Chapter 10

Modeling of Coordinated Planning and Allocation of Resources

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The chapter proposes a method for the formal description of enterprises as complex human-technical systems. In distinction from other methods this approach is aimed at the analysis of parallel planning and allocation of resources from different points of view. The method is valid for every hierarchical level of enterprise subdivision. It allows the design of decision making systems for various tasks of coordinated planning and allocation of resources. The optimal decisions are made in parallel for different subdivisions and subsystems, then the generalised decision for the global task is determined.

INTRODUCTION

Control of enterprise functioning lies in optimal planning and allocation of resources with regard to the whole set of performance tasks. Difficulties in the optimal coordinated resources allocation are caused by the problems, such as the interdependency of systems, resources and application tasks, a lack of resources and time, contradictory criteria for the decision of resource-consumption tasks, insufficient information about the current state of enterprise subsystems, and also the tendency towards reduced staff size under increasing complexity of application tasks (Boulatov, Shaposhnikov et al., 1997; Petrov, 1998).
Computer support for resource allocation is therefore vital. Automation of resource control makes it possible to make control decisions quicker, more precisely, provide a full overview of data and all desirable explanations.

Unfortunately, existing information systems cannot satisfy modern requirements completely and cannot provide the coordinated resource control (Boulatov et al., 1997; Petrov, 1998). Most of these systems are only database systems without reasoning capabilities. Intelligent systems can solve just a limited set of control tasks. This is due to the difficulties in developing a unified formal representation of enterprises for solving a variety of particular resource allocation tasks. At present, no complete methods are elaborated for the design of decision support systems based on system approach. It means that no decision-making system is able to support the coordinated control of the whole set of resource-consumption processes based on a unified methodological position.

This problem determines the aim and tasks of the research. The purpose consists in the elaboration of methods of the design of resource allocation control system based on system approach. To achieve the purpose, the following tasks have been set:

1. Formal description of enterprises, their structures and resource consumption processes.
2. Decision support in planning and allocation of resources.
3. Design of decision control systems for resource allocation.

Let's look at how these tasks were solved.

**FORMAL DESCRIPTION OF ENTERPRISE PERFORMANCE**

Decision support system for planning and allocation of resources must be able to analyze the whole set of resource consumption processes from different points of view but based on a unified methodological approach. To design such systems, it is necessary to work out a general model for a formal description of an enterprise as a unified object. This approach should formally reflect internal structures and various resource consumption processes as well as a decision-making process for control of resources allocation.

Before discussing the generalized model, it is necessary to say a few words about enterprises as objects of performance. Enterprises are considered as complex, multifunction, closed, autonomous objects. In general, they can be represented as a totality of three interdependent components: organizational, technical, and resource structures (Petrov, 1998; Gegov, 1997).

The technical structure reflects the structure of technical systems of the enterprise, their distribution, physical and functional interconnections, and the techni-
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