The Normalized Economic Mechanism in the Digital Environment

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***Abstract* — The review describes the updated model of the Normalized Economic Mechanism (NEM). The complexes of NEM (resource support; production of real commodities; trade of real commodities; stockpiling of vital commodities; investment; the state budget, reserves, taxes, duties; regional budgets and taxes; education and population development; development of systems for life support and organization; social security funds; documenting the commodity-money circulation and the property statuses; management of economic activity) operate on the basis of electronic services in the digital twins environment. The updated structure and system of mandatory and orienting regulations of NEM functioning stimulate (by means of taxes, duties and other economic instruments) citizens to conduct economic activities aimed at protecting and enhancing the economic potential of their country. The updated technology of normalized commodity-money circulation includes the technology of e-trade with direct lending and the technology of designated payments. General characteristics of the updated methodology of the variational budgeting in a hierarchical system of expense items and the online service "Cost Planning", which implements this methodology, are given.**

***Keywords* — e-trade with direct lending, methodology of the variational budgeting, normalized economic mechanism, technology of designated payments.**

I. INTRODUCTION

The mechanism of an economic activity (*EM*) – one of the most complex organizational-technical systems invented by human beings. For many centuries the transition from one version of *EM* to another, as a rule, was dictated by the need to eliminate obvious disadvantages. The country's population activities are realized in the processes of status rivalry between individuals and between legal entities. The purpose of public administration is to protect the country's potential and its development by means of the legal regulation of the status rivalry processes[1]. Changes in the country's potential allow assessing a state of the object of public administration. The priority list of indicators of the country's potential and their interpretation (including ways of assessing and stimulation of changes) form the basis for planning management of the population activities. Economic systems of status rivalry belong to one of the most widely spread types of status rivalry systems [1], [2].

Methods of doing business depend on the objectives set. The choice of the main goal of economic activity is not the subject of scientific discussion. Supporters of the supranational organization of the world believe in *the economy of extraterritorial profit*, opponents believe in the prior development of national economic potential and mutually beneficial cooperation between corporations and citizens of different countries. No matter what goal has been chosen or what measures aimed at its accomplishment, they should be formulated. It is impossible to judge the model of *EM* without a clear answer to the question what purposes was it designed for. In any economic model as in a model of human-machine system it is necessary to state the purpose of the model and formulate the objectives that it will help to solve. In the models offered in the famous works on economics (e.g. [3]-[6]) the default assumption is that the prioritized goal of economic agents is extraterritorial profit.

A. An economic activity mainly aimed for extraterritorial profit

For those seeking extraterritorial profit the main goal is not the economic development of the country. To achieve their goals corporations hire guest workers and seek locations which offer cheaper labor, land, etc. (e.g. in China and other Asian countries). The result – the population of developed countries lose professional qualifications and switch to activities not related to the production of *vital commodities* (*vc*). The conceptual basis of *the economic mechanism of extraterritorial profit* (*PEM*) is supported by the ideas presented in [3]-[8]. *PEM* is presented as having faults, but having no alternative. The economic troubles inherent in *PEM* are interpreted as the native elements or the unpredictable events like in casinos and racetracks. The inevitable consequence of the use of *PEM* are: the growing number of capable people who consume real commodities, but do not produce them; an unsustainable pattern in the real economy; the financial sector dominates the sectors producing real commodities (as money and securities remain highly profitable commodities); under the existing rules of the economic activities the state can lose control even over the corporations producing vital commodities (the scheme is well known: corporations borrow from foreign banks, debts which they are unable to pay back → as a result foreign banks become owners of the property of these corporations).

These days many participants of foreign trade transactions do not use their national currencies, but instead use the US dollar, which plays the role of a global reserve currency. Dollars issued in the USA (but not backed by real commodities produced in the USA) are used not only to import real commodities to the USA but are lent to "the dollar-addicted global contingent" (which backs this currency by their real commodities when they use dollars in foreign trade contracts). At present the WTO and other international organizations carry out global governance of external exchanges between their member countries. The existence of such governance is justified by leading American economists [7].

