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### The Sufficiency Principle as the Ideas Quintessence of the Club of Rome

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#### ABSTRACT

The paper suggests an approach to solving some basic economic problems and corresponding to them mathematical tasks, taking into account the principle of sufficiency, which, in the authors' opinion, is the quintessence of the ideas of the Club of Rome. According to this principle humanity must rationally limit its needs, produce and consume just a sufficient number of goods and in sufficient quantity. The goal of this paper is to demonstrate opportunities of application the principle of sufficiency for dealing with some problems (tasks), namely the consumer task and the producer task, both aimed at the achievement of not maximal but sufficient utility. In addition, the problem of optimal linear production planning aimed at the search of an optimal plan which from all admitted plans provides a maximal profit is considered. Since nowadays there is no common method of solving all these problems, possibility of finding their private solutions is described.

#### INTRODUCTION

In April 2018 the Club of Rome has celebrated its 50<sup>th</sup> anniversary. Its activity the Club started on the 6–7<sup>th</sup> of April, 1968 with the meeting in the Dei Lincei academy in Rome, where did the title of this non-commercial organization come from, though now its headquarter is located in Paris. The Club of Rome peak influence on the world public opinion came to 1970–1980`s of the last century. Under the influence of its activity the *globalistics* was formed as the social science discipline. In 1990–2000`s the ideas of globalistics became the part of scientific culture, but the activity of the Club of Rome and public attention to it decreased significantly.

One of the main problems of the contemporary world besides the domination of the global speculative financial capital the authors of the last report called excess consumption and super consumption of the world resources. The authors of the report stated that nowadays noosphere of V. Vernadsky by the greed and basic ignorance has been transformed in its opposite (Zarnadze, 2011; Yerznkyan, 2011).

Herewith, for the first time, the issue on the sufficient consumption was formed in a form of *Principle of sufficiency* almost ten years ago in the work (Gataullin T., 2009) and was further developed in the works (Gataullin T., 2012; Gataullin T., Gataullin S., 2013; Gataullin T., Malykhin, 2010). There the authors put forward the idea about changing the paradigm of economic science. As it is known, the economy started together with labor division. Production forces were still weak and there could not be any speech about wealth accumulation it was available only for a few. The paradigm of that economy may be expressed by the phrase – it was “survival economy”. There was no any entire economic science. The paradigm of economy was changing with the development of production forces and corresponding to them production relations (from this it is clear that the authors stand on the Marxist platform).

Capitalist society and paradigm of its economy could be expressed by the phrase – it was and has been the “consumption economy.” The pursuit of profit, wealth was the characteristic feature of such economy. The contemporary paradigm of developed capitalist society could be shortly expressed, for example, as “How and what to produce more for the satisfaction of our growing needs”. Social way of production and paradigm of its economy could be expressed by the phrase – the purpose of production “*to produce more and all produced distribute evenly as possible and fairly*”. It is unknown whether the social way of production (and life) only is a short-term episode of the human history. Here an inspiring example is socialist China succeeded in avoidance of the problems known after V. Draskovic (2018) as *clototrization of transition*. The above-mentioned paradigm should be changed into the other one “*How and what to produce in order to live in the harmony with the nature*”. This new paradigm could be expressed in the form of the following more general principle, which is the quintessence of the Club of Rome ideas.

## 1. THE PRINCIPLE OF SUFFICIENCY

As underlines Sergey Glaziev in his introduction to the T. Gataullin and V. Malykhin (2010, p. 3) monograph, “*economic theory takes too much attention to the still completer satisfaction of humanity needs, leaving without proper attention still diminishing recourses*”.

In this context recourses are understood in the broadest sense, including, for example, radio frequencies, whose using by cellular companies can have a harmful effect on bees. Presumably, radio waves of a certain frequency can adversely affect the ability of “*bees to return from the honey to the hive with the help of the dance language, to accurately inform their carters about the location of the extraction, to which the other bees immediately react*” (Lacan, 1995, p. 67). And although these words of the French psychologist Jacques Lacan were told to him on another occasion - to clarify the question of whether the code or the signaling system of bees becomes language, and this dance, by the way, is not language because of the rigid correlation of its signs with reality – the problem remains. One of the solutions to the problem of negative externalities caused by the action of radio frequencies is the legislative restriction, and quite strong, of the use of cellular communication in a number of places in the US and Canada (Gataullin and Malykhin, 2010, p. 104). In general, allowance for the limited resources is necessary to understand the true meaning of the principle of sufficiency, which in the original author's version reads: “*humanity must reasonably limit its needs, learn to produce and consume only a sufficient number of goods in sufficient quantities*” (Ibid., p. 20). To the above, we add that the principle of sufficiency should be guided by both economic theory and management practices, and all this is in full accordance with the principled provisions of the socioeconomic doctrine of D. S. Lvov et al. (1996).

