



Analysis of the supply and demand in the TFT–LCD market

James T. Lin^a, Fu-Kwun Wang^{b,*}, Shin-Lian Lo^a, Wan-Ting Hsu^a, Yen-Tai Wang^c

^a*Department of Industrial Engineering and Engineering Management, National Tsing-Hua University, Kuang Fu Road, Hsinchu 300, Taiwan, ROC*

^b*Department of Management, National Taiwan University of Science and Technology, No. 43 Keelung Road, Sec.4, Taipei, 106 Taiwan, ROC*

^c*Marketing Division, Desktop Display Business Unit, AU Optronics Corporation, Science-Based Industrial Park, Hsinchu 300, Taiwan, ROC*

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Abstract

A methodology for the analysis of the supply and demand in the Thin-Film Transistor (TFT)-liquid crystal display (LCD) market in 2004 is proposed. The quarterly history supply and demand data are collected from 63 factories in Taiwan, Korea, Japan, and China during 2000–2003. This method takes into the account supply, demand, and differences between supply/demand. For the supply, a heuristic approach is used to forecast the future supply. For the demand, a transfer function model is used to forecast the future demand. The difference analysis of the supply and demand shows that it can predict whether or not there appears to be a shortage in the market of 2004. In addition, three important managerial implications such as pricing strategy, product-mix decision, and customer's priority are discussed in this paper.

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1. Introduction

Display became a critical interface for connecting the information during the 21st century. The Flat Panel Display (FPD) plays a major role in exploring the advancement of modern IT devices. Chung et al.

* Corresponding author.

E-mail address: fukwun@mail.ntust.edu.tw (F.-K. Wang).

[1] discusses the megatrend of FPD technology. Low temperature polycrystalline silicon (LTPS)-based display device first became a major trend. The active LTPS display, where advanced circuits are integrated on the panel, may continuously adopt liquid crystal. Secondly, the trend may include the potential of adopting organic light-emitting device (OLED) as a display component replacing the current liquid crystal and the fluorescent backlight system. Finally, the trend brings a flexible plastic substrate for the TFT back plane and a color filter to make a flexible display. Mentley [2] concluded that there are no limits to creativity of the display developers or to the tools available for discovery and development. The challenge is to find the right combination of display performance and manufacturing cost to make FPDs attractive and affordable to the masses of people, which in turn will enrich their lives through technology.

The current FPD market has been dominated by Thin-Film Transistor (TFT), which has Amorphous Silicon (a-Si) to run an active matrix liquid crystal display (LCD). The large-size TFT-LCD has many applications such as a Notebook PC, a desktop LCD monitor, a mobile, and an LCD-TV. Mentley [2] also reported that the a-Si TFT-LCD would dominate FPD technology until 2010.

The motivation for this research stems primarily from the following issues associated with forecasting in the TFT-LCD market. First, the supply of TFT-LCD is the current capacity for the manufacturer of the TFT-LCD, and the ability and rate of manufacturer to add additional capacity if new technology can be implemented. Second, the demand for TFT-LCD is a prediction of how much TFT-LCD is purchased. The gap between supply and demand is whether or not there is excess in either demand or supply. Finally, depending on the degree of the gap between supply and demand, either the supply or capacity will increase the maximum rate possible or the proportion of the maximum rate required will satisfy future predictions of demand. A shortage will continue for multiple periods if either predictions or assumptions of the demand of the possible market underestimate the actual demand. On the other hand, a shortage may exist for multiple periods because future demand exceeds the ability to bring new capacity for satisfying demands immediately. Shortages in capacity allow manufacturers to modify their strategy and to obtain maximum profits.

Zhao et al. [3] evaluated the impact of forecasting models and early order commitment in a supply chain with one capacitated manufacturer and four retailers under demand uncertainty. They noticed that a proper forecasting model would enhance the effectiveness of early order commitment. Chan et al. [4] proposed a framework of a central coordination system, which is equipped with a multicriteria genetic optimization feature to assist collaboration activities. The optimization results indicate the influences of different sets of weightings on the demand allocation results. In this study, we examine the supply and demand in the TFT-LCD market. Based on the different analysis of the supply and demand, we can predict whether or not there appears to be a shortage in the market of 2004. This article is divided into the following sections. The development of the TFT-LCD industry in Japan, Korea, and Taiwan is reviewed in Section 2, followed by the forecasting model of the supply/demand, and lastly, the results. Here, the forecasting of the supply is used by a heuristic approach, and a transfer function model is used as the forecasting of the demand. The difference analysis between supply and demand and managerial implications are presented in Section 4, and the conclusions are made in the final section.

2. The development of the TFT-LCD industry

The development of LCD began in 1964. Kawamoto [5] provided the details of the history where development spans the world's major industrial centers: the USA, Europe, and Japan. Each industrial

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