The inadequate functioning of the *PEM* is also proved by the fact that the financial sector of the economy has become more significant than the real sector that produces commodities. This dominance has been raised for centuries.

[1] Ilyin V. D. 2013. What should be the main objectives of state regulation of economic activity in countries with developed market economies? ResearchGate. Available at: https://www.researchgate.net/post/What_should_be_the_main_objectives_of_state_regulation_of_economic_activity_in_countries_with_developed_market_economies (accessed November 12, 2019).

Belonging to influential circles of the financial sector became attractive for former high ranking officials long ago. They occupy “strategic highs” in commercial financial institutions not only in Russia, and the former “toilers” of the financial sector “penetrate” into state authorities. The ideology of financial dominance is clearly expressed in the description of the purpose and function of the Federal Reserve System [8].

B. The digital environment of economic activity

In our days of intensive development of cloud computing and *online services* for various purposes (navigation, education, etc.) [9]-[12], the attention of researchers and IT developers is attracted to the idea of integrated service-based automation of various activities. Since the mid-1990s, the importance of successful implementation of this idea (called the "digital economy» [13]-[14]) has been steadily growing and associated with the competitiveness of corporations and countries[2]. *Internet of things* (*IoT*) is changing the environment of economic activity [15]. 3D printing technology has a great potential to change everything from our daily lives to the global economy [16]-[17]. Social networks are increasing the influence on the economical behavior of buyers and manufacturers. The role of information assets is increasing. The G20 community has determined its position on the digital economy in 2016[3]. In 2017, Russia has approved the state program "Digital Economy of the Russian Federation»[4].

C. The presented results

The article presents the updated model of *the Normalized Economic Mechanism* (*NEM*). It is a thematic continuation of [2]. The results were obtained in the performance of research work "Modeling of social, economic and environmental processes" (№ 0063-2016-0005) under the state task of FANO of Russia for the Federal research center "Informatics and control" RAS.

D. Markuping text fragments and writing formulas

For markuping text fragments, the modeling language *TSM* (*Textual Symbolic Modeling*[5]) is used:

□ <text fragment> □ means definition;

◊ <text fragment> ◊ means note.

Italics are used to highlight the concepts and sentences, to which the authors want to attract the attention, and also for variables in formulas.

II. The Normalized Economic Mechanism (NEM) [2]

□ *Economic performance* depends on an architecture of *EM*, stocks of resources, technological levels of production plants, productivity of farms, creativity and earning capacity of those involved in economic activity. □

◊ We consider expedient such architecture of *EM* that would stimulate the citizens of a country to produce the required amount of vital commodities of the appropriate quality (including those necessary for defense) and maintain rational production structure; to invent and apply advanced technologies and means of their realization; to improve the educational system and the system of scientific research; to treat with care the human gene pool and natural resources (water, fossils, etc). Not all countries can manufacture *vc* independently. The composition of such commodities varies from country to country. Joint-stock ventures, mutual investments, international trade unite manufacturers of different countries and make them beneficially interdependent. ◊

NEM includes the following complexes: resource support; production of real commodities (*rc-production*); trade of real commodities (*rc-trade*); stockpiling of vital commodities (*vc-stockpiling*); investment; the state budget, reserves, taxes, duties; regional budgets and taxes; vocational education and population development; development of systems for life support and organization; social security funds; management of economic activity (*ea-management*); documenting the commodity-money circulation and the property statuses: carried out by the banking system (*ea-documenting*).

◊ *NEM* functioning is determined by a *system of obligatory and orienting regulations* [2]. *Obligatory regulations* include the ones relevant to the country’s laws. Regulations that determine the relations of economic coordination between corporations and citizens of different countries should be referred to as *orienting regulations*.◊

A. Management of economic activity

ea-management sets the goals and objectives for the development and improvement of *NEM*-complexes; directs and stimulates economic activity through taxes, excise, duties and other means of economic regulation; coordinates the fulfilment of the objectives and controls the results achieved.