While analyzing the development economics of D. S. Lvov (2008) and comparing it with the Chinese experience of modernization, it should be especially stressed that D. S. Lvov focused not on individual measures, but on the priorities of economic policy, on the positive dynamics of the standard of living. General in the approaches to the reforms between D. S. Lvov and Deng Xiaoping are the following principal guidelines:

- abandonment of dogmas, taking into account the real situation, the specifics of the country (historical, demographic, resource, etc.) in determining the modernization strategy;
- attention to the development of productive forces;
- preventing the polarization of society;
- attention to socio-psychological factors.

As shown in (Yerznkyan, 2014), this principle, which for all its seeming simplicity is far from being just simple, can claim the role of the economic equivalent of a more capacious concept – *ecological imperative*. This term, introduced by an adherent and companion of D. S. Lvov in the Club of Arbat N. N. Moiseev (1998, p. 186), describes the desired state of society, capable in its framework "to ensure the development of civilization in these specific natural conditions". It is about ensuring the development of society and, more broadly, civilization in a specific natural environment, but with compliance with imperative requirements. In this sense, the environment "does not act as an independent developmental constraint, as it was in previously thought, but as a constraint, the requirements for which are set by a person (society, civilization)" (Yerznkyan, 2014, p. 18).

This approach is fundamentally different from the traditional approach to the nature, familiar from previous socio-economic doctrines. The paradigm of capitalist economy, as we know, has its core of competition, at the core of which lies the pursuit of profit. It is the generalizing indicator of the success of the whole economy and its individual subjects, allowing pay interest to creditors and dividends to shareholders, etc. It is useful to note that when this paradigm is followed, the satisfaction of the needs of the population occurs automatically, automatically. In turn, the ecological imperative is in a certain sense similar to the *categorical imperative* of I. Kant, whose significance has not diminished in the meantime.

Quite the opposite: it intensified even more, for if there were no moral guidelines, principles that became a moral law for an individual, an imperative – even if utopian – humanity would be doomed. At the same time, "the ecological imperative – unlike the categorical imperative of Kant – does not concern individual people, but individual countries, integration associations and the entire global society as a whole" (Yerznkyan, 2014, p. 23), setting its vector of development.

To stick to the alternative, like the rejection of environmental activities because of the impossibility of taking into account the consequences of global and uncontrolled ecological chaos (which are not known in their essence - Jonas, 1979), hardly makes sense. Its meaninglessness is due to the fact that the refusal of activity deliberately dooms humanity to death, while attempts to find an adequate development paradigm and a relevant strategy for its implementation give it a chance to escape.

This requires a fundamentally new development strategy, and the concept of sustainability is, albeit not an absolute, but an effective step in the right direction. To build it, we must change the "axioms of the past," in other words, "those beliefs, the system of views, the perception of the world, on which our actions were based until recently, based society's development" (Moiseev, 1998, p. 63). This means that a new institutionalization of society is needed, including both the development of informal (beliefs, etc.) and formal (law, enforcement mechanisms, etc.) institutions (Yerznkyan, 2014, p.24).

In itself, the principle of sufficiency can not serve as a panacea for the continuing "conquest" of nature, but it can not be an ecological imperative. We also note the following. The idea of competition and the principle of sufficiency are incompatible with each other, or at least to some

extent contradictory. After all, competition is aimed at achieving maximum profit, and the principle of sufficiency proclaims the desirability of its limitation. We must state that there are as yet no models reflecting this inconsistency to the full, but we can offer something in this direction, considering the solution of economic problems taking into account the principle of sufficiency.

But how to understand what is sufficiency, how exactly to understand the principle of sufficiency? In the standard university courses of economics confirms that economics studies the issues of resources efficient exploitation, production and management with the aim of achieving maximum satisfaction of material human needs. If it is so, it should be mentioned that economic science is seriously ill and needs in the paradigm change. If to use the notion of horizon planning or action it could be said that humanity should behave in the way that the horizon of the life of living persons as biological species could be unlimited.

The transition to the new paradigm will involve fundamental changes in the whole human activity (see *inter alia* Bychkova, 2014; 2016). But in this paper we only consider several known problems or tasks of economic character the solution of which we require taking into account the principle of sufficiency. So, let us consider the following known economic problems and corresponding to them mathematical tasks.

## 2. THE PROBLEMS/TASKS AND THEIR SOLUTIONS

The *consumer task* is as follows: find a set of goods  $X$ , fit for the cost into the consumer budget  $M$  and maximizing its utility function  $u$ , in the symbolic form

$$\begin{aligned} u(X) &\rightarrow \max \\ PX &\leq M, X \geq 0 \end{aligned} \quad (1)$$

At constant prices the desired maximum value of the consumer utility function is denoted as  $u_M$ .

