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BASES OF AXIOMATIC THEORY OF ECONOMIC ANALYSIS. PART I

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Abstract

In this work the idea of conceptual construction of economic analysis theory reflecting the qualitative modification to the structure of the integrated market under the influence of globalization process in the world economy is conducted consistently.

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1. INTRODUCTION

Development of the world economy at the end of XX – beginning XXI centuries takes place in the direction of economic activity unification, including production processes and legal security of the international common market. It was initiated by the globalization – by the natural process of relaxation (smoothing), typical to every complex conservative system, to world economy in particular. The mechanism of relaxation must provide the equilibrium state of megaeconomy thanks to action of smoothing factors, affecting all the fields of international economic cooperation in commercial, financial-economical, industrial, investment and cultural spheres. In spite of distinctions in the levels of integration potential all the subjects of the world market (separate enterprises, firms, corporations, countries) must follow common laws determined by the regularities in the development of global economy. In the given work the idea of two different levels of such regularities is examined: regularities of the first level are related to the forming simple and branched global chains of financial-production relations, and the second – with the improvement of global chains and formation of the absolute global chains. All the theoretical researches conducted in this work are based on the assumption, that in the conditions of globalization transformations international economic activity becomes the basic type of economic activity and, obviously, will become a unique kind, when the globalization will exhaust the reformative resource. Such situation requires the improvement of foundation of economic analysis theory, especially as the representatives of modern theoretical-economic schools of the world level in the works on the problems of the integrated economy use traditional approaches, analysing economic activity of subjects of the world market out of connection with a global economic environment or only marking such communication (see, for example, [1], [2]).

The development of the idea of "integrating" regularities resulted in creation of axiomatic theory of economic analysis (ATEA) with principle new logistics conception (the ERC conception), a central place in which is given to the economic registration certificate (ERC) having five registration-analytical forms ERC1-ERC5.

2. FORMULATION OF THE PROBLEM

Accounting and economic analysis of enterprises serving the world market will be the logically conditioned operation, if it is the structural element of the conceptually formed economic policy. Here we develop the analytical scheme of the axiomatic theory of economic analysis (ATEA) within the framework of which it is possible to harmonize the relations of enterprise-producer A of products X, made partially or fully from raw material Y, bought in at an enterprise-supplier B, with subsequent realization of it at the market C. Thus the use of symbols A, B, C, X, Y suggests wide interpretation of terms which are designated by them. So "enterprise-producer" A includes a production enterprise and financial institutions investing production; under raw "material" Y we understand both real raw material, and a different set of parts etc.

3. RESULTS

DEFINITION 1. Well – arranged set of subjects of economic activity $\{B, A, C\}$ is named *the local chain of financial-production relations* (l.c. FPR) *with elements* B, A, C. Arranged pairs of elements $\{B, A\}$, $\{A, C\}$ are named *the elementary structures of financial-production relations* (e.s. FPR). Elements B, A, C are named accordingly *subjected*, *active-subjected* and *active* depending on arrangement relations.

DEFINITION 2. Symbol in terms of

$$B \xrightarrow{Y} A \xrightarrow{X} C, \tag{1}$$

where arrows point to the movement of raw material Y and products X between the elements l.c. FPR, is called *the diagram of local chain of financial-production relations* (d.l.c. FPR). Expressions $B \xrightarrow{Y} A$, $A \xrightarrow{X} C$ are named *the links* of diagram (1).

We notice here, that in general case raw material Y is p-component: $Y = \left(Y^1, Y^2, ..., Y^p\right)$, where Y^i, $i = 1, 2, ..., p$ – is qualitatively different components. At the beginning we consider the case of one-component raw material $Y \equiv Y^1$.

Element B in (1), being subjected in this diagram, in its turn can form elementary structures or local chain, presented as active in the proper diagrams. In this case instead of symbol B we use symbols $A * B$ or $C * B$ depending on that, whether enterprise B produces products Y or resells it. The proper elementary structures and local chain of financial-production relations have a form

(a) $\{B_1, A * B\}$;

(b) $\{B_1, C * B\}$; (2)

(c) $\{B_2, A * B_1, C * B\}$.

DEFINITION 3. The use in the local chain of financial-production relations (1) of the new elementary structures and local chains (2) is named its *extension*.