The complex of *ea*-management includes state institutions (ministries and the central bank) and commercial institutions (boards of directors, etc).

B. rc-production and rc-trade

□ *rc-production* is the transformation of original resources (labour, equipment, materials, etc) into real commodities of certain types. □

Manufacturers of real commodities: the systems of water-, heat- and energy supply; plants producing foodstuffs, clothing and footwear; complexes constructing buildings, bridges, roads; planning and design offices, institutions for scientific research; education, recreational and healthcare facilities.

The complex of *rc*-trade includes wholesale and retails companies (domestic and international) and means of storage and delivery.

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[2] Oxford Economics. 2015. The new digital economy: how it will transform business. Available at: http://www.pwc.com/mt/en/publications/assets/the-new-digital-economy.pdf (accessed November 12, 2019).

[3] G20 Summit. 2016. G20 digital economy development and cooperation initiative. Available at: http://en.kremlin.ru/supplement/5111 (accessed November 12, 2019).

[4] Pravitel'stvo Rossiyskoy Federatsii. 2017. Programma «Tsifrovaya Ekonomika Rossiyskoy Federatsii» [The program «Digital Economy of the Russian Federation»]. Available at: http://d-russia.ru/wp-content/uploads/2017/07/programma-tsifrov-econ.pdf (accessed November 12, 2019).

[5] Ilyin, V. D. 2019. Simvol'noe modelirovanie [Symbolic modelling] // Bol'shaya rossiyskaya entsiklopediya – Great Russian Encyclopedia. Available at: http://dev.bigenc.ru/technology_and_technique/text/4010980 (accessed November 12, 2019).

C. Division of labour and specialization

The division of labour and specialization of manufacturers have resulted not only in improved products and increased productivity, but also in a number of social problems (including the problems of "single-industry towns"). Job creation for the able-bodied population is one of the goals of economic activity management that constantly remains urgent. An acceptable solution to this problem requires a revision of production and distribution technologies.

D. Modularity, unification, complexing

The principle of constructing complexes from unified modules does not require an explanation. Modern production plants should be built (and those built earlier should be rebuilt) in accordance with this principle. Manufacturing complexes made from unified modules is the key method to solving the problem of unemployment among employable population.

E. Ordered production

The higher the cost of a product, the less reasonable it is to produce it without an order and delivery contract. Production to order is an alternative to production "to the warehouse". This mode of production is technologically provided by the modern e-services (in particular, by services of information portals of modern corporations).

F. i-enterprises and c-corporations

In *NEM*-system economic agents are divided into *commercial* and *not-for-profit* ones. Not-for-profit economic agents have a right to sell only assets that are their personal property. All those who have a right to sell other items of property belong to commercial organizations. Commercial economic agents can be either individual entrepreneurs or representatives of *c*-corporations. Individual enterprise (*i*-enterprise) is set up by one economic agent. In order to enroll the enterprise in the public electronic register, it is necessary to submit the regulations of the *i*-enterprise endorsed by the founder's digital signature (together with the list of commodity types that it is going to produce). The regulations should be drawn up according to the template approved by law. A *c*-corporation is set up by more than one economic agents. The founding treaty should include the amount of money invested by each of the founders and /or property objects, initial division of powers, conditions of withdrawal of the founders and accession of new members (if it is stipulated in the articles of association). Articles of association are unified instruments of economic system created on the basis of a template approved by law. The template articles of association has a form of a questionnaire that includes a sufficient number of points. The founding treaty and the articles of association (endorsed by the founders' digital signature) are a comprehensive set of documents necessary for the public electronic registration of the enterprise in the *NEM*-system. The documentary proof of a state registration is the assignment of a unique global identifier to a business corporation that is necessary to open an account of the given *c*-corporation. The articles of association point out who is entitled to manage the monetary and non-monetary funds and to carry out sales transactions of property items that belong to the c-corporation. References to relevant sections of the c-corporation's account are included into private accounts of the founders. At the same time references to private accounts are included into the *c*-corporation's account.

