ABSTRACT. An analytic model of the resource allocation decision process in a decentralized organization is presented. The model follows the philosophy of Kornai and Liptak in its decomposition procedure but employs the binary search technique in its resource allocation process. Briefly, the model provides two important concepts relevant to the decision making process of a decentralized organization: (1) satisficing technique of coordination and (2) simulation of a resource allocation decision process.

1. INTRODUCTION

A great deal of research has been conducted to develop effective solutions to specific organizational problems such as decision making, delegation of managerial responsibilities, communication, and the like. However, only a very limited number of studies have attempted to analyze organizational processes through conceptual and analytic models. The purpose of this paper is to provide a background on this important area of management and to present a mathematical model that explains the process of resource allocation in the hierarchical decentralized organization, a typical form of large complex organizations.

Decentralized decision making, especially the process of resource allocation, has been studied by many different groups of professionals: economists, behavioralists, and management scientists. Economists have studied the topic as part of market economy. Malinvaud [12] presents a brief history of the literature on decentralized planning. The works of Koopmans [7], and Arrow and Hurwicz [1] are especially important. Behavioralists have also addressed the problem of decentralized decision making primarily on the basis of extensive personal experience and empirical experiments. Behavioralists' models, however, have not been analytical and often fail to recognize the economic aspects of organizations [13]. Management scientists have dealt with the topic in connection with decomposition techniques of large scale programming problems.
These studies by different groups lack either analytic aspects as in the case of behavioralists or behavioral aspects as in the case of economists and management scientists. The efforts to integrate analytic and behavioral sides have been made by Kornai [8], Ruefli [16], Collomb [2], and Freeland [6]. Kornai discussed a decomposition technique in the context of economic planning in a socialist economy. Ruefli introduced the important concept of three level organization with externalities employed in the model. He was also the first one who proposed organizational structures as one of the important variables in his analytic model of decentralized decision making. Collomb’s goal interval oriented model, even though it does not lend itself to decomposition due to its nonconvexity, has dealt with the resource allocation in a decentralized organization. Freeland employed the concept of ‘bounded rationality’ in his model. The ‘bounded rationality’ describes the limited capacity of human beings to cope with complexities.

The above integrated models have their limitations. One predominant limitation is their computational inconvenience. The speed at which the value of objective function converges to the optimum solution is very slow indeed. Another limitation is their single goal assumption of either maximizing profit or minimizing cost. Perhaps the most effective technique that can handle multicriteria decision making problems is goal programming. Ruefli and Freeland employed the notion of goal programming, but the attempt was incomplete as they did not employ preemptive priority factors for multiple goals. Moreover, these models have severe computational inconveniences due to their special features. Ruefli presented a three level model where divisional goal levels are interdependent and project characteristics of operating units are not specifically known. This added feature of three level concept is very attractive conceptually and seems to describe the characteristics of a decentralized organization more generally. However, this feature demands an exorbitant computational process. Freeland also employed the concept of the interdependence between divisional goal levels but with the conventional two level model. The computational inconvenience of his model is primarily due to the goal partitioning algorithm which requires a solution of a master problem with as many constraints as the product of the number of divisions and the number of iterations.