For example, by the extension l.c. FPR (1), caused by expression (c) in (2), we have an expression

$$\{B_2, A*B_1, C*B, A, C\}. \tag{3}$$

with a diagram

$$B_2 \xrightarrow{Y_1} A*B_1 \xrightarrow{Y} C*B \xrightarrow{Y} A \xrightarrow{X} C.$$

It is easily to see from this diagram, that enterprise $A*B_1$ produces Y from Y_1, and intermediary company $C*B$ resells raw material Y to the enterprise-producer A.

Extension l.c. FPR (1) can be conditioned by three factors:

1. By the technological requirements connected with the multi-staged process of production of raw material Y.

2. By commercial interests effecting introduction in l.c. FPR intermediary firms with the functions of resale, logistics service etc.

3. By simultaneous action of logistics the reasons described in the first two points.

Let the process of production of raw material Y be n-staged with qualitively different states Y_k, $k = 0,1,2,...,n$. It means that in an elementary structure $\{A*B_{k+1}, A*B_k\}$ a qualitive transformation Y_{k+1} in Y_k, $k = 0,1,...,n-1$ takes place; thus we suppose $B_0 \equiv B, A*B_n \equiv B_n, Y_0 \equiv Y$.

DEFINITION 4. Extension $\{B_n, A*B_{n-1},..., A*B_1, A*B, A, C\}$ l.c. FPR (1), caused by the technological requirements n- staged process of production of raw material Y, is named *maximal technological extension*. Number n is called a *technological parameter* Y and is designated $n_{tec}(Y)$.

We give the diagram of maximal technological extension l.c. FPR (1):

$$B_n \xrightarrow{Y_n} A*B_{n-1} \xrightarrow{Y_{n-1}} ... \xrightarrow{Y_2} A*B_1 \xrightarrow{Y_1} A*B \xrightarrow{Y} A \xrightarrow{X} C. \tag{4}$$

DEFINITION 5. Extension of maximal technological extansion of local chain finanacial–production relations (1) is named its *commercial extension*.

Comparing THE DEFINITION 4 AND 5 it is easily to notice that commercial extension differs only from the maximal technological extension l.c. FPR that in the first one the elements $C*B_k$ appear designating intermediary firms. For illustration of these definitions we will consider the next example. Let the technological requirements be characterized by a parameter $n_{tec}(Y) = 2$. Then the maximal technological extension l.c. FPR (1), in accordance with ***Definition 4***, will have a form

$$\{B_2, A*B_1, A*B, A, C\},$$

and one of its commercial extensions can have an expression

$$\{B_3, C*B_2, A*B_1, A*B, A, C\},$$

that correspond to DEFINITION 5**.**

DEFINITION 6. Well-arranged set of elements $\{Y_p', Y_{p-1}', ..., Y_1', Y, X\}$, where $Y_m' \in \{Y_j\}_{j=1}^{n_{tec}(Y)} \cup \{Y\}$, $m = 1,2,...,p$, corresponding to arbitrary local chain

expansion of financial-production relations (1), is named *products indicator* X *with respect to raw material* Y and is designated $ind\, X/_Y \overset{def}{=} \{ Y_p', Y_{p-1}', ..., Y_1', Y, X \}$. Integer $p+1$ is named *the indicator factor* and designated $f\left(ind\, X/_Y\right) \overset{def}{=} p+1$. For maximal technological or commercial extension the expression $f_{tec}\left(ind\, X/_Y\right)$ or $f_{com}\left(ind\, X/_Y\right)$.

LEMMA 1. Indicator factor of the maximal technological extension l.c. FPR (1) is equal to $n_{tec}(Y)+1$, and the indicator factor of its commercial extension exceeds $n_{tec}(Y)+1$.

Proof. Statements of lemma are obvious, as according to ***Definitions 4–6*** at maximal technological extension $p = n_{tec}(Y)$, and at commercial extension $p > n_{tec}(Y)$. A lemma is proved.

