


## МЕНЕДЖМЕНТ

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## Management of the formation of stocks of material resources of the enterprise

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The article deals with the problem of forming a reasonable level of stocks of material resources of the logistics system of a manufacturing enterprise. It was stated that in the share of material resources of industrial enterprises, the leading place is occupied by stocks of raw materials, materials, semi-finished products, and blanks. The latter belong to the category of inventories. Therefore, the management of this type of material resources is one of the most urgent tasks for enterprises. In this regard, there is a need for a modern approach to the problem of managing stocks of material resources and the economic assessment of the profitability of creating production and commercial stocks. And at the same time, one of the important questions is to determine their optimal volume.

It was found that when forming stocks of material resources, it is necessary to simultaneously comply with the requirements for the sufficiency of their volume to ensure the normal operation of the enterprise's logistics system, to reduce their volume as much as possible while increasing the degree of mobility, and to minimize the total costs associated with the formation of stocks.

An analog model for assessing the economic efficiency of the influence of changes in the size of the stock of material resources on the comparative economic effect of the logistics activities of an enterprise is proposed for practical use. This model takes into account the causal relationship between natural (partial) and cost (generalizing) indicators of the inventory management system of material resources and provides an opportunity to calculate the comparative economic effect of changes in the volume of inventories at the enterprise. In practice, this will make it possible to economically substantiate the decision on the need to form stocks of one or another type of material resources.

It is shown that the economic effect of the functioning of the logistics system of a manufacturing enterprise is significantly influenced by the growth of fixed and circulating assets. To determine the assessment of the impact of the growth of fixed and current assets on the value of the economic effect, an analog model is proposed. The main structural elements of such a model are an increase in capital investments in fixed assets, an increase in profits from product sales, a change in logistics costs, an increase (savings) in investment in current assets, a change in the cost of production. These factors are directly related to the growth of depreciation charges, the increase in profits from the acceleration of inventory turnover and the increase in net profit.

Taking into account the results of the studies performed, it was found that the economic effect is formed by the total discounted net profit and the amount of depreciation (provided there are no penalties) minus the total additional capital investments in the enterprise. To calculate the economic effect, a corresponding mathematical relationship is proposed.

**Key words:** enterprise, stock, stock size, material resources, evaluation, relative economic effect.

**Problem statement and analysis of recent research.** The increase in the circulation rate of circulating assets, the main part of which is represented by the stock of material resources, is one of the most important tasks at manufacturing enterprises under the modern conditions [6; 13–15]. Unified statistic data of many years let one see the structure of the circulating assets of the industry enterprise in which, as specialists think, the leading place on specific weight still belongs to the very productive stock (raw material, other materials etc.). The basis for this statement is a research of organizational-economic and technological patterns in the productive and final consumption of the produce, as well as the processes of the stock renewal, its consumption and expenses for its delivery and storage. Depending on time and material resources placement they change the categories of stock step by step, that's why one may say about reasonability of managing different categories of stock in the logistic schemes of enterprises.

If the enterprise doesn't pay attention to managing the stock, it may lead to the underestimation of the future need in the stock. As a result the enterprise usually faces the situation when it has to invest more capital into the stock than it was anticipated. Because of this there is a necessity in a modern approach to the problem of material resources management [2; 3; 4; 7; 8; 10; 11; 16; 17–19], economic estimate of creating industrial and commercial stock.

The stock managing systems are created in order to solve the following problems as effectively as possible [1; 4; 9; 17]: a real estimate of the stock present state; a statement of the necessary terms for the stock placement; a definition of the goods rational quantity to be ordered; an estimate of the necessary quantity of the insurance stock; an estimate of the expenses for the stock management and finding the way and methods to minimize them.

The simplest task in estimating the stock reasonability is to find the optimal size of the order (delivery lot). This task is often decided with the help of Harris-Wilson formula. In the theory of the stock management this formula is known for more than a hundred years and based on a number of significant simplifications which admit stability of the reference data to calculate the optimal lot of goods. In defining the point (moment) of the order with the help of Harris-Wilson formula one should only take into account the expenses for the purchase and storage of the goods depending on the delivery lot size, and should not take into account such factors as acceleration (or deceleration) of the circulating assets circulation, deficiency in profit in case of the stock decrease and increase of delivery failure risks, time factor, economic sanc-

tions due to delivery failures etc. In the article [12] we suggest that we should modify Harris-Wilson formula by means of taking into account the profit lost due to the lost (unused) opportunities connected with acquiring and storing the stock. But it is methodologically incorrect to summarize present expenses and predicted losses of the profit.

