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FORMATION LOCAL AND GLOBAL EQUILIBRIUM LAWS IN THE UNIVERSAL LOGISTICS SYSTEMS

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In the work with the help of the mathematical apparatus of axiomatic theory of economic analysis(ATEA) and the Bellman's recovery theory solved the problem of the harmonious operation of logistics management in a universal logistics system(ULS). ULS is a simple or branched global chain of the financial-productive relations, wich is characterized by the presence of reviving. Reviving as set macrologistical systems within ULS provides operations fo the supply of raw materials, production and marketing of finished products with minimal logistics costs. The level of logistics costs is determined by the applicable law of sales of main products, wich is subject to transaction on the global market. Law of sales initiates all logistics activities in ULS, wich is based on local and global equilibrium laws. Local equilibrium laws harmonise shot-range communication between the links of global chain and are responsibale for the implementation of technological and commercial requirements at each stage of technological or commercial transformation of the components of raw materials. Global equilibrium law in ULS is constructed as a synergistic union of the local laws and meets the requirements of the products competitiveness in an environment of the analogical global chains in the world market. We give a strict description of the local and global equilibrium laws, taking into account the basic parameters of the initial the law of sales: the time of resources turnover and their optimal quantity.

Key words: *account, analysis, logistics, law of sales, reviving, economic registration certificate (ERC).*

Introduction. Investigating evolution of the structural organization of the economical analysis in conditions of global economy, and also studying practical experience of the companies representing interests of national economic with various levels of technological way, it is possible to draw a conclusion that transformation of the economical analysis in the fundamental economical theory is possible only when in the center both analytical constructions, and practical application will be some universal economic object realizing the closed scheme “raw material – products – market”. This idea has served as motivation for creation of the axiomatic theory of economic analysis (ATEA) [1, 2] within the framework of which the major task of conceptual character connected to definition of object of research is solved: the object of research in ATEA is the simple or branched global chain of financial- productive relations. As basic subject ATEA reviving is marked – the global logistics systems in terms of which the problems of optimization of parametrical lines (form ERC3 of the economic registration certificate) and decrease in non-productive costs are investigated. Thus the TVS – methodology, which includes diagram method (rules R1-R4) and a method of TVS-connections (rule r1-r9), plays essential role. In works [1, 2] the new conception of global logistics (the ERC-conception) is formulated, in basis of which is the economic registration certificate (ERC), consisting of five account-analytical forms ERC1-ERC5. ERC-conception is realized at a level of local and global equilibrium laws in simple and branched global chains of financial – productive relations. Here we find obvious expressions for these laws, using designations specified in works [1 , 2]. Thus references to formulas in works [1] or [2] begin with the number of these works, for example: [2.14] means the formula (14) works [2].

Formulation of task. In the construction of analytical scheme ATEA [2] fundamental role the relative law of reserve saving plays

$$1 = r(t) + \int_0^t r(t-\tau)w(\tau)d\tau, 0 < \tau \le t, t > 0. \qquad (1)$$

The equation (1) is the equation Bellman's type for unknown *function of renewal of reserve* $w(t)$, in terms of which central object ATEA – the economic registration certificate (forms ERC4 and ERC5) is formulated. Our purpose in the given work is to find decision of the equation (1) in some important cases from the applied point of view.

3. Results. We find obvious structure of function of renewal $w(t)$, when the law of sales $P(t)$ with parameters M and T is determined by speed of sales $V(t)$, possessing the following properties:

(a) The speed of sales $V(t)$ is the power function

$$V(t) = V_0 t^n, n = 0,1,2,\ldots, V_0 > 0, 0 < t \le T. \qquad (2)$$

Determining coefficient V_0 from the equation

$$M = V_0 \int_0^T t^n dt \equiv V_0 \frac{T^{n+1}}{n+1}, \qquad (3)$$

for the normalized function of the remain we receive

$$r(t) = (1 - \frac{1}{T^{n+1}} t^{n+1})[h(t) - h(t-T)], t > 0, \quad (4)$$

where $h(t)$ – is the Heavyside's function.