It is easily to see that any extension l.c. FPR (1) is isomorphism in the sense of keeping line order to the indicator. Therefore it is possible to speak about an indicator $ind\, X/_Y$ as the extension l.c. FPR, and ordered pairs $\{ Y_k', Y_{k-1}' \}$, $k = 1, 2, ..., p$ to name elementary structures. Thus it is necessary to keep in mind the following *rules of diagram technique*:

R1. If in an elementary structure $\{ Y_k', Y_{k-1}' \}$, $Y_k' \neq Y_{k-1}'$ and $k \neq p$,then it needs the symbol $\xrightarrow{Y_k'} A * B_{k-1} \xrightarrow{Y_{k-1}'}$ in the proper diagram of $ind\, X/_Y$, and at $k = p$ – symbol $B_p \xrightarrow{Y_p'} A * B_{p-1} \xrightarrow{Y_{p-1}'}$.

R2. If in an elementary structure $\{ Y_k', Y_{k-1}' \}$, $Y_k' = Y_{k-1}'$ and $k \neq p$, then it needs the symbol $\xrightarrow{Y_k'} C * B_{k-1} \xrightarrow{Y_{k-1}'}$, in the proper diagram $ind\, X/_Y$ and at $k = p$ – symbol $B_p \xrightarrow{Y_p'} C * B_{p-1} \xrightarrow{Y_{p-1}'}$.

We show on a particular example, as these rules of diagram technique work. Let $ind\, X/_Y = \{ Y_3, Y_3, Y_2, Y_1, Y, Y, X \}$. We write out the diagram which corresponds to it, taking into account that $f\left(ind\, X/_Y\right) = 6$. We have

$$B_5 \xrightarrow{Y_3} C * B_4 \xrightarrow{Y_3} A * B_3 \xrightarrow{Y_2} A * B_2 \xrightarrow{Y_1} A * B_1 \xrightarrow{Y} C * B \xrightarrow{Y} A \xrightarrow{X} C.$$

DEFINITION 7. Maximal technological extension or commercial extension of local chain of financial-production relations (1) is called *the simple global chain of financial-production relations* (s.g.c. FPR).

We consider the general case now, when raw material Y in some “technological” state is multicomponent.

DEFINITION 8. If at the technological extension l.c. FPR (1) some its element $A*B_k, k=0,1,2,...$ initiates creation of two or more *branches* – independent maximal technological extension, than newly formed extension of local chain is named *branching technological extension*, and element $A*B_k$ *– magistral (* M *-element)*.

In connection with the introduction of ***Definition 8*** we do a number of explanations. It is easily to see that product indicator X with respect to raw material Y without taking into account branches has an expresion $ind\, X/Y = \{Y_k, Y_{k-1}, ..., Y_1, Y, X\}$ and if M-element $A*B_k$ forms p branches, than raw material Y_k is a result of "processing" p component $Z^1, Z^2, ..., Z^p$ at an enterprise $A*B_k$. In this case it is possible to speak about an indicator m-components $Z^m, m=1,2,...,p$, $indZ^m = \{ Z^m_{n_m}, Z^m_{n_m-1}, ..., Z^m_1, Z^m \}$ and about the factor of its indicator $f_{tec}(indZ^m) = n_m = n_{tec}(Z^m)$.

LEMMA 2. Technological extension l.c. FPR (1) up to M-element is maximal.

Proof. Indeed, let the branch l.c. FPR (1) begin with M - element $A*B_k$. Then the proper technological extension has a kind of

$$\{A*B_k, A*B_{k-1}, ..., A*B_1, A*B, A, X\}. \tag{5}$$

We write out the indicator of extension (5)

$$ind\, X/Y = \{Y_k, Y_{k-1}, ..., Y_1, Y, X\}, \tag{6}$$

where $Y_i \neq Y_j$, if $i \neq j$ and $Y_i \neq Y, i = I, 2, ..., k$. Accoding to DEFINITION 4, extension (5) with regard (6) is maximal and is characterized by a technological parameter $n_{tec}(Y) = k$. A lemma is proved.

