ANALYTICAL GROUNDS OF OPTIMAL STOCK LEVEL

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This article deals with peculiarities of stock management analysis.

Optimization of stock level is one of the main goals of assets management. Optimal stock level means minimum total level of costs connected with stock and uninterrupted supply of material assets for production needs. Analytical grounds of optimal stock level are very important as maintenance of optimal stock level will allow minimizing costs; correlating costs with profit if management tools making it possible to exercise constant monitoring of optimal stock level will be introduced and working out norms of stock level and providing system of control with relevant information.

Methods of analytical provision of material and production stock depends upon strategy and manner of stock management at an enterprise. As the research shows one of the main goals of management is minimization of costs connected with the processes of stock formation and storage.

Specialists pay much attention to the problem of analytical grounds of optimal stock level. The main problem arising during the analysis is the classic contradiction - the choice between costs of storage of additional stock and costs of more often production and purchase. Groundless decrease of stock level can cause failures in production and supply to the customer which in its turn leads to losses connected with the loss of market and penalties. So, on the one hand, the stock should be small (finance of an enterprise should not be "frozen") and, on the other hand, they should be high enough (they should not cause failures in production and supply).

It is necessary to point out that defining optimal level of stock is an important task as stock plays an important role in the current assets of an enterprise. As a rule, optimization of material and production stock means make working capital available which is equivalent to receiving additional profit.

There are a lot of analytical methods and models allowing to define optimal stock level. There are also simplified formulas of stock size calculation. To our great regret now there is no common method defining guidelines for setting optimal stock size. Specificity of the enterprise and its production as well as other factors influence the choice of model and method. It's difficult to define a lot of costs connected with stock level as they have probabilistic or indirect character. That is why practical use of mathematical methods of optimal planning is quite difficult. The situation is worsened by the fact that stock range can be rather wide. Completeness factor can influence solving of the problem as sometimes different stock needs the same limited resource, for example, warehouse area. In connection with this many optimization schemes can only have all-methodological outline within which it is possible to build concrete methods of stock planning. That is why the development of methods of optimal stock level analytical grounds which will consider numerous aspects of business is extremely important.

Introduction of progressive schemes and concepts of stock management and the use of these systems greatly changes the structure and the size of an enterprise expenditures connected with material supply and use.

World experience shows that a lot of leading enterprises stepped to the "pull" concept of interrelation of structural links of a company in the chain "supply-production-sales" which is based on ideology "just in time". The core of this concept is that the block setting goals is sales department. Finished products stock management, production management, raw materials and materials stock management, preparation of material securities are built in accordance with the sales programme in accordance with the above mentioned it is suggested making analytical grounds like this: for finished products stock; for raw materials and materials stock.

Analytical grounds of finished products optimal stock should be made by way of contrast-

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ing the group of costs directly dependant on the level of stock to the group of costs inversely dependant on the level of stock The first group includes immobilization costs; costs connected with stock storage; costs connected with stock insurance; costs connected with natural loss of stock. The second group includes costs connected with the loss of customers; costs connected with the loss of competitive advantage; costs connected with the loss of production advantages. Let's consider the method of calculation of the second group. The costs connected with the loss of customers are caused by impossibility to complete the order in time because of the lack of finished products. The losses of an enterprise because of insufficient stock of finished products must be defined by the formula:

$$УПП = (ОЦ - ПФС) \cdot (1 - СТП)$$

where *УПП*- customer loss costs; *ОЦ* - Ex-factory price of production unit; *ПФС* - full factual cost of production unit calculated in accordance with tax accounting rules corrected for the value of constant and temporary differences; *СТП* - profit tax rate.

To calculate the costs of the loss of customers it is necessary to have exact plan (data of the same retrospective period) of finished products shipment to the customer. The analyzed period *t* consists of equal time parts *n*. The number of these time parts is *k*.

$$t = n_1 + n_2 + ... + n_k.$$

It is necessary to calculate minimum stock level for each *t*. At that strict consequence should be observed. The calculation should be started from the last time part n_k.

The calculation of the minimum stock level necessary for satisfying the needs of the customer during the period n_k will be defined by the formula:

$$ЗПmin\ n_k = ОР\ n_k - ПМ\ (if\ ОР\ n_k > ПМ),$$

$$ЗПmin\ n_k = 0\ (если\ ОР\ n_k < ПМ),$$

where *ЗПmin (PS min)* n_k - minimum level of finished product stock in the period n_k, necessary for satisfying the needs of the customer; *ПМ(РС)* - production capacity of the enterprise during the period *n*; *ОР(SV)* n_k - finished product sales (shipment) volume during the period n_k.

Minimum stocklevel for other *n* of the time period *t* will be defined by the formula:

$$ЗПmin\ n_{k-1} = ОР\ n_k + ЗПmin\ n_k - ПМ.$$

With the help of such calculation it is possible to define minimum finished product stock level for each *n*, necessary for satisfying the needs of the customer; to calculate the average stock level during the period *t*, to define production programme of the finished product output and to define the interdependence of the finished product stock level and costs (losses) from the loss of customers.

