

1 Introduction

Since the 1980's, Thailand has oriented itself toward industrialization. As a result, Thailand Gross Domestic Product (GDP) has increased along with the GDP of its industrial sector. In contrast, the agricultural sector's GDP has dramatically decreased in comparison with the agricultural sector's GDP at the beginning of the 1980's, contributing only 8.9 percent to Thailand's GDP in 2009 (BOT 2009). However, the agricultural sector is still an important element to Thailand as it contributes to the raw material of many industries, in particular, the food industry. Moreover, the agricultural sector employed around 38.2 percent of the Thai labor force in 2009 (BOT 2009). Agricultural products which are crucial to Thailand's economy are rice, rubber, chicken and seafood, and notably shrimp products.

From 1993 to 2002 Thailand had been the world's largest seafood exporter. Since then China has exceeded Thailand as the largest seafood exporter (Kagawa & Bailey 2006), however, Thailand still leads the world in export of shrimp products (DIT 2007b). Thailand exports various shrimp products averaging 300,000 tons per year. The main competitors in the global shrimp market are China, Indonesia and Vietnam, where shrimp and labor costs are lower (Kagawa & Bailey 2006). Therefore, in order to survive in the world market, Thai seafood processors must improve quality and differentiate their products. However, if production costs of Thai shrimp are too high, competitors will take the market with their lower prices. Cost reduction hence is the key success factor. Furthermore, transportation costs are a pivotal factor which influences the costs of raw materials used in production.

Due to the deregulation of the transportation industry in the USA, including the rail, motor, and airline sectors (Ekenstedt 2004), competition has greatly increased within the past four decades. Businesses have had to reduce costs in order to survive, and transportation costs were a substantial part. The hub-and-spoke-system has been a successful strategy which provides efficiency and reduces costs of transportation. Hub networks lead to an agglomeration of transportation flows and thus promote economies of scale. A hub is centrally located within many propagating spokes; hence it can be a suitable place to gather materials and later redistribute (O'Kelly 1998).

The hub-and-spoke system has been successfully used for cost reduction and increasing the efficiency of transportation in many businesses. This study, therefore, aims to apply the hub-and-spoke system to the agricultural transportation and distribution networks of Thai agricultural products, as well as to investigate the location of facilities within the shrimp industry.

This study engages in applying the hub-and-spoke system to the Thai shrimp industry in order to minimize the sum of the shrimp transportation costs in the system. The study considers not only transportation costs but also fixed costs and the costs reflecting the characteristics of agricultural products. This session concerns with the background and problem statement. The second chapter deals with various approaches for location planning as divided into descriptive approaches and normative approaches. The definition, characteristics of the hub-and spoke system and types of hub location problems are presented. Furthermore, the methods to solve problems of location optimizations are conversed. Finally, this chapter reviews the hub location problem and previously used solution methods.

The hub location problems, which are the keys to design of the hub-and-spoke systems and genetic algorithms, which are the solution method for hub location problems, are detailed in the third chapter. In this chapter, p-hub median problems, uncapacitated hub location problems and genetic algorithms are explained. The fourth chapter outlines the Thai shrimp industry and the application of the hub-and-spoke system to the Thai shrimp industry is briefly discussed. The hub location models for the Thai shrimp industry are presented. In the fifth chapter, the computational results from the model in the fourth chapter are discussed. Finally, the conclusion and discussion of this study are summarized in the sixth chapter.