The Technologies of Commodity-Money Circulation on the Basis of Personal and Corporative e-Banks

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Abstract — **The review describes three technologies of commodity-money circulation (CMC-technologies) implemented on the basis of personal e-banks (PEBs) owned by individuals and corporate e-banks (CEBs) owned by legal entities. The technology of designated payments and the technologies of payment lending and product lending are presented. The applied meaning of each CMC-technology is defined by a system of rules that direct and control actions of the parties to the agreement on commodity-money circulation (CMC-agreement). In implementation of CMC-technologies, PEBs and CEBs are considered as artificial intelligence systems, endowed with the ability to learn in the process of fulfilling CMC-agreements. Data on controlled events described in the agreements is supplied by digital twins. PEBs and CEBs are to be implemented on the basis of portable computer devices (smartphones, tablets) and stationary computers. CMC-technologies are aimed at improving the economic security of deals and reducing the influence of factors causing a decrease in the tradable capacity of money.**

Keywords — **technology of designated payments; technology of payment lending; technology of product lending; personal e-bank (PEB); corporate e-bank (CEB); agreement on commodity-money circulation (CMC-agreement).**

I. Introduction

In the current credit system, the conceptual framework of which was defined in [1-3], the central bank acts as the lender of the last resort for credit organizations of the banking sector (including commercial, savings and mortgage banks), the insurance sector (insurance companies and pension funds) and specialized non-banking institutions.

Nowadays the banks are granted by law (on banks and banking activities[1]) the exclusive right to credit activities in which the funds of individuals and legal entities are used.

The banks, continuing the pursuit of profit, are insistently striving to maintain the possibility of poorly limited disposal of funds of individuals and legal entities, using them in the processes of lending, currency trading and other activities that reduce the tradable capacity of money.

Despite the existing technological capabilities to ensure the economic security of banking operations, the banks continue operations on accounts facilitating a fraud – without the obligatory online confirmation of the admissibility of transaction previously obtained from account holders [4, 5].

However, the logic of progressive digitalization of various types of activities inevitably brings closer the days when the designated payments technology that increases the economic security of deals will become familiar [6], and smartphones and tablets with special software will play the role of personal e-banks (PEBs) (first proposed in [7, p. 126]), and corporate e-banks (CEBs) [4, 5].

Markuping the text fragments. To markup definitions, remarks and examples, we use the following tools of the TSM-complex language (TSM: textual symbolic modeling) developed for the formalized description of textual models[2]:

□ <description fragment> □ ≈ statement (definition, axiom, etc.) (hereinafter, the symbol ≈ replaces the word "means");

◊ <description fragment> ◊ ≈ remark;

□ <description fragment> □ ≈ example.

The first occurrences of the names of concepts and the description fragments to which authors want to draw attention are highlighted in italics.

The presented results. The article presents part of the results of methodological support development for *commodity-money circulation technologies in the digital environment*.

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◊ The article content is addressed primarily to those involved in the methodological support of information technologies development in the digital economy [8-12]. ◊

II. The Basics of Methodological Support of CMC-technologies

Specified property items (*sp-items*) – are means of production, trade, stockpiling, documenting, management belonging to legal and physical entities (economic agents) and consumer items, registered in the economic system.

Every *sp*-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 *sp*-item specification is an e-document that presents it as a commodity [5].

□ *A commodity* is a *sp*-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

[1] Federal Russian Law «On the banks and banking activities». Available at: https://cbr.ru/content/document/file/36339/law_banks.pdf (accessed March 5, 2020).

[2] Ilyin, V. D. 2019. Simvol'noe modelirovanie [Symbolic modeling] // Bol'shaya rossiyskaya entsiklopediya [Great Russian Encyclopedia]. Available at: http://dev.bigenc.ru/technology_and_technique/text/4010980 (accessed March 5, 2020).

of the category of commodities, information about customs duties and on the terms of sale within and outside the economic system.

The type of commodity, within a certain category, determines the level of duties applicable on domestic and overseas sales.

◊ 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) [5]. ◊

The *CMC*-technologies considered here are represented by *the technology of designated payments in the digital twins environment* [6], *the technology of payment lending* and *the technology of product lending*.

Credit technologies are designed for two types of credit relations:

- the customer lends to the supplier (*payment lending*),
- the supplier lends to the customer (*product lending*).

The technologies of product lending are based on the *technology of e-trade with direct lending* [13].

The means of payment provided on credit can be arbitrary [from the list of acceptable in credit relations (┌ electronic Russian rubles, electronic yuan, etc. ┐)].

◊ A mandatory requirement is the use of payment means owned by the creditor (*own means of payment*). ◊

Goods sold on credit can also be arbitrary [from the list of acceptable in credit relations of the specific type (┌ vehicles, educational services, etc. ┐)].

◊ *Participants of the CMC-deal (CMC-participants)* are owners of PEBs and / or CEBs with the right to make CMC-transactions. ◊

Software tools for *CMC*-technologies are included in the *normalized banking software* (*NB software*), the core of which is a special artificial intelligence system that, by means of digital twins [14], tracks the events defined in the *CMC-agreement*. NB software is installed on the PEBs and CEBs of the agreement parties and on the computers of the banks-providers, whose clients are participants of *CMC*-deals.

A. CMC-agreement

In implementation, the *CMC*-agreement is *an intelligent system that contains a description of the CMC-deal and the rules for its execution by the CMC-participants*. In the process of monitoring the execution of the agreement, a system exchanges data with the trained digital twins created by it, tracking the events defined in the *CMC*-agreement. The *situational cost planning* [15] is one of the optional system functions of the system in the course of agreements execution.