DEFINITION 9. The indicator of products X with respect to raw material Y of branching technological extension l.c FPR (1) is named expression

$$Ind\, X/Y \overset{def}{=} \left\{ \begin{matrix} indZ^1 \\ ..... \\ indZ^p \end{matrix} \middle| \, ind\, X/Y \right\}. \tag{7}$$

The factor of indicator (7) is the number

$$F_{tec}(Ind\, X/Y) \overset{def}{=} \sum_{m=1}^{p} f_{tec}(indZ^m) + f_{tec}(ind\, X/Y) + 1. \tag{8}$$

Determining the technological parameter of the branching technological extension l.c. FPR (1) by equality

$$\tilde{n}_{tec}(Y) \overset{def}{=} \sum_{m=1}^{p} n_{tec}(Z^m) + n_{tec}(Y) + 1, \tag{9}$$

it is easily to find, based on LEMMA 1 and taking into account structure (8), that

$$F_{tec}\left(Ind\,X/Y\right)=\tilde{n}_{tec}+1=\sum_{m=1}^{p}n_m+k+2. \tag{10}$$

DEFINITION 10. Maximal technological extension (5) with M -element $A*B_k$ is called *a magistral* of branching technological extension of local chain of financial-production relations (1).

By virtue of DEFINITION 8,10 branching technological extension l.c. FPR (1) is a set of $p+1$ branches, one of which is *a magistral*, and other p - *side* branches.

DEFINITION 11. Extension of local chain of financial-production relations (1) by means of the introduction of an element of kind $C*B_m$ at least in to one of branches of its branching technological extension is named *branching commercial extension of local chain of financial-production relations*.

If the commercial extension l.c. FPR has p side branches, its indicator $Ind\,X/Y$ has a kind (7), and the indicator factor is given by equality

$$F_{com}\left(Ind\,X/Y\right)\overset{def}{=}\sum_{m=1}^{p}f\left(indZ^m\right)+f\left(ind\,X/Y\right)+1, \tag{11}$$

where f equals f_{com} or f_{tec} depending whether the proper side branch or magistral contains commercial elements or not.

DEFINITION 12. Branching technological extension or branching commercial extension of local chain of financial-production relations (1) is named *the branching global chain of financial-production relationships* (b.g.c. FPR) with the indicator factor (8) or (11).

Using THE DEFINITION 1-12 it is easily to make the form of the ERC1 economic registration certificate (ERC), in which industrial specification of the global chain FPR is reflected Tabl.1.

On the basis of the diagram technique rules R1, R2 and tabl.1 content of the form ERC2 (production structure) is determined (tabl.2).

DEFINITION 13. The number of the elements s.g.c. FPR or b.g.c. FPR (without a market C) is named the volume of the proper global chain an is designated N or $\tilde{N}$. The volume of s.g.c. FPR is equal

$$N=F\left(ind\,X/Y\right)+1, \tag{12}$$

and the volume of b.g.c. FPR is equal

$$\tilde{N}=\sum_{m=1}^{p}N^m+N^M, \tag{13}$$

where N^m – the volume of side branch

$$N^m=F\left(indZ^m\right)+1, m=1,2,...,p, \tag{14}$$

and N^M – the volume of magistral

$$N^M=F\left(ind\,X/Y\right)+1. \tag{15}$$

Taking into account equalities (8), (11), (14), (15), and also DEFINITION 12**,** on the basis of (13) we get

$$\tilde{N} = F\left(Ind\, {}^{X}\!/_{Y}\right) + p. \tag{16}$$

We notice here, that all symbols in formulas (12) – (16) have the double value; for example N equals N_{tec} or N_{com} depending on the character of the extension of l.c. FPR, and etc.

DEFINITION 14. Quantity N_c or $\tilde{N}_c$, equals to the difference between the volumes of extension of local chain of financial-production relations (1) commercial and technological at forming according by simple or branching chain, is named *the level of commercialization* of global chain, i.e.

$$N_c \overset{def}{=} N_{com} - N_{tec}, \tag{17}$$

or

$$\tilde{N}_c \overset{def}{=} \tilde{N}_{com} - \tilde{N}_{tec}. \tag{18}$$

DEFINITION 15. A quantity

$$\chi \overset{def}{=} \frac{N_c}{N_{com}}, \tag{19}$$

or

$$\tilde{\chi} \overset{def}{=} \frac{\tilde{N}_c}{\tilde{N}_{com}}, \tag{20}$$

is named *the degree of commercialization* of simple or branching global chain of financial-production relations.

Thus, by DEFINITION 14,15, level of commercialization $N_c\left(\tilde{N}_c\right)$ – is *absolute number* of commercial companies in the structure of the proper global chain, and degree of commercialization $\chi\left(\tilde{\chi}\right)$ *is the portion* of such companies in a volume $N_{com}\left(\tilde{N}_{com}\right)$.