Value $n = 0$ in (2) corresponds to constant speed of sales $V(t) \equiv V_0$, $0 < t \le T$ and on according to (3), $V_0 = \frac{M}{T}$. Supposing in (4) $n = 0$ we have

$$r(t) = (1 - \frac{t}{T})[h(t) - h(t-T)], t > 0. \quad (5)$$

(b) Speed of sales $V(t)$ has a local maximum:

$$V(t) = c \sin \frac{p}{T} t, 0 < t \le T, c > 0. \quad (6)$$

Finding coefficient c from the equation

$$M = c \int_0^T \sin \frac{p}{T} t dt \equiv c \frac{2T}{p}, \quad (7)$$

for the normalized function of the remain we receive

$$r(t) = \frac{1}{2}(1 + \cos \frac{p}{T} t)[h(t) - h(t-T)], t > 0. \quad (8)$$

For the decision of the integrated equation (1) the operational method is used on the basis of integrated Laplas' transformation as the second item in the right part (1) looks like convolution. As functions (5), (8) are limited, parameters of growth of the function-original $w(t)$ and $r(t)$ in (1) are equal to zero.

Carrying out Laplas' transformation in (1) and using thus the theorem of multiplication of E.Borell, we find

$$L(w) = \frac{1 - pL(r)}{pL(r)}, p = s + is, \quad (9)$$

where $L(r)$, $L(w)$ – Laplas' transformations accordingly functions $r(t)$ and $w(t)$.

If s_0 is the order of growth of function $r(t)$ using (9), we receive the formal decision of the equation (1) for function of renewal of reserves $w(t)$:

$$w(t) = \frac{1}{2pi} \int_{b-i\infty}^{b+i\infty} e^{pt} \frac{1 - p\int_0^\infty e^{-pt} r(t) dt}{p \int_0^\infty e^{-pt} r(t) dt} dp, \quad (10)$$

$\operatorname{Re} p = b > s_0$.

At the beginning let's consider a case (a), when $n = 0$. On the basis (5) we find transformation of function $r(t)$:

$$L(r) = \frac{1}{p}(1 - \frac{1}{pT}) + \frac{1}{p^2 T} e^{-pT}. \quad (11)$$

Substituting (11) in the formula (9) we shall receive

$$L(w) = (1 - e^{-pT})(pT + e^{-pT} - 1)^{-1}. \quad (12)$$

Taking into account, that the order of growth s_0 the function-original $r(t)$ is equal to zero, we choose in the formula (10) value $\operatorname{Re} p = b > s_0$, $s_0 = 0$ so that the inequality $\left|(pT - 1)e^{pT}\right| > 1$ to carry out (it corresponds to straight line $\operatorname{Re} p = b$ located more right of all zero is of function (11)). Then the decision of the equation (1) can be written down in the form

$$w(t) =$$

$$= \frac{1}{T} \sum_{k=0}^{\infty} \frac{(-1)^k}{k!} [(\frac{t}{T} - k)^k h(t - kT) \exp(\frac{t}{T} - k) -$$

$$-(\frac{t}{T} - k - 1)^k h(t - (k+1)T) \exp(\frac{t}{T} - k - 1)]. \quad (13)$$

Let's choose decisions on each of intervals $nT < t \le (n+1)T$, $n = 0, 1, 2, \ldots$, from (13), using definition [2.14]:

$$w_{0;1}(t) = \frac{1}{T} \exp(\frac{t}{T}),$$

$$w_{1;2}(t) = \frac{1}{T} \exp(\frac{t}{T}) - \frac{t}{T^2} \exp(\frac{t}{T} - 1),$$

. . . .

$$w_{n;n+1}(t) = \frac{(-1)^n}{Tn!} (\frac{t}{T} - n)^n \exp(\frac{t}{T} - n) + \quad (14)$$

$$+ \frac{1}{T} \sum_{k=0}^{n-1} \frac{(-1)^k}{k!} [(\frac{t}{T} - k)^k \exp(\frac{t}{T} - k) -$$

$$-(\frac{t}{T} - k - 1)^k \exp(\frac{t}{T} - k - 1)],$$

. . . .