G. vc-stockpiling

◊ In addition to the state reserves it is desirable to develop a non-government stockpiling of vital commodities. ◊ *vc* in the depositary networks of state and non-government *vc*-stockpiles are a useful trade buffer (both for consumers and producers and for those engaged in wholesaling).

The volume of different types of stockpiled *vc* is to be changed depending on the situation in a country, but in any case such a trade buffer contributes to better predictability of *vc* sales and, as a result, to the greater stability of production. Rational management of *vc*-stockpiling is an important objective, and the results of its decision influence price stability. It is rational to attract private and corporate investments to construction and exploitation of the depositary network of non-government *vc*-stockpiles, and also to purchase of *vc* for them.

H. Documenting the results of economic activity

The core of the *ea*-documenting complex is the *property status system* (*ps-system*). Documenting the sale and purchase transactions, investments, gifts and donations, and documenting the public dues payments, is done by the *personal electronic banks* (*PEBs*) of economic agents (where original accounts and other documents of business activity are kept). At the closing of each deal the copies of participating accounts are updated on the servers of *banks-providers* that play the role of certifying centers and depositaries of updatable copies of the ea-accounts and other documents, and the same operations are performed on the servers of central bank once a day (or at another time period set by law). All the documenting is carried out in accordance with program-implemented systems of rules. Each stage of documenting is done on the basis of advanced information technologies using tested computer devices that are hard- and software of personal e-banks, the servers of the central bank and the banks-providers.

I. Property items and their exchange

Specified property items of the NEM-system (*NEM-items*) – are means of *rc*-production, *rc*-trade, *vc*-stockpiling, *ea*-documenting, *ea*-management belonging to legal and physical entities (economic agents) and consumer items, registered in the *NEM-system*. Every *NEM*-item corresponds to a unified electronic specification that includes its name, purpose and characteristics. If it is a manufactured item, then a manufacturer and a release date and expiry date are recorded. A reference for sales and delivery regulations is indicted for the item to be sold. The *NEM*-item specification is an e-document that presents it as a commodity.

□ *A commodity* is a *NEM*-item which can be sold. □

Categories and types of commodities are to be determined by law. Within their categories (food, clothing, etc.) every type of commodity must have a unified specification that includes the number of this type according to the priority list of the category of commodities, information about customs duties and on the terms of sale within and outside the *NEM*-system. The type of commodity, within a certain category, determines the level of duties applicable on domestic and overseas sales. *NEM*-items of refundable property exchange include: real

commodities (including services of state mechanism); savings (money savings and non-monetary savings) of economic agents, reflected in their ea-accounts. Money savings are used in purchase and sale transactions and in contractual investments. Non-monetary savings, reflected in accounts by hyperlinks to specifications of registered property, are used in sales transactions involving credit (as collateralized property of the customer) and in contractual investments (as collateralized property of the investment recipient). Donations (of real commodities and/or money savings), contributions and etc. relate to free of charge property exchange (the exhaustive list and terms of fulfillment are to be fixed by law).

III. The System of Property Statuses (*PS*-System) and Normalized Money (*NM*)

□ *ps-system* implemented in digital environment is the system of e-documentary representation of monetary and non-monetary components, that reflect property status of economic agents. Monetary components are represented in *nm*-amounts that are in the currency sections of *unique unified multi-currency accounts of economic agents (ea-accounts)*. Non-monetary components of *ps*-system are represented by hyperlinks to e-documents proving ownership of land, houses, etc. □