The *producer task*: find the amount of a firm  $X$  (the amount of recycled resources) maximizing the firm's profit

$$\begin{aligned} \nu f(X) - PX &\rightarrow \max \\ X &> 0 \end{aligned} \quad (2)$$

Here  $f$  is production function,  $P$  – the prices vector on resources,  $\nu$  – the price on the firm production. Let us denote the desired maximum value of the producer's profit at constant prices as  $P_M$ .

In both tasks the maximizing function is concaved and if it is with several variables, its Hessian is negatively determined.

So, how to reformulate these problems (tasks) with regard to the sufficiency principle?

We will look for not maximum but a value that is close to it, for example, the value not less than 90% from its maximum. Consequently, the consumer task will be like this

$$\begin{aligned} u(X) &\geq 0,9u_M \\ PX &\leq M, X \geq 0 \end{aligned} \quad (3)$$

where  $u_M$  is taken from the solution of task (1).

That is, in order to solve the task (3) it is necessary previously to solve the task (1). Is it possible to solve the task (3) otherwise, not recognizing beforehand the value  $u_M$ , i.e. not solving the task (1) before? This is all the more interesting that the task (3) seems to be easier than the task (1).

As to producer task, it will look approximately like this

$$\begin{aligned} v f(X) - P X &\geq 0,9 P_M \\ X &> 0 \end{aligned} \quad (4)$$

where  $P_M$  is taken from the solution of task (2).

That is, in order to solve the task (4), it is necessary previously to solve the task (2). Is it possible to solve the task (4) otherwise? Not recognizing beforehand the value  $P_M$ , that is not solving the task (2) before? (Again the same task (4) seems to be easier than the task (2)).

Here are a few more similar problems (tasks) of economic character.

The problem (task) of optimal linear production planning (OLPP): let us consider a company which from  $m$  types of resources (further just resources) produces  $n$  types of production ((further just production). The production is characterized by the consumption rates that are summarized in the matrix  $A = (a_{ij})$ , where  $a_{ij}$  is the number of units of  $i$  resource, spent on one unit production of  $j$  production. As the most important resource is living human labor. The company receive profit  $c_j$  monetary unit from production and the following realization of a unit of  $j$  production. These unit profits are summarized in the row vector  $C = (c_j)$  of unit profits. The company has some resource stocks: let  $b_i$  is a stock of  $i$  resource. Stock values form a column-vector  $B = (b_i)$ . In order to find out how and what resources are needed for production plan  $X = (x_j)$  (further the plan) it is necessary to multiply the matrix of consumption rates by a column-vector of a plan and we receive  $AX$ . A plan  $X$  is called admissible if there is enough available stock, that is if  $AX \leq B$ .

The task OLPP itself in a matrix-vector form is recorded as the following

$$\begin{aligned} P(X) = CX &\rightarrow \max \\ AX \leq B, X &\geq 0 \end{aligned} \quad (5)$$

In words it can be said like this: To find a valid plan which of all valid plans brings a maximum profit – such plan is called *optimal*.

At constant stock resources  $B$ , the required maximum value of a profit function from the realization of produced production mark as  $C_B$ .

So, how will this task be formulated with regard to sufficiency principle?

The task OLPP with regard to sufficiency principle will look like roughly so:

$$\begin{aligned} C(X) &\geq 0,9 \cdot C_B \\ AX \leq B, X &\geq 0 \end{aligned} \quad (6)$$

where  $C_B$  is taken from the task solution (5).

That is to solve the task (6) it is necessary previously to solve the task (5). Is it possible to solve the task (6) otherwise, not recognizing beforehand the value  $C_B$ , that is not solving the task (5) before? This is all the more interesting that the task (6) seems to be easier than the task (5).

Let us consider a general mathematical task of finding an extreme value, for example the maximum of the function

$$\begin{aligned} f(X) \rightarrow \max \\ X \in D \end{aligned}, \quad (7)$$

where  $D$  is the domain of the function  $f$ .

Let us point out that the important in terms of applications is a class of tasks when a target function is (Gataullin, 2004; Gataullin et al., 2017). In the context of sufficiency principle this task looks like this

$$\begin{aligned} f(X) \geq 0,9 \cdot f_M \\ X \in D \end{aligned}, \quad (8)$$

where  $f_M$  is the maximum value of function  $f$  on  $D$ . And again the question of the means of task solution (8) without beforehand the task solution (7) arises. It is clear that all the three considered tasks are the tasks of this type. Let's now consider the task of function minimization

$$\begin{aligned} f(X) \rightarrow \min \\ X \in D \end{aligned}, \quad (9)$$

where  $D$  is the domain of the function  $f$ . In the context of sufficiency principle this task looks like this

$$\begin{aligned} f(X) \leq 1,1 \cdot f_M \\ X \in D \end{aligned}$$

Let us point out that until now there is no general type of solution of all considered tasks. But today the authors of this paper could suggest something in this direction.