Let's write on the basis (13) obvious expression for standard function of renewal

$$w^{st}(x) = \sum_{k=0}^{\infty} \frac{(-1)^k}{k!} [(x-k)^k h(x-k) \exp(x-k) -$$

$$-(x - k - 1)^k h(x - k - 1) \exp(x - k - 1)], x > 0. \quad (15)$$

Taking into account equality (14), (15), it is easy to find that

$$w^{st}_{n;n+1}(x) =$$

$$= \sum_{k=0}^{n-1} \frac{(-1)^n}{n!} [(x-k)^k \exp(x-k) -$$

$$-(x - k - 1)^k \exp(x - k - 1)], \quad (16)$$

$$n < x \le n+1, n = 0, 1, 2, \ldots.$$

Formulas (16) allow to carry out full research of the standard $w^{st}_{n;n+1}(x)$ on intervals $n < x < n+1$, $n = 0,1,2,\dots$. The behavior of function $w^{st} = w^{st}_{n;n+1}(x)$ for values $n = 0$ and 1 is show on fig. 1.

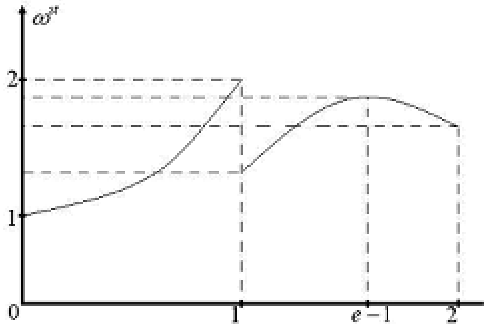

Fig. 1. The graph of standard function $w^{st} = w^{st}_{n;n+1}(x)$ for $n = 0,1$

Let's write now set of standard base speeds of renewal [2.17], on based (16):

$$n^{st}_{0;1}(\frac{t}{T}) = [1-(1-\frac{t}{T})]\exp(\frac{t}{T}),$$

$$n^{st}_{1;2}(\frac{t}{T}) = [1-(2-\frac{t}{T})](\exp(\frac{t}{T}) - \frac{t}{T}\exp(\frac{t}{T}-1)),$$

. . . .

$$n^{st}_{n;n+1}(\frac{t}{T}) =$$

$$= [1-(n+1-\frac{t}{T})]\{\frac{(-1)^n}{n!}(\frac{t}{T}-n)^n \exp(\frac{t}{T}-n) +$$

$$+\sum_{k=0}^{n-1}\frac{(-1)^k}{k!}[(\frac{t}{T}-k)^k \exp(\frac{t}{T}-k) -$$

$$-(\frac{t}{T}-k-1)^k \exp(\frac{t}{T}-k-1)]\},$$

. . . . (17)

Schedules of base speeds of renewal [2.16] $n_{n;n+1}((n+1)T;t) = \frac{1}{T} n^{st}_{n;n+1}(\frac{t}{T})$ for $n = 0,1$ are shown on fig. 2.

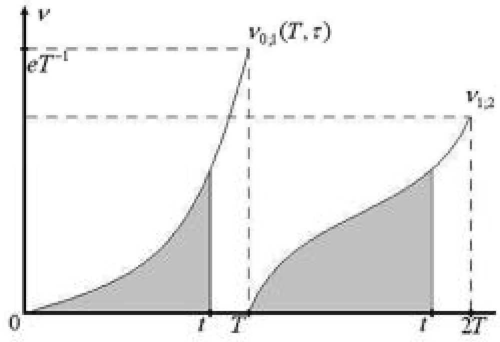

Fig. 2. Bihaviour of base speed of renewal $n_{n;n+1}((n+1)T;t), n = 0,1$ of corresponding speed of sale (2) $V(t) = V_0$

For the local T -law [2.20] we receive

$$m_{n;n+1}((n+1)T;t) = g^{st}_{n;n+1}(\frac{t}{T}),$$
$$n < \frac{t}{T} \le n+1, n = 0,1,2,\dots, \quad (18)$$

where the standard law of renewal $g^{st}_{n;n+1}(z)$ according to (5), [2.18], [2.22] is given by equality

$$g^{st}_{n;n+1}(z) = \int_n^z [1-(n+1-x)]w^{st}_{n;n+1}(x)dx, \quad (19)$$
$$n < z \le n+1, n = 0,1,2,\dots.$$

The area of the shaded flat areas on fig. 2 is as geometrical illustration of the T -law (18) for $n = 0$ and 1 The reduction local law of deliveries [2.32] of raw materials Y, working in elementary structure $\{B, A\}$ of local chain of financial – production relations and corresponding to the law of sales in elementary structure $\{A, C\}$ with constant speed $V(t) = V_0$ (2) has, with the account (19), a kind

$$g_n(t) =$$
$$= M \int_n^{n+\frac{t}{T}} [1-(n+1-x)]w^{st}_{n;n+1}(x)dx, 0 < t \le T,$$
$$n = 0,1,2,\dots. \quad (20)$$

The function (20) continued on period T on all semiaxis $(0,\infty)$, determines a mode of renewal of raw material Y during any time interval $(0,t)$, $t > 0$.

