

CHAPTER 1

INTRODUCTION

To become or maintain competitive advantage in their markets, companies must continuously strive to gain maximum return on their investment resources. Managers in 1960s-1970s tried to develop detailed market strategies, which focused on creating and capturing customer royalties. Organizations in that period realized that competitive advantages depended on strong engineering designs, which were able to translate customer needs into product, high-level quality and reasonable cost. Due to demand for new products that escalated in the 1980s, manufacturing organizations were required to increase their flexibility, in order to meet ever-changing customer demand. In the 1990s, as rapid development of manufacturing capabilities, information technology and globalization, businesses are becoming more and more competitive. Traditional production distribution schemes have changed dramatically. Managers have realized that materials and service inputs from suppliers and upstream companies have a major impact on their organization's ability to meet customer needs, while getting the products to customers at the right time and with the right quantity is also important. To maximize the competitive advantage all members in the supply chain should work together to serve the end customer. Owing to the realization, one company no longer competes with others, but one supply chain competes against other chains. Most companies have been forced to relocate or redesign their manufacturing network and improve the partner relationship in order to survive in the current market. Therefore the term of supply chain management has now become an interesting and challenging topic in both academic and business areas.

A supply chain may be defined as an integrated process where a number of various business entities work together in an effort to acquire raw materials, convert these raw materials into specified final products, and deliver these final products to retailers. This chain is traditionally characterized by a forward flow of materials and backward flow of information. The term of supply chain management is the integration of these activities through improved supply chain relationships to achieve a sustainable competitive advantage.

Inventory decisions are high risk and high impact in a supply chain management. Inventory committed to support future sales drives a number of anticipatory supply chain activities. Without a proper inventory assortment, lost sales and customer dissatisfaction may occur. Therefore, material ordering policy and inventory control system are considered to be one of the key issues in the supply chain systems. However, managing inventory in complex supply chains is typically quite difficult and may have a significant impact on all chain's partners. The difficulty in determining appropriate mechanisms with that efficient production, distribution, and inventory control strategies that can reduce the costs and improve the customer service level must take into account. Although determining this inventory control mechanisms may be quite complex and challenging, the benefit is enormous.

In order to determine appropriate inventory control mechanisms for each member in supply chain, it is important to consider interaction or relationship formed between various facilities and the impact of this interaction on the inventory policy that should be implemented by each facility. According to the different situations of information sharing

and ordering information, the relationship between each member in the chain can be described as two controlling policy which are decentralized and centralized controlling policies. Under the decentralized controlling policy, the inventories at different echelons of the supply chain are controlled independently. There is no information sharing among the members in the chain. Each member makes their inventory decisions according to their own forecasting. Under the centralized controlling policy, all members in the chain can retrieve the end customer's demand information in a synchronized manner. The upstream members will not depend on its downstream member, but on the end customer's demand directly.

1.1 Problem Statement

Recently a steady stream of research has focused on the role of inventory in the supply chain. When one party (i.e., retailer) decides to reduce its inventories so as to cut down its costs, this surely has a significant impact on other parties. In order to maintain the same service level, the upstream members (i.e., suppliers) need to increase their inventories to compensate for the inventory reduction from the downstream members (i.e., retailers). As a consequence, even though the retailer can reduce its cost, other members may have to pay extra costs to run their businesses. Therefore, traditional inventory models that solely focus on optimizing an individual company without concerning other partners in the chain are no longer effective in practice.

In order to determine an appropriate ordering quantity and inventory level among partners in the chain, it is important to consider the relationship among members and its impact on the supply chain system as a whole. Two contrasting policies, which used to set and control the ordering quantity and inventory level, are the decentralized and centralized controlling policies. Decentralized control is a casual relationship formed among members. It is usually implemented when all members in the system belong to different owners. As a result, each member in the chain aims to maximize its own profit without considering others. On the other hand, the centralized control is normally implemented when all members in the chain belong to one owner. Hence, only one controller controls all activities in the chain as well as aims to maximize the profit of the chain as a whole.

Unfortunately, the centralized control may not guarantee to improve the performance of all members in the chain and it is not easy to implement in practice due to conflicting goals (if members in the chain are from different owners who also have different interests). Therefore, the field of supply chain's studied with coordinating mechanism that aims to maximize the profit of all members in the chain, has recently grown in popularity. In this study, several types of the coordinating mechanism are put into the test to find its significant contribution and appropriate level of sharing. Building flexibility in the chain is really another challenge since such practice is done under conflicting interests among partners from different companies. The study has also designed this coordinating mechanism to be as flexible as possible to accommodate in dependency among members in the chain. This aspect is of importance for the implementation and is mostly ignored in literature.

1.2 Objectives of the Thesis

A prerequisite to become a chain is coordination and information sharing. Such information sharing and coordinating are hardly achieved among individual companies.

Therefore, the study is aimed to examine the problem of how to establish a coordinating mechanism in terms of financial incentives to improve overall performance of the whole chain as well as each member in the chain. In addition, three configurations of the chain (i.e. single dyadic chain, single retailer-multi manufacturers, and single manufacturer-multi retailers) are limited to the scope of the study. Parameters for controlling the appropriate ordering policy and inventory control systems at each member in the chain are optimized by using Genetic Algorithm (GA). This is to ensure that all systems are compared under the same basis (not comparing a good parameter setting with a bad parameter setting system). So the objective of the study may be summarized as follows:

1. Identifying the financial benefit to operate under the supply chain concept.
2. Investigating different chain's configurations under various strategic managements.
3. Recommending a coordinating mechanism in form of financial incentives as a first step to improve both cooperation and performance of all members in the chain as well as create a win/win situation to all members.
4. Optimizing material ordering and inventory control systems under the supply chain concept using Genetic Algorithm.

1.3 Overview of the Thesis

This thesis is divided into 7 chapters. The first chapter deals with the introduction. It includes problem statement, objectives of the thesis and overview of the thesis. Chapter two deals with literature review. This review includes the supply chain concept, bullwhip effect, information sharing, inventory management, strategic management and optimization in the supply chain. Next, chapter three describes the method of approach. Chapter four explains the characteristic of a single dyadic supply chain, and using GA to determine the appropriate ordering policy and inventory level at each member. Chapter five and six deal with a single manufacturer and multi-retailers' chain, and a single retailer and multi-manufacturers' chain respectively. The conclusion and recommendation for further study are lastly presented in Chapter seven.