□ *nm* is an e-document that serves for quantify representation of values of commodities and monetary components of *ea*-accounts; payment of commodities, taxes and duties; accumulation of wealth in universal form; monetary investment; monetary gifts and donations. *nm* is represented by records in *ea*-accounts, which certify property rights to a share of the commodity value of the *NEM*-system and property liabilities in relation to other economic agents. Real numbers with a sign are used to present the sums in *ea*-accounts (the minus sign is used for those sums that are to be returned, the plus sign for those sums which have been received in accordance with contracts of closed deals). *nm* has two states: *assigned* (e.g. a debt due to a commodity purchase; investment; tax, etc.) and *non-assigned* (sums in the "*I own"* sections of *ea*-accounts). Assigned *nm* may be used only for a certain purpose [e.g. those received from investors can be used in accordance with the investment contract (purchase of new equipment, etc.)]. Non-assigned *nm* is used according to the self-determination of the owner of *ea*-account (in any permissible deal). □

A. Representation of commodity value

A market value of a commodity is expressed by an amount of *nm* and is a result of trade-off between a buyer and a seller which depends on supply and demand.

B. nm as a store of value

The *nm*-savings of an economic agent are reflected in his *ea*-account in the form of records of the currency sums in the sections "*I own"* and in subsections *"I invested"* of the sections "*Investment"*. The values in the sections "*I own"* imply unbound savings [non-assigned *nm*-sums]; investment accumulation is recorded in subsections *"I invested"* of the sections "*Investment"* (an assigned sums that can be used only in accordance with investment contracts).

C. Purchasing power (tradable capacity) of nm

Let us assume that in some region of an *NEM*-system one can purchase *el*[*A*] kilowatt-hours of electric power for *A* roubles or *wa*[*A*] liters of fresh water. Amounts *el*[*A*] and *wa*[*A*] represent a regional tradable capacity of *nm* (in roubles) for electric power and fresh water. The tradable capacity of *nm* for the same type of commodity (e.g. electric power) can vary significantly in different regions of the *NEM*-system. It is rational to use the same amount *A* in all the regions within the *NEM*-system (to make comparisons of the regional tradable capacities for the chosen type of a commodity). Changes over time in the regional tradable capacity of *nm* (for commodity types) reflect changes in the supply-and-demand situation (for commodities of these types). Data about these changes play an important role for producers and investors. It is efficient to publish changes in regional tradable capacity of *nm* (for commodity types) on special web-sites of trade and bank portals.

D. Unique unified multi-currency account of economic agent (ea-account)

□ *ea-account* is a unified e-document consisting of currency sections (which are activated by the central bank), each of which has the following basic items: "*I own"*, "*Designated payments"*, "*Lending"*, "*Investment"*, "*Taxes and duties"*, "*Gifting"*, "*Donation"*. The set of permissible operations for amounts recorded to *ea*-account is determined by subsections to which they belong (e.g. an amount from the "*Received"* subsection of a section "*Investment"* can be used only to pay for goods whose types are listed in investment contracts). As far as an *ea*-account has a multi-currency structure, it can be applied to record the results of internal and overseas economic activities. □

No change in the *ea*-account sections can be made without a documented encrypted confirmation of its owner (and in non-ordinary situations – without documented ciphered confirmation of the state authority determined by law). The change in the state of *ea*-account can be realized only after obtaining the state confirmation of admissibility of the operation on the account. The confirmation is given by the special online service of the central bank. The basis for obtaining a confirmation is the data of the transaction (purchase or sale transaction, contractual investment, etc.). In this way, the possibility of violating the rules of commodity-money circulation established by law (unacceptable economic transactions, failure to pay statutory fees, etc.) is excluded.

In *the technology of designated payments*, which is to be implemented in the environment of digital twins [20], the rules of order execution and payment are rigidly linked. Each payment is certified by the special service of central bank. A state of the payment system and the paid orders is continuously modelled by their digital twins.

As far as an *ea*-account has a multi-currency structure, it can be applied to record the results of internal and overseas economic activities. The application of *ea*-accounts assumes that every economic agent has his own unique identifier.