Let's pass now to consideration of a case (b) when speed of sales $V(t)$ has a local maximum and is defined by equality (6).

Laplas' transformation of function (8) looks like

$$L(r)=\frac{1}{2}\left(\frac{1}{p}+\frac{p}{p^2+\left(\frac{p}{T}\right)^2}\right)-\frac{1}{2}\left(\frac{1}{p}-\frac{p}{p^2+\left(\frac{p}{T}\right)^2}\right)e^{-pT}. \quad (21)$$

Substituting (21) in the formula (9) we find

$$L(w)=\frac{\frac{1}{2}\left(\frac{p}{T}\right)^2\left(1+e^{-pT}\right)}{p^2+\frac{1}{2}\left(\frac{p}{T}\right)^2-\frac{1}{2}\left(\frac{p}{T}\right)^2 e^{-pT}}. \quad (22)$$

Let's choose in (10) $\operatorname{Re} p=b>s_0$, $s_0=0$ so that $\left|\frac{\frac{1}{2}\left(\frac{p}{T}\right)^2 e^{-pT}}{p^2+\frac{1}{2}\left(\frac{p}{T}\right)^2}\right|<1$ (it corresponds to the requirement according to which straight line Rep=b should be in the field of analyticity of function (2)). Then it is possible to present (22) in the form

$$L(w)=\frac{1}{2}\left(\frac{p}{T}\right)^2\sum_{k=0}^{\infty}\frac{\frac{1}{2}\left(\frac{p}{T}\right)^2\left(e^{-kTp}+e^{-(k+1)Tp}\right)}{\left[p^2+\frac{1}{2}\left(\frac{p}{T}\right)^2\right]^{k+1}}. \quad (23)$$

To find of the original $w(t)$ on Laplas' transformation (23) we enter introduce parameter l in the formula (23) and we designate $D_l^{(k)}\overset{def}{=}\frac{d^k}{d\,l^k}$. Then, carrying out corresponding differential operations and supposing in the end $l=1$, it is easy to find

$$L(w)=\frac{1}{2}\left(\frac{p}{T}\right)^2\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}D_l^{(k)}\left[p^2+l\,\frac{1}{2}\left(\frac{p}{T}\right)^2\right]^{-1}\times$$
$$\times\left(e^{-kTp}+e^{-(k+1)Tp}\right). \quad (24)$$

As $l\in B(1;d)$, where $B(1;d)$ – small enough d -vicinity of unit designating $l^*=\sup_{l\in B(1;d)} l$, we receive

$$\left|\int_{b-i\infty}^{b+i\infty}e^{tp}\frac{(-1)^k}{k!}D_l^{(k)}\left[p^2+l\,\frac{1}{2}\left(\frac{p}{T}\right)^2\right]^{-1}e^{-kTp}dp\right|\le$$
$$\le\int_{-\infty}^{\infty}\frac{e^{bt}\left[\frac{1}{2}\left(\frac{p}{T}\right)^2\right]e^{-kTb}}{\left[\left(b^2+s^2\right)-l^*\frac{1}{2}\left(\frac{p}{T}\right)^2\right]^{k+1}}ds<+\infty. \quad (25)$$

