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The Optimal Allocation of Simulation Resource in Logistics Information Systems

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Abstract

The idea of building logistics systems is based on the integration of planning, monitoring and controlling of manufacturing business, financial and economic support, information and cyber service. This is a set of interrelated units of a complex control system to coordinate the material, financial and informational flows. The methodological basis of logistics is the methods of system analysis, operation research, modeling, identification, aggregation, coordination, optimization and decision making. Logistics is the science of planning and implementing the acquisition and use of the resources necessary to sustain the operation of a system. Lack of coordination between departments leads to imbalance in the system because of the desire to achieve the purposes of private individual subsystems. The objective of the study is to increase the effectiveness of material, financial and informational flows which is based on the principles of aggregation (integration), coordination, modeling and optimization (rational decisions), in order to get the overall impact on the system, this exceeded the effects derived from each element of the logistics system and the individual .

Keywords**:** logistic, subsystem**,** stochastic character**,** modeling.

1. The Problem of Resource Allocation

The problem is to understand everything that is used in the production and commercial action. For example, finance, raw materials, people, etc., you can prove that the most important tasks of planning and management, emerging in logistics systems are problems of resource allocation. The classical problem of resource allocation is to ensure that available in the presence on some interval stationary of the resources (financial, time, energy) to distribute the work to be performed. If resources were sufficient for efficient (high-quality, timely, and cheap) performance of all works, then the task would not have risen. In reality, there are always deficiencies for some resources. The transfer of resources from the mechanism of execution of one job to another leads to a change in the overall performance of all work together. Here we see that the distribution problem reduces to finding a best allocation of resources, which maximizes the total revenue (profit) of enterprises or minimizes the total cost [1, 2]. Effective organization and operation of logistics systems is premised on the legitimate constraints of available resources available to the user, without which it would lose its sense of a comparison of different variants of planning decisions. In the optimal plan every scarce resource, in contrast to non-deficient (free) is used entirely, but if the quantity is changed, then changed and the optimal objective function value. If you change the scarce resource is changed and the optimal objective function value. Volume of a scarce resource acts as a constraint optimization problem. Changing the resource may be deterministic in nature (explicitly depend on time), have a stochastic character (onset of the epidemic may be predict with a certain probability in a given season) or be vague, poorly predictable, depending on various factors.

A significant number of problems solved in the planning and management of logistics systems is reduced to an optimal allocation of resources. The importance of this problem is determined by the scarcity of resources and the fact that the efficiency of resources used in different areas (production and consumption) is manifested in different ways, and the force's effectiveness depends on the amount of resources and the method of distribution. Problems of resource allocation arise at the time of planning of the operation and when the resources available to carry out all works best are not enough. Depending on the task information, task allocation can be divided into three groups:

- Want to distribute the resources given between scheduled to perform work that way. to maximize profits or minimize the expected costs;
- To be determined. the resources necessary to carry out specified works to minimize the total cost of production;
- What is required to determine: the composition of the work can be done given the resources to provide some measure to maximize the efficiency [3, 4].

2. Models of Resource Allocation

In modeling the optimal distribution of resources in logistics systems in most cases, various modifications of the classical problems of linear, nonlinear and integer mathematical programming problems of optimal network planning and management in determination , fuzzy and stochastic productions (the latter decision is based on probabilistic estimates of future values of the parameters), the assignment problem in static (single) and dynamic (in particular fixed values of the variable parameters) productions, the problem of optimal long-term planning in terms of scarcity (limited resources) and others [1, 2, 5].

The problem of optimal allocation of resources is to ensure the most efficient way to allocate scarce resources given (finance, raw materials, machinery, and People, etc.), ensuring the maximum possible production of goods and thus optimizing the efficiency of the selected criteria (volume of production, profit, costs, capital expenditures, profitability, etc.). If as a criterion to select optimal total profits of the enterprise, the objective function $F(x)$ can be written as:

$$F(x) = \sum_{j=1}^{n} c_j x_j \to \max \tag{1}$$

Restrictions are imposed on the variables of the model dedicated resources to fund the time of the equipment or available financial resources in the form of relations:

$$\sum_{j=1}^{n} a_{ij} x_j \le b_i \quad (i = \overline{1,m}) \tag{2}$$

Terms of view positive variables have

$$x_j \ge 0 \quad (j = \overline{1,n}) \tag{3}$$

The mathematical model represented by equations (1) - (3) applies to the simplest type of resource allocation models in the class of linear programming problems. In general in the model represented by equations (1) - (3) may include the following resource constraints:

- Restrictions on the hardware resources b_i in the form of fund-time *i-th* group of equipment.

  $$\sum_{j=1}^{n} a_{ij} x_j \le b_i \quad (i = \overline{1,m});$$

- Restrictions on the variables related to the range of products in a range of values x_j of each variable

  $$d_1^- \le x_j \le d_j^+ \quad (j = \overline{1,n});$$

- Restrictions on the consumption of materials, labor costs and payroll.