The analysis of the methods for stock economic grounds presented in the special literature [1; 4; 5; 9; 11; 17] shows that most of the authors only consider the given formula and try to better it some way. But in whole the methodology of the economic grounds for creating and storing stock, its change either way depending on the actual (normative) stock at the present moment is actually absent. That's why the scientific and practical value belongs to the development of the methodological ways for the economic estimate of the reasonability to create (or correct) different stock types.

From all the things stated above it follows that at the present moment Harris-Wilson formula used as the basis to define the delivery lot size cannot provide the necessary accuracy of calculations under the market conditions. One of the reasons for that is that while calculating the optimal delivery lot size of raw materials, materials or goods produce the researchers don't take into account such indicators as acceleration (or deceleration) of the circulating assets circulation, deficiency in profit in case of the stock decrease and increase of delivery failure risks, time factor, economic sanctions due to delivery failures etc. In order to realize this as the methodological grounds for the economic management of material resources stock one should use the regulations from the theory of the economic evaluation of investments and innovations effectiveness which didn't find the corresponding use in the methodological and scientific publications of logistics specialists [3; 4; 9; 10; 12].

**The aim of the study.** Development of recommendations for improving the management of inventories of material resources in industrial enterprises.

**Material and research methods.** The theoretical and methodological basis of the study is the dialectical method of cognition, conceptual provisions and results of fundamental research of domestic and foreign scientists on the management of material resources of enterprises.

Basic research methods: abstract-logical – for theoretical generalizations of the results of scientific research and formulation of conclusions, economic-mathematical modeling – for the construction of analog models of material resources management.

**Research results and discussion.** The author thinks that while solving any problem on the stock management strategy improvement in the logistic systems (LS) at producing enterprises one only needs to evaluate the economic effectiveness for investments into one or another way to organize the logistic activities (LA) which needs a strict definition for expenses and results and their change connected with implementing the chosen organizational and managing innovations. The latter include any measures of a managing character connected with making decisions to create stock, to increase/decrease stock, to change the material delivery lot or the raw material processed lot etc.

While forming stock it is necessary to simultaneously follow such demands: its quantity should be enough to provide a normal functioning of the LS, it should be possible to maximally minimize its volume with a simultaneous increase of the mobility extent, and the minimization of the total expenses connected with stock creation. That's why, as a rule, in evaluating the logistic system effectiveness some part of the researchers' circle confine themselves to minimizing logistic expenses chosen for the role of the LS functioning effectiveness criteria. There are also attempts to use the profit maximum and logistic expenses profitability which are statistical indicators and don't take into account time factor and settlement days as the LS

functioning criteria. Because of this the profitability is not the final, integral indicator of economic effectiveness. Some authors of scientific publications the list of logistic expenses mistakenly includes the profit loss due to unused possibilities – that is methodologically incorrect. The mentioned author suggests that one should define the profit loss as the product of the profitability of an enterprise, the average stock and price of a stock unit which doesn't take into account the change in the circulating assets circulation. Besides that, in the calculations of stock value incorrectly uses the average stock indicator, but the material (raw material) delivery lot purchase is equal to the maximal stock volume, and not to the average stock volume.

Taking into account all the said above the analogue model for evaluating the economic effectiveness of the influence of the material resources stock size change on the relative economic effect from the LA must take into consideration the cause-and-effect relations between the natural (partial) and cost (generalizing) exponents of the material resources stock managing system (Figure 1). It will give the specialists an opportunity to get correct calculations of the relative economic effect from the change in the stock volume in the LS and because of that – an opportunity to make the economically grounded decision concerning the necessity to create the latter.

