pattern of sparkling beverage consumption rates in Southern Thailand and to determine precisely product preferences in each market segment, including forecast the sales revenue for both short- and long-term trends.

1.2 Rationale of study

Generally, business owners and managers need to know about their sales trends and profitability. Not only overall but by departments or products within each department, they also have to consider the potential of their business improvement from different areas. However, most managers do not have the time or expertise to analyze and forecast their sales data themselves.

Sales analysis is used to provide accurate management information relating to sales activities, key opportunity and issues to be addressed that are very useful for business planning and decision making (Syspro 2007). Forecasting is an important area for research. Marketing and other executives can benefit from formal forecasting methods. Strategy formulation, planning, and all types of future-oriented decision-

making require predictions about the future. Forecasts help managers by reducing some of the uncertainty, thereby enabling them to develop more useful plans. Forecasts are also used to predict profits, revenues, costs, productivity changes, prices and law materials (Kran 2008). Sales forecasting helps to set sales targets and to plan production, marketing, distribution, etc. (Lingham 2004). Developing sales forecast is important for several reasons; (1) for understanding market share and the competition, and the determinants of sales, including promotions, pricing, advertising and distribution; (2) for decision-making about scheduling of production, transportation and personnel; (3) for long-term strategic planning and cross-checking the reasonableness of annual plans developed from the financial goals; (4) for establishing a baseline business-as-usual forecast. Modern organizations require short-, medium- and long-term sales forecasts. Short-term sales forecasts are needed for scheduling of personnel, production and transportation. Medium-term sales forecasts are needed to determine future resource requirements in order to purchase raw materials, hire personnel, or buy machinery and equipment. Long-term sales forecasts are used in strategic planning. Such decisions must take account of market opportunities, environmental factors and internal resources. For example, a forecast of a large increase in sales may be used to make plans for increasing production capacity by building a new factory (Hyndman 2009).

Forecasting is an active research area for many decades. If the forecasts are timely, accurate, and realistic, considerable strategic and operational benefits will result. Accurate sales forecasts facilitate effective and efficient allocation of scarce resources. However, sales forecasting is often done poorly and frequently confused with planning and goals. Over-estimates of demand lead to several problems. First,

excess inventory uses up valuable shelf space and leads to obsolescence. Second, scarce working capital blocked up in inventory carrying charges cannot be used for other purposes such as research and development or promotional expenses. Third, storage charges are incurred to store excess inventory in public or private warehouses. Finally, margins are reduced when excess inventory is removed through end-of-year clearance sales. Under-estimates of demand lead to a different set of problems. First, stock-outs lead to wasted shelf space. Second, insufficient inventory leads to lost sales and consequent lost margins. Third, failure to keep up with customer demand may necessitate the use of limited and expensive overtime production leading to lower profitability. Finally, and most importantly, the firm may lose customers when prospects facing an empty store shelf try an alternative brand or go to an alternative store and are satisfied by the competitive offering. Given the detrimental impact of inaccurate forecasts, marketers use a variety of sales forecasting techniques in order to forecast sales accurately. So, sales forecasting research need to concentrate on the development of techniques.

From an academic perspective the study demonstrates how easily business data analysis and forecasting can be taught to both students and managers. From a managerial perspective, the study demonstrates that developing accurate sales analysis and forecasting capability need not be expensive or overly time-consuming.

1.3 Definition

Sales analysis involves the gathering, classifying, comparing, and studying company sales data. Forecasting is about predicting the future as accurately as possible, given

all the information available including historical data and knowledge of any future events that might impact the forecasts (Hyndman 2009).

Williams (2007) defined sales forecast as the amount of a product the firm actually expects to sell during a specific period at a specified level of marketing activities. Forecasts are basic inputs for many kinds of decisions in business organizations.

Steps to forecast are: 1) decide what to forecast, 2) evaluate & analyze appropriate data, 3) select & test the forecasting model, and 4) generate the forecast and monitor forecast accuracy over time.