The costs (losses) from the loss of competitive advantage are difficult to define as they have probabilistic or indirect character. The analysis of short-term changes of competitive advantage is imposed on market research specialists. For analytical calculation of optimal stock level such data can be accounted in costs (losses) of the enterprise from the loss of customers. Another way is to create in the so called risk periods (when there is market boom) fixed reserves which can satisfy boom. Costs from the loss of production advantages are essential for enterprises engaged in production of different products with the use of the same technological which bear losses when tooling (adjusting) this equipment from one kind of product to another. These costs should be connected with the production programme on the output of finished product taking into consideration costs (losses) from the loss of customer.

After getting the results of functional dependence for each type of costs it is necessary to define the total functional interdependence of such costs with finished product stock level setting up minimum value of total costs and the corresponding level of finished product.

On the base of the calculated optimal finished product stock level and production programme it is necessary to define optimal raw materials and materials stock level, correct finished product sales programme and optimize finished product production schedule. When correcting the programme you should follow the strategy providing the orders which are not completed at the optimal level of finished product stock are completed when there is no need in stock or it is minimum. The economic contents of the task of analytical calculation of optimal level of raw materials, materials and resources is closely connected with the contents of the task of analytical calculation of optimal finished product stock level. So when solving the task it is necessary not only define optimal stock volume but also the

volume of the order of resources and the terms of its registration. One of the popular methods of calculation is EOQ model (Economic Order Quantity model). For this model you should use renewed formulas: the formula of raw materials storage costs; the formula of materials supply costs; the formula of optimal delivery lot; the formula of optimal materials stock.

The formula of raw materials storage costs:

$$Z_{хр.т.} = РПП \cdot t \cdot (k_{имб} \cdot g_{имб} + C_{х.р.п.} + k_{стр} \cdot g_{стр} + k_{убыль} \cdot g_{убыль}) / 2,$$

where $Z_{хр.т.}$ - the sum of costs of the storage during the analyzed period; $РПП$ - lot during the analyzed period; t - analyzed period; $g_{убыль}$ - cost of unit of finished product stock for the calculation of costs connected with the natural loss of raw materials and materials; $k_{убыль}$ - coefficient of natural loss; $g_{стр}$ - cost of unit of finished product stock for insurance purposes; $k_{стр}$ - coefficient of insurance; $C_{х.р.п.}$ - variable costs of stock unit storage; $g_{имб}$ - cost of raw materials stock storage for the calculation of immobilization costs; $k_{имб}$ - coefficient of immobilization.

The formula of materials delivery costs:

$$Z_{з.м.} = (Z_{в.п.} + Z_{к.р.} + Z_{о.р.} + Z_{о.з.} + Z_{т.р.}) + РПП \cdot (C_{ф.м.} - C_{в.с.}),$$

where $Z_{з.м.}$ - materials supply costs; $Z_{в.п.}$ - negotiations costs; $Z_{к.р.}$ - business trips costs; $Z_{о.р.}$ - calculations costs; $Z_{о.з.}$ - расходы по оформлению заявки; $Z_{т.р.}$ - transportation costs (the delivery of materials to the warehouse) (such costs change not linearly but unevenly, so, they can be included either in constant or variable part of materials supply costs); $РПП$ - volume of materials lot; $C_{ф.м.}$ - factual cost of materials unit set by the supplier; $C_{в.с.}$ - bonus given by the supplier (usually the size of bonus changes dependant on the lot).

So, the optimal delivery lot and the volume of raw materials and materials stock will be:

$$РПП_{опт} = (Z_{в.п.} + Z_{к.р.} + Z_{о.р.} + Z_{о.з.} + Z_{т.р.}) / (0{,}5 \cdot t \cdot (k_{имб} \cdot g_{имб} + C_{х.р.п.} + k_{стр} \cdot g_{стр} + k_{убыль} \cdot g_{убыль}) + C_{в.с.} - C_{ф.м.}),$$

$$РЗ_{опт} = (Z_{в.п.} + Z_{к.р.} + Z_{о.р.} + Z_{о.з.} + Z_{т.р.}) / (t \cdot (k_{имб} \cdot g_{имб} + C_{х.р.п.} + k_{стр} \cdot g_{стр} + k_{убыль} \cdot g_{убыль}) + 2 \cdot (C_{в.с.} - C_{ф.м.})),$$

where $РПП_{опт}$ - optimal volume of raw materials and materials delivery; $РЗ_{опт}$ - optimal volume of raw materials and materials stock.

It is also necessary to stress the fact that that stock management of an enterprise should not only calculate optimal stock level for losses minimization but also to take measures for minimization of this optimal stock level. The main methods for such decrease can be measures aimed at speeding up shipment of finished products and drawing up calculation documents; improvement material and technical supply in order to provide uninterrupted supply of production with the necessary material resources and decrease of the period when the capital is "frozen" in stock; decrease of production cycle due to production intensification (use of new technologies, automation and mechanization of production processes, fuller use of production capacities, human and material resources, etc.).

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