Services of e-banking and the functioning of the *ea*-accounts are based on programmable sets of rules fixed by law. Access to the *ea*-account, reading of its content and recording of something are carried out by certified software that is installed on the device of a *personal e-bank* (*PEB*). Any change is registered, and a copy is automatically sent to a bank-provider that serves this *PEB*.

E. Permissible transactions with results reported in the ea-accounts

Only results of transactions that are allowed by law may be recorded in *ea*-accounts [purchase and sale of real commodities (using lending or free from it), investment, registration of real estate, etc].

IV. E-BANKING SYSTEM

The e-banking system of the *NEM* is the primary means of *ea*-documentation. It includes *PEB*s of economic agents, *banks-providers* and *central bank*, which manages all the other banks.

A. A Central bank

□ *A central bank* is a state institution that manages the banking system. The central bank performs the following functions: grants and revokes licenses to carry out banking activity (for owners of *PEB*s and banks-providers); activates and deactivates the currency parts of *ea*-accounts; controls implementation of banking activity rules; analyses the financial component of the *NEM*-system's activity and presents the results of analysis in order set by law; develops, modifies and approves tested unified forms of banking documents (including *ea*-accounts); controls the efficiency of monetary state reserve funds and social protection funds allocation, etc. □

The central bank possesses a network of servers located on the territory of a country under whose jurisdiction the *NEM*-system functions.

B. Banks-providers

□ *Bank-provide*r is a commercial institution established by legal entity (or by associations of legal entities and individuals) which deals with *rc*-production, *rc*-trade or *vc*-stockpiling. The bank-provider produces and sells unified e-services to owners of *ea*-accounts. These services include: processing queries of *ea*-account's owners, which are directed by *PEB*s when the deal is effected (including queries to certify the state of the *ea*-account, sent to business partners upon authorization by the *ea*-account's owner); storing of the copies of *ea*-accounts; analysis of investment queries of clients (prospective investors and investment recipients); (banks-providers can execute orders of investment recipients to consolidate investors' orders in order to accumulate the ordered investment sum); registering signed agreements [for permissible transactions] and maintaining the database of such agreements; legal support of deals etc. Legal support of deals is an important component of bank-provider's services. □

The bank-provider disposes a consolidated network of servers, designed to process the queries of *PEB*s' owners and to interact with the servers of a central bank.

◊ Notes on implementation: it is rational that banks-providers should be established by legal entities, which have sufficient monetary as well as non-monetary property grounds (reflected in *ea*-accounts); rules that determine the processes of establishing, operating and liquidating of banks-providers (implemented under control of the central bank) are to be set by law. ◊

C. PEB

□ *PEB* is a portable electronic device (like tablet PC) with smartphone' functions. *PEB* stores the original *ea*-account and documents on deals. The mobile banking software (certified by central bank) is the core of *PEB*' application. The encrypted database of an *ea*-account is stored in the memory of the device, and its copy is stored on the memory card. Records in the files of *ea*-account can be initiated only by *ea*-account' owner. □

The copies of *ea*-account and documents of serviced deals are kept in the bank-provider' databases (for the period of time, set by law of the given *NEM*-system).

D. The axiom of permissibility of an operation

□ *The axiom of permissible operation* means that any change of *ea*-account cannot be realized without the documentary encrypted confirmation of the owner of *ea*-account (and in some unusual situations – after getting documentary encrypted confirmation from a state authority appointed by law). □

The operation becomes permitted (at purchase and sale transactions, lending, investment operations, etc.) only when the code "*agree"* is received from owners of each *ea*-account involved in the transaction (in response to a query about the permissibility of the operation). This confirmation is included in the document that reflects the operation (the owners of *ea*-accounts get its copy; the copy of the document is kept for a certain period of time on the servers of banks-providers; storage period of original documents in *PEB*s is determined by the owners of *ea*-accounts).