DEFINITION 16.The number of intermediary firms being on one enterprise in maximal technological extension

$$r \overset{def}{=} \frac{N_c}{N_{tec}}, \tag{21}$$

or

$$\tilde{r} \overset{def}{=} \frac{\tilde{N}_c}{\tilde{N}_{tec}}, \tag{22}$$

is named the coefficient of instability of simple or branching global chain of financial–production relations.

DEFINITION 17. A quantity reverse to the coefficient of instability (21) or (22) is named *the coefficient of competitiveness* of simple or branching global chain of financial-production relations, i.e.

$$k \overset{def}{=} \frac{1}{r}, \tag{23}$$

or

$$\tilde{k} \overset{def}{=} \frac{1}{\tilde{r}} \tag{24}$$

For maximal technological extensions we suppose

$$k = \infty, \tilde{k} = \infty. \tag{25}$$

DEFINITION 18. The series of kind

$$P.S.(S) \overset{def}{=} (f_{tec}, f_{com}, N_{tec}, N_{com}, N_c, \chi, r, k) \tag{26}$$

or

$$P.S.(B) \overset{def}{=} \left(F_{tec}, F_{com}, \tilde{N}_{tec}, \tilde{N}_{com}, \tilde{N}_c, \tilde{\chi}, \tilde{r}, \tilde{k}\right). \tag{27}$$

is named *the parametrical series* of simple or branching global chain of financial-production relations.

In expressions (26), (27) for simplicity we write $f_{tec} = f_{tec}\left(ind\, {}^{X}\!/_{Y}\right)$, $f_{com} = f_{com}\left(ind\, {}^{X}\!/_{Y}\right)$ and etc.

THEOREM 1. In subset $(\chi, r, k) \subset P.S(S)$ the task of one parameter simply determines others.

Proof. Taking into account equality (23) it is enough to show that parameters χ and r are connected by simple correlation. On the basis of foundation (17), (19), (21) it is easily to get the chain of equalities

$$\chi = \frac{N_c}{N_{com}} = \frac{N_c}{N_{com} + N_c} = \frac{N_c}{N_{tec}} \cdot \frac{1}{1 + \frac{N_c}{N_{tec}}} = \frac{r}{1+r}. \tag{28}$$

On transitiveness in (28) we get

$$\chi = \frac{r}{1+r}. \tag{29}$$

Transforming equality (29) in relation to r we have

$$r = \frac{\chi}{1-\chi} \tag{30}$$

and, finally, on the basis of (23), (29), (30) we find

$$\chi = \frac{1}{1+k} \tag{31}$$

$$k = \frac{1}{\chi} - 1. \tag{32}$$

A theorem is proved.

REMARK. Obviously, that parameters $\tilde{\chi}, \tilde{r}, \tilde{k}$ from $P.S.(B)$ (27) satisfy to equations (29)-(32).

COROLLARY THE THEOREM 1. Analysing the second from equalities (28) it is possible to make a conclusion that change of level of commercialization N_c on a value

ΔN_c leaves coefficients unchanged r, k and χ only in case if volume N_{tec} of maximal technological extension will change on a value $\Delta N_{tec} = \left(\frac{1}{\chi} - 1\right)\Delta N_c$.

THEOREM 2. Task of any two parameters from subset $\left(f_{tec}, f_{com}, N_{tec}, N_{com}, \chi\right) \subset P.S.(S)$ determines simply all parametrical series $P.S.(S)$ (26).

Proof. On the basis (17), (12) we get

$$N_c = f_{com} - f_{tec}, \tag{33}$$

$$N_{com} = f_{com} + 1. \tag{34}$$

Substituting (33), (34) in the first from equalities in (28), we find

$$\chi = \frac{N_c}{N_{com}} = \frac{f_{com} - f_{tec}}{f_{com} + 1} = \frac{N_c}{N_{tec} + N_c}. \tag{35}$$

Assertion of theorem follows from the chain of equalities (35). Thus it is necessary to take into account relation (30), (32). A theorem is proved.

