

WHY FORESIGHT?

- THE IMPACT OF RESOURCE CONSUMPTION AND TECHNOLOGY ON THE ABILITY TO FORESEE THE FUTURE -

Abstract:

In this article we attempt at providing evolution of the resource consumption (RC) which meets the needs of a modern society.

In analyzing the impact of resources consumption and technologies to meets the needs, over the possibility of anticipating the future is necessary to establish patterns based on past information. On the those information, we can say that RC evolution between the α and Ω moments follows a logistic curve. Based on the graphic representation of the RC evolution, we can identify four different phases, with specific characteristics. Each phase will be the basis for building a pattern of RC evolution. For each of the four patterns we analytically present the risks of performing an exercise of future's anticipation.

The analysis indicates that currently, the forecasts lose representativeness and becomes less important compared with the foresight. The foresight, through its features, answers much better the needs to anticipate the future evolution of the society, compared to the forecast. Foresight exercises are offensive compared to the defensive nature of forecast exercises. The foresight exercise specialist is not just a spectator to the evolution of the phenomenon, as in the forecast's case, but is involved in making and implementing decisions. Foresight exercises, although not able to generate accurate projections of the future, will help to correlate the current technologies with the future needs of society.

Key words: *resource consumption, technology, foresight, possibility of anticipating the future*

1. INTRODUCTION

Economy has as an objective the solving of problems regarding the efficient management of resources that are limited in relation to the unlimited needs of society. According to Lionel Robbins (1932)²: *Economy is the science that studies the human behaviour as a relationship between needs and the limited resources having alternative³ uses.*

This definition acquires the value of an axiom and sets, even if at least at conceptual level, the limits of available resources.

In this paper we attempt to conduct an analysis of the way the *resource consumption*⁴ (CR) evolved in time.

From the definition of the Economy, it comes out that mankind's resources are limited. Moreover, a significant percent of the consumed resources is not renewable or very hard to be renewed.

2. OBSERVATIONS CONCERNING THE RESOURCE CONSUMPTION AND THE USED TECHNOLOGIES

As a conclusion, we may say that, at global level, the *cumulated resource consumption* (CRC) has a *lower limit* (LLCRC) and a *upper limit* (ULCRC).

Excepting the extreme situations, when mankind might disappear following the occurrence of an exterior factor, we may consider that mankind's existence, at least in the form we know it now, will be limited to a time interval of the form $[\alpha; \Omega]$, where α corresponds to the moment of the human being's appearance and Ω corresponds to the moment of its disappearance, as a consequence of the depletion of all available resources.

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² Lionel Robbins, (1932), *The essay in the nature and significance of economic Science*, N. Y. University Press

³ *Economics is a science which studies human behavior as a relationship between ends and scarce means which have alternative uses.*

⁴ *By resources we mean all useful resources to meet the needs of society*

In order to analyze the impact that resource consumption and technologies have on the *future anticipation process* it is necessary to identify some *patterns*. Their identification has at its basis the following observations:

1) At the moment α , the LLCRC was almost null. The resources consumed at the time moments which were very close to the moment α represented a very small percent of the available resources. Moreover, due to the lack of advanced technologies, most of the consumed resources were easily renewable.

2) At the moment Ω , the CRC reaches in an asymptotic way the ULCRC.

3) The moment Ω exists is finite, but it is not clearly known and it depends on the knowledge of the ULCRC.

4) If at a certain moment, the ULCRC may be approximately known, with the appearance of some *revolutionary technologies*⁵, new resources may be capitalized, being considered non-eligible in the initial moment and modifying the ULCRC. As a result, we may postulate that in the process of future anticipation, the ULCRC is *finite* and *unknown*⁶. It is *renewable*, as it increases with each occurrence of a new *revolutionary technology* on the market.

5) The occurrence at an exact moment of time of new *revolutionary technologies* is very difficult, if not impossible, to be foreseen. We propose the distribution of *new technologies* in two categories, according to *their possibility to be foreseen* and to *their impact on the ULCRC*⁷:

- **evolutionary technologies** – they are based on old technologies, they use the same functioning principles and they propose an improvement of already existing technologies. These technologies have a *high anticipation degree*. Their effect is to *preserve* the ULCRC and to *lag* the moment when this will be reached.