The real problem of resource allocation in the logistics system is reduced to that to find a value of the vector variables $x^* \in \Omega_x \subseteq R^n$, which gives an extreme (for definiteness, maximum) to one or more particular criteria $y_i = \varphi_i(x), \quad i = \overline{1.k}$, keeping the rest $y_i, \quad i = \overline{k+1,m}$ at a certain level $B_i \quad i = \overline{k+1,m}$

$$Q(x) = \{\varphi_1(x), \cdots, \varphi_k(x)\} \to \max_{x \in R^n}, \tag{4}$$

$$R_i(x) = \varphi_i(x) \ge B_i, \quad i = \overline{k+1,m} \tag{5}$$

$$a_j(x_\ell) \le x_j \le b_j(x_\ell), \quad x_j \ge 0, \quad j = \overline{1,n} \tag{6}$$

The solution of (4) - (6) shall be set to take into account the constraints. Functional limitations (5) reflect the dependence of the analytical type balanced equations and statistical dependence of the type of production functions. Part of the functional limitations criterion plays the role of constraints

$$\varphi_j(x) \ge B_j, \quad \varphi_\ell \le B_\ell \tag{7}$$

Which is realized when execute as quasi-optimal version of the plan, ensuring the proper functioning of the logistics system. The parameters of functional limitations are determined by the results of observations so that they contain various kinds of uncertainty. The main causes of uncertainty are random deviations of the parameters process. The volitional address organizational issues are Unpredictable, the changing conditions of non-random manner manifestation of the environment, aging and wear and tear. In models of optimal resource allocation uncertainty is manifested in the unreliability of the source data is incomplete, inadequate and contradictory relations used by the system restrictions. The uncertainties of multi-objective problems include the uncertainty introduced by the initial data, the regularization parameter in assessing the functional limitation, approximation of an ill-posed problem and the convolution of partial criteria. The problem of optimal allocation of resources in logistics systems under uncertainty can be represented by model [3, 4, 6]:

$$Q(x, \gamma_1) = \{\varphi_1(x), \cdots, \varphi_k(x); \gamma_1\} \to \max_{x \in D}, \tag{8}$$

$$D(x; \gamma_2, \gamma_3) = \{x \in R^n, \quad R_i = \varphi_i(x, a, \gamma_2)\} \ge B_i,$$
$$a_j(x\ell, \gamma_3) \le x_j \le b_j(x\ell, \gamma_3), \quad x_j \ge 0, \; j = \overline{1,n} \; \} \tag{9}$$

where γ_1 is a component that reflects the uncertainty of the procedure of the convolution of criteria; γ_2 is random component that reflects the variation of the restriction; γ_3 is a deterministic component, which reflects changes in the source data. Resource Allocation Model (8)-(9) belongs to a class of problems stochastic programming. The functional model is not explicitly set and it requires averaging γ, which is equivalent to the cost of computing the solution of determinate totality of *linear and nonlinear programming*. Therefore, the solution of such problems, more preferably performed with the aid of a procedure whereby reducing the problem of stochastic programming a set of deterministic problems in linear and nonlinear programming for fixed values of the random vector $\gamma = \{\gamma^{\ell}\}$, where $\ell = 1,2,\cdots$.

As a result of reduction of (8) - (9) we obtain a set of deterministic problems [5, 6]

$$Q(x, \gamma_1{}^k) = \{\varphi_1(x), \cdots, \varphi_k(x); \gamma_1{}^{\ell}\} \rightarrow \max_{x \in D_\ell}, \qquad (10)$$

$$D(x; \gamma_2{}^{\ell}, \gamma_3{}^{\ell}) = \{x \in R^n, \quad R_i = \varphi_i(x, a, \gamma_2{}^{\ell})\} \geq B_i,$$
$$a_j(x\ell, \gamma_3{}^{\ell}) \leq x_j \leq b_j(x\ell, \gamma_3{}^{\ell}), x_j \geq 0, j = \overline{1, n} \}, \quad (11)$$

Solutions which form a set $\{x^{\ell}\}$. Selecting the preferred solution of a set of quasi performed by the decision. When varirovnii model parameters over a range of problem allocation of resources in the class of linear programming

$$\min_{x \in X} \{(c, x), \ Ax \geq b, \quad x \in E_+^n\} \qquad (12)$$

is replaced by a parametric programming problem, which is close to the original,

$$\min_{x \in X} \{(c_\delta, x), \ A_\delta x \geq b_\delta, \quad x \in E_+^n\} \qquad (13)$$

where $c_\delta, A_\delta, b_\delta$ - the perturbed parameter values are close to true in some metric, such as the Euclidean

$$\|c_\delta - c\| < \delta, \quad \|A_\delta - A\| < \delta, \quad \|b_\delta - b\| < \delta \qquad (14)$$

(The value of error δ accepted the same for all parameters, which does not affect the communication of results).

3. Results and Discussions

The above mentioned problem of resource allocation and models of logistic information systems is to understand everything that is used in the production and commercial action. There was accuracy in the modeling for the integration of planning, monitoring and controlling of manufacturing business, financial and economic support, information and cyber service in the ideal distribution, taking into account the error value for all parameters, where we found that the error is very small and will have no effect on the final result, as shown in Equation 13 and 14.

References

[1] Dr. Howard Bandy, Modeling Trading System Performance, Blue Owl Press, 2011.
[2] Yan, Houmin; Yin, George; Zhang, Qing, Stochastic Processes, Optimization, and Control Theory: Applications in Financial Engineering, Queuing Networks, and Manufacturing Systems, Springer, USA, 2006.
[3] Guernsey, GY, Process Dynamics: Modeling, Analysis, and Simulation, Prentice Hall, United Kingdom, 2003.
[4] Otto Bretscher, Linear Algebra with Applications, Prentice Hall, UK, 2008.
[5] Silvia T. Acuña, Software processing modeling, Springer, USA, 2005.
[6] Hossein Bidgoli, Modern Information Systems for Managers, Academic Press ,2009.

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