If in the consumer task (1) the utility function is linear, we could solve the task (3) without solving the task (1) using for finding  $u_M$  duality theory. Let us consider the next example (Prokhorov et al., 2016).

In the space of three products consider the budget set under price vector  $(p_1, p_2, p_3) = (1, 3, 4)$  and income  $M = 24$ . Find the point of optimum of the consumer if the utility function is as follows:

$$U(x_1, x_2, x_3) = \alpha x_1 + \beta x_2 + \gamma x_3, \text{ when } \alpha = \beta = \gamma = 1.$$

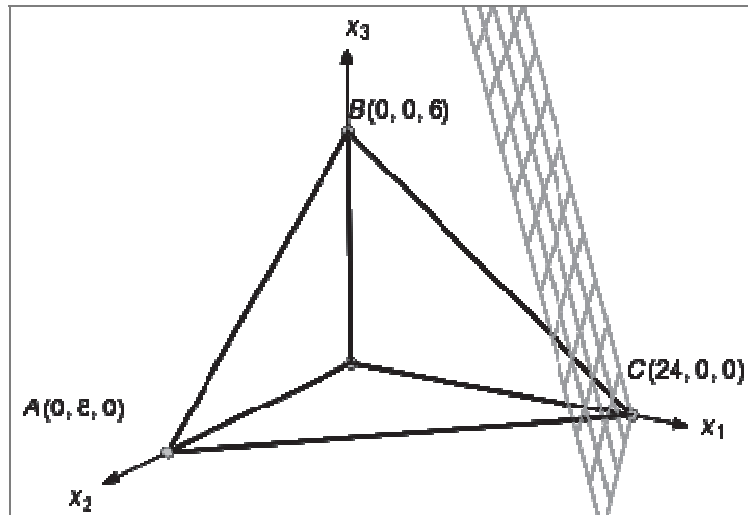
*The solution of this task by general way is given below.*

For the volume vectors of acquired production  $X = (x_1, x_2, x_3)$ ,  $X \geq 0$ , the boundary of the budget set specified:  $G = \{X: x_1 + 3x_2 + 4x_3 = 24\}$ .

The budget set  $B = \{X: x_1 + 3x_2 + 4x_3 \leq 24\}$ .

The boundary of the budget constraint is shown in the Figure 1.

**Figure 1.** The illustration of the budget constraint of the task



The utility function is linear, that is why it is possible to determine the optimum point, choosing the vertices of the budget set. The coordinates of the vertices and values of objective function are given in the next table (Table 1).

**Table 1.** The objective function value at the extreme points

Point	$x_1$	$x_2$	$x_3$	$U$
$O$	0	0	0	0
$A$	0	8	0	8
$B$	0	0	6	6
$C$	24	0	0	24

Obviously, the optimum solution is the point C, where the consumer utility function reaches  $u_M = 24$ .

Now find  $u_M$  applying the duality theory.

The dual task has the view:

$$F(y) = 24y \rightarrow \min;$$

$$y \geq 1;$$

$$y \geq 1;$$

$$y \geq 1;$$

$$y \geq 0.$$

This task has optimum solution with  $F_{\min} = 24$  on the first main duality theorem  $u_M = F_{\min} = 24$ . In such a way we find the extreme value of objective function of the task (1), without solving it. Now we can solve the task (3), which in our example has the following view:

$$X_1 + X_2 + X_3 \geq 21,6$$

$$X_1 + 3X_2 + 4X_3 \leq 24$$

$$X_{1,2,3} \geq 0$$

This task has, for example, such particular solution:  $X = (21,6;0;0)$  and on it the value of utility function value equals to 90% of maximum value. In exactly the same way, in case of 1/near objective function the task of producer (3) and the planning task (6) could be solved.

## CONCLUSION

We considered fundamental concepts of mathematical economy and mathematical tasks corresponding to the real-life economic problems in accordance with the ideas of the Club of Rome and the sufficiency principle. These concepts and tasks are of special interest for economies in transition taking into account their non-stationary in high degree regime of functioning. We tried to show that even well known problems or tasks of economic character could be solved in way to be in accordance with the principle of sufficiency. We understand that this principle is not a panacea from clockotrim, however it shows the way where to go.

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