- **revolutionary technologies** - they are not based on old technologies and propose another type of approach; they rely on new principles, they use alternative resources unexplored yet by the existing technologies. These technologies have a *reduced anticipation degree*. The impact of revolutionary technologies on the LLCRC is significant. The LLCRC *is translated, at superior level*, by the activation of new resources, insufficiently exploited until now.

6) *The transfer*, with the help of IT, of a part of the real needs of mankind in the *virtual space*. Here the used resources have practically become endless. The manner in which the needs in the virtual space will affect the consumption of real resources is indirectly done by means of the development of a request for performing IT components (hardware, software, networks, etc.) which will enable the access to the virtual space at higher standards.

3. STAGES IN THE TECHNOLOGIES' DEVELOPMENT

The literature mentions *three big technological revolutions*⁸ that have changed mankind's destiny: *The Agricultural Revolution*, originating in the Near East (11.000 BC), *The Industrial Revolution*, which occurred first in Great Britain (1750) and *The Cybernetic Revolution*⁹, having its roots in the United States of America (1944).

A major impact on the resource consumption was held by the invention of engines and, simultaneously, the automation and robotization of resource processing.

Therefore, we may ascertain that the industrial revolution had a devastating impact on resources, determining their exponential consumption. The excessive industrialization

⁵ *revolutionary technologies* will be define with more accuracy on diuring this article.

⁶ The same ideaa was presented by T. Kristof, (2006) in *It is possible to make scientific forecasts in social sciences?*, Futures 38 (2006), 561-574, rgarding referring to the ability to predict history of humanity.

⁷ This clasification is in cocncordance with classification of prospective foresight exercisses porposed by Voros, J. (2005). He classifies prospective foresight exercises, in function of their impact on technology, into: *Evolutionary* and *Revolutionary foresight exercises*.

⁸ Eduard Cornish, (2004)- *Futuring – The exploration of the future*, World Future Society, Bethesdam Maryland USA, pp. 14-19

⁹ we can't mention here Ștefan Odobleja, (1938)- *Psychologie consonantiste I, volumul I*, Editura Maloine, Paris, France

correlated with automation and cybernetization of production processes based on *traditional technologies* may lead to the collapse of resources.

When identifying the patterns that describe the evolution in time of the CRC, in relation to the existing resources and technologies, we will take into account *three periods*:

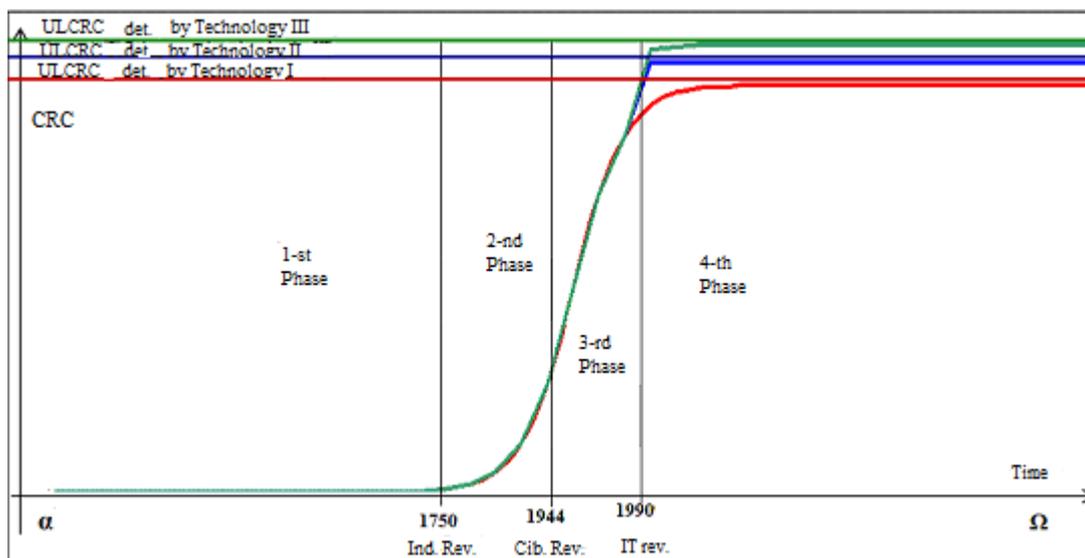
1. **Industrialization** was the turning point in the resource consumption. It was initially based on steam engines and later on the combustion engines. This enabled the passage from the manufacturing processing of resources to the mechanized one and then to the automated one. It is for the first time in history when *the offer exceeded the demand* in a constant manner, case in which the need to introduce a new discipline in the economy, namely the *marketing*, was deeply felt. This was intended to stimulate the demand. If until now the consumer was willing to wait for the purchase of goods, now the producer starts to show his availability to wait for the payment of the estranged good. The new relationship created between the producer and the buyer also facilitated *the development of the banking system* with its main function of *crediting*. The banks opened their doors to the ordinary people, increasing their buying power and thus stimulating the marketplace.