1.4 Literature reviews

Several statistical models have been used for business data analysis and forecasting. Boonruangthaworn (2007) studied about forecasting techniques for Soft Drink Industry in order to predict the demand of a new product so that the production planning and inventory control are more efficient. He collected the historical demand data from 2004 to 2006. Then, implemented both qualitative and quantitative forecasting models and compared their forecasting error such as mean square error (MSE), mean absolute deviation (MAD) and mean absolute percentage error (MAPE). Then, the best model was selected as an input of the production planning. Finally, he compared total cost by using the result from both techniques. The results showed that Least Squares is the best forecasting method with the lowest forecasting error. In addition, by using this technique, the related cost could be reduced by 90% compared to that of the qualitative technique. The result showed that this quantitative forecasting technique is more appropriate than the current qualitative forecasting technique by considering cost and service level criteria.

GSS (2007) developed VIGILANCE sales analysis application which can copy sales dollars, sales units, and associated sales attribute data quickly, easily and unobtrusively from transaction files. Clean, correct and complete sales data can be loaded into Microsoft SQL Server® Relational Database Management System (RDBMS) tables for ease of analysis, consolidation, planning, and reporting.

Chin-Tsai (2002) forecasted non-alcoholic beverage sales in Taiwan. The study applied the Grey dynamic model to forecast sales of eight sub-category non-alcoholic beverages in Taiwan between 2001 and 2003. The accuracy of the new forecasting model exceeded 95 percent. The model predicts that the total beverages market will grow, but growth rates will vary for individual sub-categories. In relation to current growth, from 2001 to 2003, tea drinks, carbonated drinks, functional drinks and sports drinks will experience decreased market growth, while bottled water and fruit and vegetable juices will be a high growth market and coffee drinks and other drinks will enjoy improved sales. These results provide a valuable reference for the Taiwanese beverage industry developing marketing plans.

Higgins et al (2005) analyzed the residual demand to test whether carbonated soft drinks is a relevant product market using weekly AC Nielsen Scanner price and quantity data for carbonated soft drink products purchased in supermarkets in the United States. The results suggested that a market for carbonated soft drinks is too narrow for purposes of merger analysis according to the Merger Guidelines established by the United States Department of Justice and the Federal Trade Commission.

Regression model

Software World (2009) developed computer model for forecasting beer consumption in UK by applying Mathematics techniques of correlation analysis and regression analysis. The model would have been accurate within 10% on 90% of occasions for forecasting monthly consumption.

RNCOS (2008) forecasted Philippines beverages and tobacco market till 2011 using ratio analysis, historical trend analysis and linear regression analysis. Information has been sourced from books, newspapers, trade journals, and white papers, industry portals, government agencies, trade associations, monitoring industry news and developments, and through access to more than 3000 paid databases. The report provides detailed overview of the consumption patterns of the Philippines in various food segments.

Ratio analysis, historical trend analysis and linear regression analysis used by Bureau (2007) were found to be useful for analyzing the factors and examining the opportunities critical to the success of the food and beverage industry in India.

Linear regression modeling is now widely used (Pardoe 2006) where a variable to be forecast is modeled as linear combination of potential input variables.

Descriptive and multiple regression analyses (Probart et al 2006) had some good features to identify the factors associated with the offering and sale of competitive foods and school lunch participation.

In the case study of carbonated soft drink consumption and bone mineral density in adolescence by McGartland et al (2003), adjusted regression modeling was used to investigate the influence of carbonated soft drinks on bone mineral density.

Poikolainen et al (2002) discovered the number of fatal alcohol peaks during festivities characterized by unrestrained drinking and relates to sales of alcoholic beverages using regression analysis of quarterly series. Regression analysis showing that 1% increase in the sales of spirits increases the number of fatal alcohol poisonings by 0.4%. The findings could be of use in efforts to decrease hard drinking.

Caruana (2001) studied steps in forecasting with seasonal regression: a case study from the carbonated soft drink market. Illustrates the steps involved in building a forecasting model utilizing seasonal regression with a practical example. The model obtained for the carbonated soft drink brand under consideration estimates a growth rate of 3,568 units per month during the last five years and identifies the seasonal effect during each month of the year. The development of such models can provide a useful input to both marketing and operations planning.