The estimation (25) means, that function $e^{tp}\frac{(-1)^k}{k!}D_l^{(k)}\left[p^2+l\,\frac{1}{2}\left(\frac{p}{T}\right)^2\right]^{-1}e^{-kTp}$ has integrated majorant. Hence, operation of differentiation $D_l^{(k)}$ on parameter l under symbol atmosphere of integral $\int_{b-i\infty}^{b+i\infty}e^{tp}\frac{(-1)^k}{k!}D_l^{(k)}\left[p^2+l\,\frac{1}{2}\left(\frac{p}{T}\right)^2\right]^{-1}e^{-kTp}dp$ is correct. On the basis (24) we find finally

$$w(t)=$$
$$=\frac{1}{T}\frac{p}{\sqrt{2}}\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}D_l^{(k)}\left\{\frac{1}{\sqrt{l}}h(t-kT)\times\right.$$
$$\times\sin\sqrt{l}\,\frac{p}{2}\left(\frac{t}{T}-k\right)+$$
$$\left.+\frac{1}{\sqrt{l}}h(t-(k+1)T)\sin\sqrt{l}\,\frac{p}{2}\left(\frac{t}{T}-k-1\right)\right\}, \quad (26)$$
$$t>0.$$

Choosing (26) decisions on each of intervals $nT<t\le(n+1)T$, $n=0,1,2,\ldots$ from (26) we receive

$$w_{0;1}(t)=\frac{1}{T}\frac{p}{\sqrt{2}}\sin\frac{p}{\sqrt{2}}\frac{t}{T},$$

$$w_{1;2}(t)=\frac{1}{T}\frac{p}{\sqrt{2}}[\sin\frac{p}{\sqrt{2}}\frac{t}{T}+\frac{3}{2}\sin\frac{p}{\sqrt{2}}(\frac{t}{T}-1)]-$$

$$-\frac{1}{T}\frac{p^2}{4}(\frac{t}{T}-1)\cos\frac{p}{\sqrt{2}}(\frac{t}{T}-1),$$

. . . .

$$w_{n;n+1}(t)=\frac{1}{T}\frac{p}{\sqrt{2}}\frac{(-1)^n}{n!}D_l^{(n)}\frac{1}{\sqrt{l}}\sin\sqrt{l}\,(\frac{t}{T}-n)+$$

$$+\frac{1}{T}\sum_{k=0}^{n-1}\frac{(-1)^k}{k!}D_l^{(k)}\frac{1}{\sqrt{l}}[\sin\sqrt{l}\,\frac{p}{\sqrt{2}}(\frac{t}{T}-k)+$$

$$+\sin\sqrt{l}\,\frac{p}{\sqrt{2}}(\frac{t}{T}-k-1)], \qquad (27)$$

Taking into account equations [2.13], (26) it is easy to write out the formula for standard function of renewal

$$w^{st}(x)=\frac{p}{\sqrt{2}}\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}D_l^{(k)}\{h(x-k)\frac{1}{\sqrt{l}}\times$$

$$\times\sin\sqrt{l}\,\frac{p}{\sqrt{2}}(x-k)+$$

$$+m(x-k-1)\frac{1}{\sqrt{l}}\sin\sqrt{l}\,\frac{p}{2}(x-k-1)\},\ x>0. \qquad (28)$$

On the basis [2.14], [2.15], (26)-(28) we find

$$w^{st}_{n;n+1}(x)=$$

$$=\frac{p}{\sqrt{2}}\frac{(-1)^n}{n!}D_l^{(n)}\frac{1}{\sqrt{l}}\sin\sqrt{l}\,\frac{p}{\sqrt{2}}(x-n)+$$

$$+\frac{p}{\sqrt{2}}\sum_{k=0}^{n-1}\frac{(-1)^k}{k!}D_l^{(k)}\frac{1}{\sqrt{l}}[\sin\sqrt{l}\,\frac{p}{\sqrt{2}}(x-k)+$$

$$+\sin\sqrt{l}\,\frac{p}{\sqrt{2}}(x-k-1)],\ \ n<x\le n+1,$$

$$n=0,1,2,\ldots. \qquad (29)$$

For the normalized speed of renewal [2.8] with the account (8), [2.13] we receive

$$n(t;t)=\frac{1}{2T}[1+\cos p(\frac{t}{T}-\frac{t}{T})]w^{st}(\frac{t}{T}), \qquad (30)$$

$$0<t\le t, t>0.$$

Let $\{t_n\}_{n=1}^{\infty}$ – the any control system and t_k – any fixed point of the control. Then there is such the integer non-negative n, that $nT<t_k\le(n+1)T$ and on the basis (30) have

$$n_{n;n+1}(t_k;t)=\begin{cases}\frac{1}{2T}[1+\cos p(\frac{t_k}{T}-\frac{t}{T})]w^{st}_{n-1;n}(\frac{t}{T}),\\ \quad if\quad t_k-T<t\le nT,\\ \frac{1}{2T}[1+\cos p(\frac{t_k}{T}-\frac{t}{T})]w^{st}_{n;n+1}(\frac{t}{T}),\\ \quad if\quad nT<t\le t_k.\end{cases} \qquad (31)$$

It is obvious, that functions (31) satisfy to the equations [2.10], [2.11].