V. MULTI-CURRENCY MARKET AND TRADE TECHNOLOGY

To buy or sell a certain type of commodity any member of multi-currency market may choose a partner from any country with which there is a trade agreement. The choice can be made on trade portals where buyers and sellers place their offers. Price of any commodity may be presented in multiple currencies (of the allowed for this type of commodities).

□ Sales tax (in currency that was used in trade deal) goes to the country that issued the license to sell the commodity. □

Trade deals among economic agents from different *NEM*-system should be done following the given obligatory rules: the applicable set of currencies is represented by an intersection of the sets of currencies that are activated by central banks of the *NEM*-system whose economic agents execute the deal; restrictions should be made corresponding to the list of commodities that are allowed for import and export, as defined by law and by international treaties. Coordinating relations between countries are necessary while developing and implementing of the above rules. Any global regulators that are limiting the freedom of economic choice are not desirable.

A. E-trade with direct lending

One of the urgent measures to normalize economic mechanism is the *e-trade with direct lending* [19], where the deferred portion of payment is documented as the buyer's debt to the seller (not to the bank). This technology is applied to purchases of any commodity, any seller and buyer. Repayment schedule is fixed in the contract. The contract also specifies penalties for violation of the schedule and improper quality of the commodity. In extreme case the

buyer has to pay by collateral. In such trading, all the benefits and risks are shared between buyers and sellers only. The legal and technological assistance to the seller and the buyer is done by their banks-providers.

B. Debt repayment: state support

In general case, debt repayment is determined by the contract. When a debt is result of purchase of the priority vital goods, the rules of early repayment from the central bank funds can be applied. These rules are defined by the central bank and act for the sellers of commodities included in the priority list defined by law. The sellers can receive the debt portion of the purchase price much more earlier than it is determined by repayment schedule in the contract. A seller sends a request to the debt department of the central bank, using special online service. In case of positive decision, the central bank transfers the debt amount to the seller's *ea*-account, and then the buyer pays the debt to the department of the central bank. A seller informs buyer about such way of repayment before making a deal. Early repayment of debts from the central bank funds implements the state program to support production and sale of priority commodities.

C. Emission of debt amounts

The central bank makes emission only when it does not have necessary sum to return a debt amount to seller of priority commodities. The emitted sum is the difference between the debt amount and the sum available on the debt department account. Emission of debt amounts is used for the state regulation of total sum of *nm* in economic system and their purchasing power. Rules of emission of debt amounts exclude a possibility of emission of *nm* not backed by real commodities.

D. Stimulation of sales for national currency

On the *NEM*' multi-currency market the e-trade with direct lending stimulates sales of priority products with payment in national currency: sellers have the possibility to quickly return the debt portion of the purchase price only when sale is made with payment in national currency.

E. E-trade with direct lending as anti-inflationary instrument

E-trade with direct lending makes use of current bank loans unnecessary. Such trade serves as effective anti-inflationary tool: change in the total amount of money is always strictly related to the change in the total value of goods sold in the economic system. In the first stage of normalization of banking activity the central bank has to oblige other banks to provide and serve the trade accounts which reflect operations of e-trade with direct lending.

VI. THE IMPLEMENTATION

The first phase of implementation of *NEM* includes a set of *Resource Planning Online Services*[6] for solving problems of budgeting and resource allocation in accordance with *mandatory and orienting requirements* [21]-[23].

A. The cost planning problem based on situationally defined requirements *for decision*

Given the numeric segments $[a^{min}, a^{max}]$ ($a^{min} \geq 0$, $a^{max} > 0$, a^{min} is minimal and a^{max} is maximal estimated amount of the resource), $[b_i^{min}, b_i^{max}]$ ($b_i^{min} \geq 0$, $b_i^{max} > 0$, $i = 1, \ldots, n$, b_i^{min} and b_i^{max} are minimal and maximal resource requests for the i-th expense item), and the requests priorities $p_i > 0$ ($i = 1, \ldots, n$), a cost plan $[x_i^{min}, x_i^{max}]$: $\{0 \leq x_i^{min} \leq b^{min}{}_i, x_i^{max} \leq b_i^{max}, \sum x_i^{min} \leq a^{min}, \sum x_i^{max} \leq a^{max}, i = 1, \ldots, n\}$ (1)
is to be found. For the total vector of the plan $\boldsymbol{x} = (x_1^{min}, \ldots, x_n^{min}, x_1^{max}, \ldots, x_n^{max})$ a set of requirements