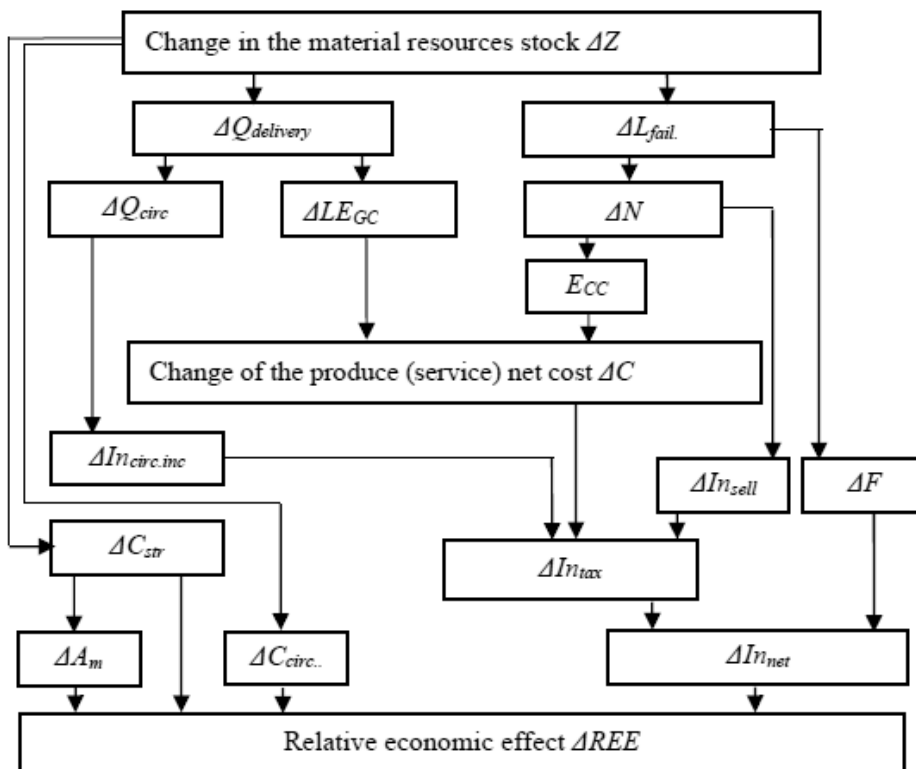


Fig. 1. The influence of the material resources stock in the logistic system of the producing enterprise on the relative economic effect.

Source: made by the author.

Taking into account all said we shall present an analogue model for evaluating economic effectiveness of the influence of the material resources stock size change on the relative economic effect from LA in the form of a scheme (Figure 1) which shows the cause-and-effect relations between the natural (partial) and cost (generalizing) exponents of the material resources stock managing system. In other words, the formalized analogue model gives a chance to calculate the relative economic effect from the change in the stock volume in LS and due to that to make an economically grounded decision on whether it is necessary to form the latter.

Figure 1 has the following conventions:

$\Delta Q_{delivery}$  – the change of material resources deliveries quantity;

$\Delta L_{fail}$  – the change of expenses (losses) from deliveries failures;

$\Delta Q_{circ}$  – the change of circulations quantity of the circulating assets during the settlement days;

$\Delta LE_{GC}$  – the change of the amount of the general current logistic expenses which is caused by the growth (algebraic sum) of their components (expenses for moving the material resources within the LS of the enterprise, managing the logistic informational flows, paying the interest for the borrowed capital use, expenses connected with force majeure, with logistic risks reimbursement, with losses from material resources damage);

$\Delta N$  – the change of the production volume (services quantity) as a result of failures in the technological processes or elimination of these failures;

$E_{CC}$  – the economy on conditional-constant expenses with the production volume (services quantity) increase;

$\Delta In_{cir.inc}$  – the income growth from the acceleration (deceleration) of the circulating assets circulation caused by the material resources stock cost change;

$\Delta In_{sell}$  – the change of the sales income;

$\Delta In_{tax}$  – the change of the taxed income;

$\Delta In_{net}$  – the increase (decrease) of the net income;

$\Delta F$  – the sum of the fines to be paid for the contract obligations failure;

$\Delta C_{str}$  – the growth of the capital investments into the LS infrastructure (the cost of the warehouse, transport, computing machinery etc.);

$\Delta C_{circ}$  – the growth of the capital investments into the circulating assets caused by the change in the material resources stock volume at the enterprise;

$\Delta A_m$  – the increase (decrease) of the amortization fees connected with the growth of the capital investments into the infrastructure.