For base control system (BCS) when $t_k=kT$, $k=1,2,\ldots$, we receive with the account [2.16], (31) system of base speeds of renewal

$$n_{n;n+1}((n+1)T;t)=\frac{1}{T}n^{st}_{n;n+1}(\frac{t}{T}), \qquad (32)$$

where standard base speed of renewal looks like

$$n^{st}_{n;n+1}(x)=\frac{1}{2}[1+(-1)^{n+1}\cos p\,x]w^{st}_{n;n+1}(x), \qquad (33)$$

$$n<x\le n+1, n=0,1,2,\ldots.$$

The behaviour of function $n^{st}_{n;n+1}(x)$ for $n=0$ and 1 is show on fig. 3.

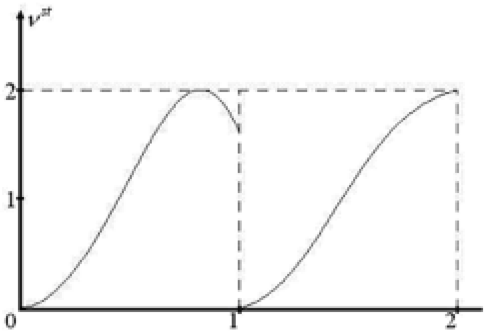

Fig. 3. The graph of standard base speed of renewal $n^{st}_{n;n+1}(x), n=0,1$

The local T -law [2.21] corresponding to speed of sale (6), is determined by equation

$$m_{n;n+1}((n+1)T;t)=g^{st}_{n;n+1}(\frac{t}{T}), \qquad (34)$$

where the standard law of renewal has the form [2.22]

$$g^{st}_{n,n+1}(z)=\int_n^z[1+(-1)^{n+1}\cos p\,x]w^{st}_{n;n+1}(x)dx, \qquad (35)$$

$$n<z\le n+1,\ n=0,1,2,\ldots.$$

The geometrical illustration of the standard (35) is shown on fig. 4.

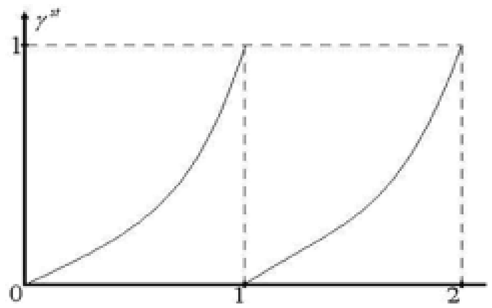

Fig. 4. The graph of the standard law of renewal
$g^{st}_{n;n+1}(z), n = 0{,}1$

The reduction local law of deliveries of raw material Y [2.32], corresponding to speed of sale (6), is given by equality

$$g_n(t) = M\,\frac{1}{2}\int_{n}^{n+\frac{t}{T}}[1+(-1)^{n+1}\cos p\,x]w^{st}_{n;n+1}(x)dx,$$
$$0 < t \le T, n = 0,1,2,\ldots, \quad (36)$$

where standard function of renewal $w^{st}_{n;n+1}(x)$ is defined by the formula (29).

In works [1,2] we marked, that the economic registration certificate (ERC) is a basis of the analysis and the account of reviving, i.e. of all logistical activity in global chain of financial – production relation. But structure ERC is determined with three universal functions: standard function of renewal [2.13], standard base speed of renewal [2.17] and the local law of equilibrium [2.22]. It was sufficient motivation for creation of computer program (CP) "BCS-1: Accounting" with simple card of deliveries of raw material (SCD), including volumes and terms of deliveries and operating for the period of time $nt < T \le (n+1)T$, $n = 0,1,2,\ldots$ [3].

Thus, SCD provides all ten positions of account – analytical form ERC5 [2].