Formally, a rule is an expression of one from two types: either ($D_1 \Rightarrow D_2$) or ($D \Rightarrow I$). Here D, D_1, D_2 are descriptions of arbitrary events that belong to the set of controlled events defined in the *CMC*-agreement; and I is an instruction defining actions if event D occurs.

B. Representation of property statuses of CMC-participants

□ *The system of property statuses of CMC-participants (ps-system)* implemented in digital environment is the system of e-documentary representation of monetary and non-monetary components, that reflect property statuses of deal participants.

Monetary components are represented in e-money amounts that are in the currency sections of unique unified multi-currency accounts of economic agents (*ps-accounts*).

Non-monetary components of *ps*-system are represented by e-documents proving ownership of real estate, transport and other property (which, if necessary, can be considered as a security). □

□ *ps-account* is a unique multi-currency account placed in the PEB of an individual or the CEB of a legal entity. It is a unified e-document consisting of currency sections (which are activated by the central bank). □

E-money is an e-document that serves for:

- quantifying representation of values of commodities and monetary components of *ps*-accounts;
- e-payment for commodities, taxes, and duties;
- accumulation of wealth in universal form;
- monetary investment;
- monetary gifts and e-donations.

E-money is represented by records in *ps*-accounts, which certify property rights to a share of the commodity value of the economic system and property liabilities in relation to other economic agents.

Signed real numbers are used to present the sums in *ps*-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).

E-money 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 *ps*-accounts).

Assigned e-money 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 e-money is used according to the self-determination of the owner of *ps*-account (in any permissible deal).

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

The e-money savings of an economic agent are reflected in his/her *ps*-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 e-money sums); investment accumulation is recorded in subsections "*I invested*" of the sections "*Investment*" (an assigned sums that can be used only in accordance with e-investment contracts).

◊ *Software-implemented entries in the files of ps-accounts can be initiated only by the owners of ps-accounts making a deal* ◊.

Requests for a deal servicing (certifying the state of the ps-account and saving an updated copy of the ps-account) are received by the banks-providers (see section 2.3), the services of which are used by the deal participants.

C. The axiom of admissibility of operation on ps-account

□ No change in the ps-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[3]). □

D. e-Banks in the implementation of CMC-agreements

PEBs, CEBs, banks-providers and the central bank are used for the implementation of *CMC*-agreements.

It is assumed that the *central bank* possesses a network of servers located on the territory of a country under whose jurisdiction the economic system functions.

Bank-provider is a commercial institution established by legal entity (or by associations of legal entities and individuals) which deals with goods production and/or selling. Bank-provider disposes a consolidated network of servers, designed to process the queries of PEBs' and CEBs' owners and to interact with the servers of a central bank.

PEBs and CEBs, as a rule, are quite productive portable computer devices (┌ tablets, smartphones ┌) endowed with reliably protected communication tools. The originals of the ps-accounts and the *CMC*-agreements are stored in encrypted form in PEBs and CEBs.

E. Payment and product lending using PEBs and CEBs

□ Payment lending is the software-controlled partial or full prepayment of the ordered product (□ equipment, educational services, etc. □), the rules for the implementation of which are tightly connected with the rules for the order execution.

A schedule of the credit repayment is contained in the *CMC*-agreement and is monitored during the agreement implementation. □

□ Product lending is the software-controlled delivery of ordered commodities with a partial or full deferral of payment, the rules for the implementation of which are tightly connected with the delivery rules. □

It is based on the *technology of e-trade with direct lending* [13]. The technology provides registration of the deferred part of the payment for the commodity as the debt of the buyer (customer) to the seller (supplier), having CEB or PEB. The unpaid part of the commodity value is recorded as a debt, the payment schedule of which is fixed in the *CMC*-agreement (where penalties for violation of the repayment schedule and inadequate quality of the commodity are indicated).

With regard to debts resulting from the sale (supply) of some commodities, the rules for the early repayment of debts to sellers (suppliers) from the funds of the central bank can be applied. A supplier 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 supplier's ps-account, and then the customer pays the debt to the department of the central bank.

The possibility of such a debt repayment scheme is indicated in the CMC-agreement.

F. The technology of debt money emission

□ The central bank makes *money 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. □

[3] This axiom is violated by current banks

III. Concluding Remarks

1. At the present stage of the commodity-money relations development in the digital environment, a significant role belongs to the technology of designated payments [6] and to the technologies of payment lending and product lending, implemented by means of PEBs and CEBs. These technologies provide a high level of economic security and the feasibility of deals in accordance with CMC-agreements.

2. In the technology of designated payments [6], which is to be implemented in the environment of digital twins [14], 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.

3. Since payment lending and product lending technologies allow lenders with PEBs and / or CEBs to use only their own funds, the implementation of these technologies is not associated with a decrease in the tradable capacity of money [4, 5].

4. Debt money emission serves as a means of regulating the total amount of money in economic system [5, 6].

5. The rules implemented in *CMC*-technologies are based on the assumption that the owners of PEBs and CEBs are granted the right to credit by law, the implementation of which is controlled by the central bank.

6. *CMC*-technologies allow the lenders to use only their own funds.

7. The rules for execution of each *CMC*-agreement are controlled by software interacting the digital twins that track events defined in the agreement.

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