In the aspect of the researched problem the change of the net cost of the produce (services)

is a result of the change of the logistic expenses and  $E_{CC}$ :

$$\Delta C = \pm \Delta E_G \pm \dot{A}_N. \quad (1)$$

The economy on conditional-constant expenses with the production volume (services quantity) increase from the value  $N_1$  to the value  $N_2$  will be:

$$\dot{A}_C = Exp_C \cdot (N_2 / N_1) - 1, \quad (2)$$

where  $Exp_{CC}$  – is the sum of conditional-constant expenses in the net cost of the produce (services).

The part of the taxed income which is changed can be calculated the following way:

$$\Delta h_{tax} = \Delta C + \Delta h_{sell} + \Delta h_{cir.inc} \quad (3)$$

The methods to define the growth of the income from the acceleration (deceleration) of the circulating assets circulation have been considered above and published in the work [13].

The relative economic effect caused by the group of the chosen indicators on Figure 1 is to be defined by the sum of the following additional indicators:

$$\begin{aligned} \Delta REE = & [(\Delta C + \Delta In_{sell} + \Delta In_{cir.inc}) \cdot k_{tax} - \\ & - \Delta F + \Delta A_M] \cdot k_{an} - (\Delta C_{str} + \Delta C_{circ}). \end{aligned} \quad (4)$$

Let's address the concept of "general expenses" offered in 1956 by the American scientists Howard Lewis, James Kayton and Jack Stall [20]. The answer to the question "Is it beneficial to use the air transportation?" asked by the scientists in the publication can be received with the help of the algorithm on Figure 1. In the general case, without any detailed analysis, the use of the air transportation leads to the transportation expenses increase in comparison with other transport means by  $\Delta Exp_{tr}$ . But along with this the variable expenses for the materials stock storage decrease ( $\Delta Exp_{st}$ ). So, according to such a scheme the general current logistic expenses are likely to increase by the following value:  $\Delta LE_{GC} = \Delta Exp_{tr} - \Delta Exp_{st}$ . With this the necessity to pay more to the workers with the corresponding taxation is dismissed and any possible fine payments upon contract failures during the produce deliveries disappear ( $\Delta F$ ). If the use of the air transportation is one-time, then its reasonability is defined by the criteria  $\Delta In_{net} \rightarrow max$ . All the components of the taxed income growth (it means the growths of the net cost) are to be taxed, and the condition of the one-time air transportation profitability can be described as the following in-equation:

$$[\Delta F - \Delta LE_{GC} \cdot k_{tax}] > 0. \quad (5)$$

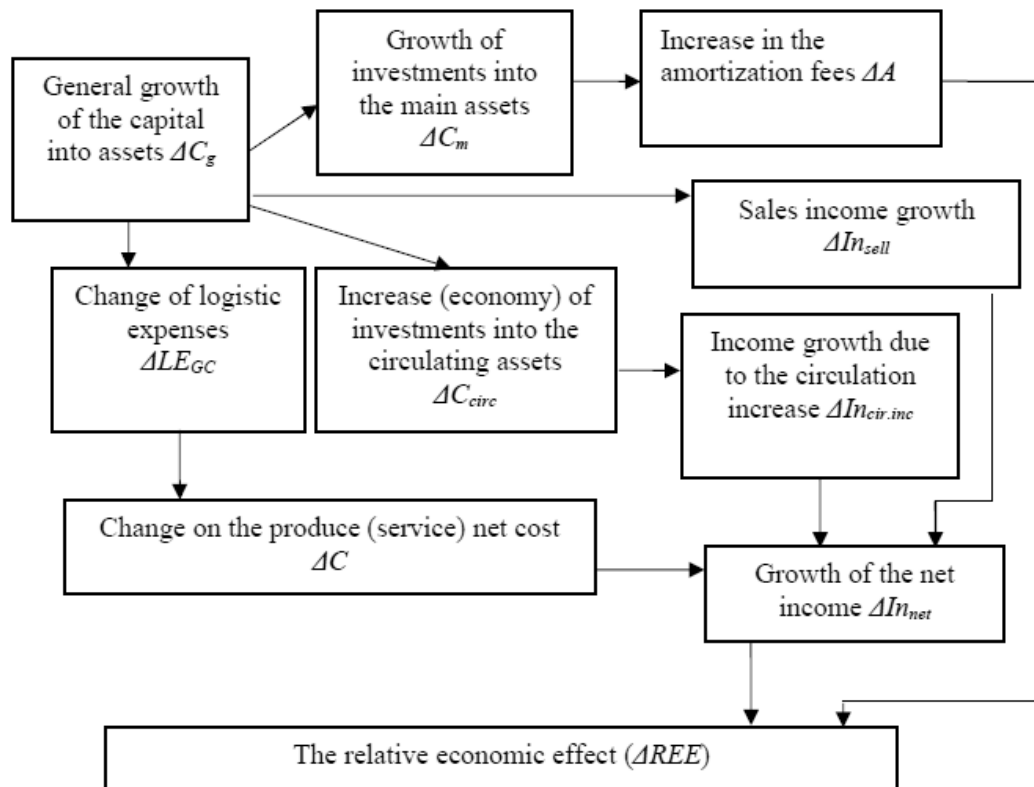


Fig. 2. The scheme to evaluate the influence of the growth in the main and circulating assets of the enterprise's logistic system on the economic effect.

Source: made by the author.

For the practical implementation of the said above let's give a simple scheme to define the influence of the change in the main assets ( $\Delta C_m$ ) and the circulating assets ( $\Delta C_{circ}$ ) of the enterprise's LS on the relative economic effect (Figure 2).

For the factors presented on Figure 2 the economic effect is the total discounted net income and amortization (if any possible fines are absent) minus the total additional investments into the logistic activities and is defined by the following formula:

$$\Delta REE = [(\Delta C + \Delta In_{sell} + \Delta In_{cir.inc}) \cdot k_{tax} + \Delta A] \cdot k_{an} - (\Delta C_m + \Delta C_{circ}). \quad (6)$$

So, the complex use of general scientific and special methods of the scientific research gives a chance to formulate a theoretical basis for fulfilling any actual applied task such as the development of the methodological grounds to give an economical evaluation of the reasonability of different types of stock or the adjustment of their level in the logistic systems of producing enterprises.

**Conclusions.** Taking into account all the said above the analogue model for evaluating the economic effectiveness of the influence of the material resources stock size change on the relative economic effect from the LA must take into consideration the

cause-and-effect relations between the natural (partial) and cost (generalizing) exponents of the material resources stock managing system. It will give the specialists an opportunity to get correct calculations of the relative economic effect from the change in the stock volume in the LS and because of that – an opportunity to make the economically grounded decision concerning the necessity to create the latter.

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### Управління формуванням запасів матеріальних ресурсів підприємства

Сумець О.М.

У статті розглянуто проблему формування доцільного рівня запасів матеріальних ресурсів логістичної системи виробничого підприємства. Констатовано, що у питомій вазі матеріальних ресурсів виробничих підприємств лідируюче місце займають запаси сировини, матеріалів, напівфабрикатів, заготовок. Останні відносять до категорії виробничих запасів. А тому керування цим видом матеріальних ресурсів є одним із найактуальніших завдань для підприємств. У зв'язку із цим існує потреба в сучасному підході до проблеми керування запасами матеріаль-

них ресурсів та економічної оцінки вигідності створення виробничих і комерційних запасів. І при цьому одним із важливих питань є визначення оптимального їх обсягу.

Встановлено, що при формуванні запасів матеріальних ресурсів необхідно одночасно дотримання вимог достатності їхнього обсягу для забезпечення нормального режиму функціонування логістичної системи підприємства, максимально можливого скорочення їхнього обсягу при одночасному підвищенні ступеня мобільності, мінімізації сумарних витрат, що пов'язані з утворенням запасів.