Conclusions. The results received by us in this work, correspond to the general plan of construction of researches in scheme ATEA, having well defined applied aspect. It is obvious, that scheme of optimization of economic activities of the companies in the world market should have the strict scientific bases. In this plan the idea that the account and the analysis of economic activities outside of its connections with suppliers of raw material and a marketing outlets will be logically contradictory and will not provide economic growth. For example, if in frameworks of reviving to build a policy of management of material flows it is necessary to agree that at any industrial and marketing strategy the model of logistics of supply should be characterized by parameter of optimum volume of reserves, offer for sale demand. It is obvious, that the value of this parameter should be defined only by the law of sales.

Minimization of expense for a conservation of reserve is in our opinion a secondary task of reviving, which does not influence on the size of optimum volume of reserve. At such reviving organization the problem of measurement of expense and return on the capital enclosed in reserves can be solved. General-theoretical interest represents connection of this problem with process of optimization of parametrical series P.S. (S) and the mechanism of pricing in simple global chain FPR. All this will be an object of research in the following work of the author.

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ЩелоковаТ.В. Формирование локальных и глобальных законов равновесия в универсальных логистических системах

В работе с помощью математического аппарата аксиоматической теории экономического анализа (АТЭА) и теории восстановления Беллмана решена проблема гармоничного функционирования логистического менеджмента в универсальной логистической системе (УЛС). УЛС представляет собой простую или разветвленную глобальную цепь финансово-производственных отношений, которая характеризуется наличием ривайвинга. Ривайвинг, как совокупность макрологистических систем в пределах УЛС, обеспечивает операции по поставкам сырья, производству и сбыту готовой продукции с минимальными логистическими затратами. Уровень логистических затрат определяется действующим законом продаж основной продукции, который является объектом трансакции на глобальном рынке. Закон продаж инициирует всю логистическую деятельность в УЛС, которая строится на локальных и глобальных законах равновесия. Локальные законы равновесия гармонизируют короткодействующие связи между звеньями глобальной цепи и отвечают за реализацию технологических и коммерческих требований на каждом этапе технологического и коммерческого преобразования компонент сырья. Глобальный закон равновесия в УЛС строится как синергетическое объединение локальных законов и соответ-

ствует требованиям конкурентоспособности основной продукции в среде аналогичных глобальных цепей на мировом рынке. В работе дано строгое описание локальных и глобальных законов равновесия, учитывающих основные параметры исходного закона продаж: время оборота запасов и их оптимальное количество.

Ключевые слова: *учет, анализ, логистика, закон продаж, ривайвинг. экономический регистрационный сертификат(ERC).*

Щолокова Т.В. Формування локальних та глобальних законів рівноваги в універсальних логістичних системах

У роботі за допомогою математичного апарату аксіоматичної теорії економічного аналізу (АТЕА) і теорії відновлення Беллмана розв'язана проблема гармонічного функціонування логістичного менеджменту в універсальній логістичній системі(УЛС). УЛС є простим або розгалуженим глобальним ланцюгом фінансово-виробничих відносин, який характеризується наявністю рівайвінга. Рівайвінг, як сукупність макрологістичних систем в межах УЛС, забезпечує операції з постачання сировини, виробництва та збуту готової продукції з мінімальними логістичними затратами. Рівень логістичних затрат визначається діючим законом продажів основної продукції, який є об'єктом трансакції на глобальному ринку. Закон продажів ініціює всю логістичну діяльність в УЛС, яка будується на локальних та глобальних законах рівноваги. Локальні закони рівноваги гармонізують короткодіючи зв'язки між ланками глобального ланцюга та відповідають за реалізацію технологічних і комерційних вимог на кожному етапі технологічного і комерційного перетворення компонент сировини. Глобальний закон рівноваги в УЛС будується як синергетичне об'єднання локальних законів і відповідає потребам конкурентоздатності основної продукції у середовищі аналогічних глобальних ланцюгів на світовому ринку. У роботі дано строгий опис локальних і глобальних законів рівноваги, який враховує основні параметри вихідного закону продажів: час обороту запасів та їх оптимальну кількість.

Ключові слова: *облік, аналіз, логістика, закон продажів, рівайвінг, економічний реєстраційний сертифікат(ERC).*

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