An interesting application of regression model to forecasting is given by Byron and Ashenfelter (1995) who use a simple regression model to predict the quality of a Grange wine using simple weather variables. However, it is far more common for regression modeling to be used to explain historical variation than for it to be used for forecasting purposes.

Holt-Winters method

Exponential smoothing is a type of time series forecasting that uses past sales data weighted so that the value of the weighting factor declines as the data gets older. Also seasonality is incorporated into the forecasting model. Exponential smoothing is easier to understand than Box-Jenkins (Brown 1963).

Exponential smoothing methods are among the most widely used forecasting techniques in industry and business, in particular the well-known Holt-Winters methods (Holt 1957 and Winters 1960) that allow us to deal with univariate time series which contain both trend and seasonally factors.

Holt-Winters methods popularity is due to their simple model formulation and good forecasting results (Gardner 1985).

Holt-Winters is popular for mass produced forecasts, for example in production planning, because of its simplicity (ONS 2008).

Newberne and Captain (2007) demonstrated the use of the Holt-Winters model, a model used when data exhibits both trend and seasonality, on common healthcare data series.

Kotsialos et al (2005) used of a damped-trend Holt-Winters method and feed forward multilayer neural networks to forecast sales data from two German companies up to 52 periods ahead.

Bermudez et al (2005) applied additive Holt-Winters forecasting procedure to the series of monthly total UK air passengers from the year 1949 to 2005.

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The Holt-Winters method uses simple exponential smoothing in order to forecast. The forecast is obtained as a weighted average of past observed values where the weights decline exponentially so that the values of recent observations contribute to the

forecast more than the values of earlier observations. The technique involves three smoothing factors which may be thought of as smoothing the level, the trend and the seasonal pattern. When compared with other methods the technique has been found to perform relatively well (Makridakis et al 1984). It has the merit of being understood by users who lack of a statistical background without sacrificing the ability to adapt to changing patterns in the data.

Lee-Carter model

The non-linear Lee-Carter approach (Lee and Carter 1992) is widely used in both the academic literature and practical applications. It has become the leading statistical model of forecasting in the demographic literature (Deaton and Paxson 2004).

The Lee-Carter method was designed for long-term forecasting based on a lengthy time series of historic data. In the typical application, this model is fitted to past data to obtain parameter estimates, then it is produced a fit to the data by linearization and thereby adds confidence to extrapolations. Since it is computationally simple to apply and it has given successful results, it was popular used for long-term forecasts. The Lee-Carter model can also be applied for seasonality and non-linearity data such as using to price a risky coupon survivor bond (Denuit et al 2007) including to describe seasonal variation and non-linear for quarterly industrial production (Franses and Van 2005). There have been several extensions of the Lee-Carter method such as non-parametric smoothing, Kalman filtering, and multiple principle components.

In this thesis, we focus on applying statistical methods for business data analysis and forecasting. Linear regression model was applied for per capita consumption analysis. The observation-driven multiple linear regression was used for short-term sales

forecasting. The Lee-Carter model and Holt-Winter method were applied for long-term sales forecasting. Having the suitable models, managers can provide a useful basis for business plans and strategies.

1.5 Road map of the present study

This thesis contains four chapters, including this chapter which, in addition to a rationale for study and includes a literature review. Chapter 2 presents the methodology of the study. It provides a description of data including data source, data management and an overview of the statistical methods used to analysis and forecast sales revenue. Chapter 3 provides data analysis and models for consumption rates and sales revenue. This chapter divides into three studies. First study is modeling consumption rates for sales analysis. Second study is modeling sales revenue for short-term forecasting. Third study is modeling sales revenue for long-term forecasting. This involves characteristics of data, distribution of sales revenue and result from fitting statistical modeling of using the models described in Chapter 2. Chapter 4 states the conclusion and limitations of the study.