Запропоновано для практичного використання аналогову модель оцінки економічної ефективності впливу зміни величини запасу матеріальних ресурсів на порівняльний економічний ефект від логістичної діяльності підприємства. Ця модель враховує причинно-наслідкові зв'язки між натуральними (частковими) і вартісними (узагальнювальними) показниками системи керування запасами матеріальних ресурсів і надає можливість розрахувати порівняльний економічний ефект від зміни обсягу запасів на підприємстві. На практиці це надасть можливість економічно обґрунтувати рішення щодо необхідності формування запасів того чи іншого виду матеріальних ресурсів.

Показано, що на економічний ефект від функціонування логістичної системи виробничого підприємства має суттєвий вплив приріст основних і оборотних активів. Для визначення оцінки впливу приросту основних і оборотних активів на величину економічного ефекту запропоновано аналогову модель. Основними структурними елементами такої моделі є приріст капіталовкладень в основні активи, приріст прибутку від реалізації продукції, зміна логістичних витрат, ріст (економія) капіталовкладень в оборотні активи, зміна собівартості продукції. Вказані чинники мають пряме відношення до зростання амортизаційних відрахувань, приріст прибутку від прискорення оборотності запасів і приріст чистого прибутку.

З огляду на виконані дослідження встановлено, що економічний ефект утворюється сумарним дисконтованим чистим прибутком та величиною амортизації (за умови відсутності штрафів) за вирахуванням сумарних додаткових капіталовкладень у діяльність підприємства. Для обчислення економічного ефекту запропонована відповідна математична залежність.

**Ключові слова:** підприємство, запаси, розмір запасу, матеріальні ресурси, оцінка, порівняльний економічний ефект.

#### Управление формированием запасов материальных ресурсов предприятия

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В статье рассмотрена проблема формирования целесообразного уровня запасов материальных ресурсов логистической системы производственного предприятия. Констатировано, что в удельном весе материальных ресурсов производственных предприятий лидирующее место занимают запасы сырья, материалов, полуфабри-

катов, заготовок. Последние относятся к категории производственных запасов. Поэтому управление этим видом материальных ресурсов является одним из самых актуальных задач для предприятий. В связи с этим существует потребность в современном подходе к проблеме управления запасами материальных ресурсов и экономической оценки выгоды создания производственных и коммерческих запасов. И при этом одним из важных вопросов является определение оптимального их объема.

Установлено, что при формировании запасов материальных ресурсов необходимо одновременное соблюдение требований достаточности их объема для обеспечения нормального режима функционирования логистической системы предприятия, максимально возможного сокращения их объема при одновременном повышении степени мобильности, минимизации суммарных затрат, связанных с образованием запасов.

Предложено для практического использования аналоговую модель оценки экономической эффективности влияния изменения величины запаса материальных ресурсов на сравнительный экономический эффект от логистической деятельности предприятия. Эта модель учитывает причинно-следственные связи между натуральными (частичными) и стоимостными (обобщающими) показателями системы управления запасами материальных ресурсов и предоставляет возможность рассчитать сравнительный экономический эффект от изменения объема запасов на предприятии. На практике это позволит экономически обосновать решение о необходимости формирования запасов того или иного вида материальных ресурсов.

Показано, что на экономический эффект от функционирования логистической системы производственного предприятия оказывает существенное влияние прирост основных и оборотных активов. Для определения оценки влияния прироста основных и оборотных активов на величину экономического эффекта предложено аналоговую модель. Основными структурными элементами такой модели является прирост капиталовложений в основные активы, прирост прибыли от реализации продукции, изменение логистических затрат, рост (экономия) капиталовложений в оборотные активы, изменение себестоимости продукции. Указанные факторы имеют прямое отношение к росту амортизационных отчислений, прирост прибыли от ускорения оборачиваемости запасов и прирост чистой прибыли.

Учитывая результаты выполненных исследований, установлено, что экономический эффект образуется суммарной дисконтированной чистой прибылью и величиной амортизации (при условии отсутствия штрафов) за вычетом суммарных дополнительных капиталовложений в деятельность предприятия. Для вычисления экономического эффекта предложена соответствующая математическая зависимость.

**Ключевые слова:** предприятие, запасы, размер запаса, материальные ресурсы, оценка, сравнительный экономический эффект.



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