REMARK. The premise and corollary *of the Theorem 2* can be restated for $P.S.(B)$ (27). Thus the chainlet of equalities corresponds to expression (35)

$$\tilde{\chi} = \frac{\tilde{N}_c}{\tilde{N}_{com}} = \frac{F_{com} - F_{tec}}{F_{com} + p} = \frac{\tilde{N}_c}{\tilde{N}_{tec} + \tilde{N}_c}. \tag{36}$$

Graphic illustration of corollary OF THE THEOREM 1 is shown in Fig.1.

As indicated Fig.1 changing parameter χ from 0 to χ_{cr} coefficient of competitiveness k diminishes from ∞ to 1, and coefficient of instability r is increased from 0 to 1. At reduction χ from χ_{cr} to a 1 coefficient k diminishes from 1 to 0, and coefficient r is increased from 1 to ∞. This situation is characteristic as for s.g.c. FPR, so for b.g.c. FPR.

DEFINITION 19. Value of degree of commercialization $\chi_{cr} = 1/2$ or $\tilde{\chi}_{cr} = 1/2$, dividing an *evolutional* region $(0, \chi_{cr})$ and *crisis* region $(\chi_{cr}, 1)$, at which the values of coefficients of competitiveness and instability coincide $k = r = 1$ or $\tilde{k} = \tilde{r} = 1$, is named *the point of structural crisis* of simple or branching global chain of financial-production relations.

Role of parametrical series (26) by definition of the structure character s.g.c. FPR is show in Table. 3.

According to Table.3 a perfection of structure of simple or branching global chain of financial-production relations must be conducted in direction from the state C5 to the state E5.

Researching branching global chains of financial-production relations we use the special rules of the diagram technique applied for drafting of diagrams *compact and expanded.*

R3. Side branch b.g.c. FPR will correspond to *semi-bold segment* or *arc* with pointing of direction of motion component of products and its indicator produced in them.

R4. Magistral of b.g.c. FPR will be represented *by the bold directed segment* with pointing of products of indicator in relation to the used raw material.

As illustration of the rules R3 and R4 we consider the compact diagrams of b.g.c. FPR, shown in Fig.2.

Using the rules R1 and R2 of the elementary structures image it is easily to make the *expanded* diagrams b.g.c. FPR, represented on a Fig. 2 compact diagrams (a) and (b). With this aim we write out the obvious type of the proper indicators. Let, for example

$$\begin{aligned} ind\, X\!\!\diagup\!\!_{Y} &= \{Y_1, Y_1, Y, X\}\ , \\ indZ^1 &= \{\ Z_1^1, Z_1^1, Z^1\}\ , \\ indZ^2 &= \{\ Z_2^2, Z_1^2, Z^2\}\ , \\ indS &= \{S_1, S\}\ . \end{aligned} \tag{37}$$

By virtue of (37) the expanded diagrams which had been considered before b.g.c. FPR (a) and (b) will have the form shown in Fig. 3.

THE DEFINITIONS 13-19 allow to fill the form ERC3 (parametrical series) (Tabl.4).

REMARK. Interest for research has local chain FPR (1) in the case when the produced products X is a multicomponent $X = \left(X^1, X^2, ..., X^n\right), n \geq 2$. Thus used raw material Y it must be p - component $Y = \left(Y^1, Y^2, ..., X^p\right), p \geq n$ and extension of local chain begins with M – element A, forming the branching global chain of financial-production relations with p side branches and *degenerative* magistral $\{A, C\}$. Descriptions of such b.g.c. FPR in natural way are modified. So, for example $ind\, X\!\!\diagup\!\!_{Y} = \varnothing$, $f_{tec}\left(ind\, X\!\!\diagup\!\!_{Y}\right) = 0$, $N^M = 1$ and etc. But, of course, and in the case of multicomponent products it is possible to apply a previous diagram to examine n independent local chains

$$B \xrightarrow{Y^i} A \xrightarrow{X^i} C\ ,\ i = 1, 2, ..., n \tag{38}$$

with the proper technological and commercial extensions.

4. CONCLUSIONS

Conceptual method, used in this work, allows to emphasize as object of the axiomatic theory of the economic analysis (ATFA) simple or branching a global chain of the financial-production relations. Researches s.g.c. FPR or b.g.c. FPR will be done in the terms of the economic al registration certificate (ERC), which formation will be completed in the second part of work.

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