$$\boldsymbol{Cx} \leq \boldsymbol{d} \leftarrow \boldsymbol{q} \quad (2)$$

can also be defined, where $\boldsymbol{C}$ is matrix of real coefficients of size $k \times 2n$ ($k \geq 1$), $\boldsymbol{d}$ – is column vector of real constants of size k, $\boldsymbol{q}$ – column vector of weights (priorities) of the rules ($0 < q_i \leq +\infty$, $i = 1, \ldots, k$).

The *mandatory requirements* have the priority $+\infty$. The priorities of *orienting requirements* are given by positive real numbers. The requirements (1) are mandatory. The requirements (2) can be both mandatory and orienting. ◊ The ability to specify a set of requirements (2) allows the expert-planner to introduce restrictions reflecting the specifics of the situation in the form of linear relationships between the components of the total plan vector. ◊ The *applied precision*, which is set by the expert, determines the minimum significant resource amount (integer degrees of 10, from –4 to 9). Data is rounded in accordance with a given applied precision. The calculation results are rounded according to a special algorithm – with the preservation of the required sum, taking into account requests and priorities. *The ability to set the applied precision allows, in particular, to solve integer problems.* ◊

Computational methods take into account the actual incompleteness of information for planning and experience in creating and implementing resource planning technologies [22], [23]. The methodology for online resource allocation in accordance with mandatory and orienting rules significantly extends the traditional arsenal of facilities for solving linear problems of resource allocation. The most important new feature is the ability to perform step-by-step search for the most efficient and realizable solution of linear resource allocation problem. At any step an expert can analyze the values of resource functions and customize the system of orienting and mandatory rules, governing the search. If the value of some "objective" function is estimated as most efficient, an expert can set the mandatory rule of fixing the function value.

B. The advantages of the methodology for variational online budgeting taking into account the priorities of expense items

If user specifies the bounds for resource and requests cautiously and follows the plan prepared with *the Cost Planning Service* [21], then the probability of going beyond the budget is drastically reduced; for each expense item user beforehand sees the bounds for possible costs, and narrows them in the course of the plan implementation. If upper bound is less than minimum request for some item, then user can timely attract investments, or exclude the item, or correct other costs. If the planning results are too "tight", user can temporarily exclude any expense item from consideration: it can be done by setting a "tick" in the corresponding cell of the table. User can simulate any real cost: set minimum request equal to maximum, mark it as mandatory, execute the command *Allocate*, and see the

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changes of bounds for the rest of expense items. User can also manually adjust the planning results.

VII. Conclusion

NEM is the market economic mechanism, the complexes of which operate on the basis of electronic services [18]. It is advisable to start step-by-step design and implementation of the *NEM*. Complexes of *rc*-production, *rc*-trade and *vc*-stockpiling have to become highly adaptive to changes in demand for vital commodities and to requirements regarding their quality.

The technology of normalized commodity-money circulation (including *technology of e-trade with direct lending* [19]) is an effective anti-inflationary instrument. The rules of emission of debt amounts and cancellation of trade in credits exclude the occurrence of money not backed by real commodities, stimulate production of the priority goods and selling them for the national currency.

In *the technology of designated payments* [20] the rules of order execution and payment are rigidly linked. Each payment is certified by the special service of the central bank. The state of the payment system and the paid orders is continuously modeled by their digital twins.

The methodology of the variational budgeting in a hierarchical system of expense items, where priorities may be set at any level of hierarchy, and *the online service "Cost Planning"*, which implements this methodology, have no known analogues [21]-[23].

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