During this period the technology was not performing, the processing return was weak, increasing the resource consumption. The RC slope was high. The result of this situation is a rapid growth of the CRC.

2. **The optimization** of existing technologies, referring to the increase in their return and the automation of the production process based on *innovative technologies* determined *a reduction in the RC slope* in relation to the previous period. During this time, the *virtual space* is opened and there is *the pioneering stage in the IT implementation*. In the first part of this stage the *consumption economy* is spreading so that, ultimately the society becomes aware of *the need to preserve the resources*.

3. **The implementation of new technologies**, the cybernetization of the production process, the miniature of equipments etc, based on *revolutionary innovative technologies*. These determined *the use of alternative resources* and *the migration towards the virtual space*, which represented a real revolution in the CR. During this period, the concept of sustainable economy became popular, having at its basis the conservation of environment and the protection of natural resources.

In brief, we may conclude that the RC evolution during the moments α si Ω was done according to a logistic¹⁰ curve, presented in Figure 1.



Source: Own synthesis

Fig. 1: CRC Evolution

¹⁰ Tessaleno C. Devazas, (2005), *Evolutionary theory of technological Change: State-of-the art and new approaches*, Technological Forecasting & Social Change 72 (2005) 1137-1152.

4. PATTERNS OF THE EVOLUTION OF RESOURCE CONSUMPTION

In *Figure 1*, we may identify four different stages, each with specific characteristics. Each stage will be at the basis of the building of a pattern for the CRC evolution. For each of the four patterns we will try to present which are the difficulties in *future anticipation*¹¹.

The **Ist pattern** corresponds to the RC evolution from the Ist region and is specific to the stage preceding *the industrialization period*.

The population is slightly increasing, due to the passage from the nomad life to the sedentary¹², stable one, based on agricultural crops. The first towns appear and, alongside, the necessary infrastructures. The used technologies are primitive, based on the human or animal power and focus on the increase in the return of agricultural works, on the exploitation of their results and on the insurance of the infrastructure necessary to the good functioning of towns. Both the population's number and the existing technology do not affect the ULCRC. In this period, it can be considered that the resources are endless in relation to the population's needs. The CRC follows an approximately linear trend, with a very low slope. The future foresight for this pattern is accurate for any time horizon and can be conducted relying on some linear models.

This pattern is characterized by environment stability, while the influencing factors can be easily quantified. As we approach the moment of industrialization, the projection errors of the future are higher.

The **IInd pattern** corresponds to the CRC evolution from the IInd stage and it is specific to the *industrialization period*.

This stage is characterized by a period of resource *waste*. It is a period of repeated experiments as regards the creation and implementation of *revolutionary technologies* leading to changes of the ULCRC. During this stage occurs the urbanization phenomenon which leads to the *demographic explosion*. This has a cumulative contribution in the RC increase beside the technologies which are big resource consumers.

The CRC evolution can be described sufficiently accurately by means of a linear trend with a high slope or by an exponential trend, thus passing from a linear approach of the future to a non-linear one. The future anticipation for this kind of pattern is still accurate for medium and long-term periods of time, the environment being stable and therefore, still easy to be foreseen. For the long periods of time, the accurateness decreases in comparison with the previous pattern due to the appearance of *revolutionary technologies*.

As we approach the period of *optimization of existing technologies*, the future projections become less and less accurate.

The **IIIrd pattern** is characterized by the *optimization of technologies* implemented during the previous stages and the opening of virtual space.

In this stage, apart from the factors already mentioned in the previous stages, intended to diminish the accurateness of future anticipation, the opening of virtual space is added, where everything becomes possible. The power to anticipate the future decreases. The need to corroborate the quantitative and qualitative methods might allow the correction of the process of future anticipation. The environment becomes more and more unstable from the point of view of the CR. In the beginning of this stage, the mankind acquires the principles of *market economy* and by its end, the need to implement a new concept is deeply felt, namely that of *environment conservation and resource preservation*. The RC evolution is characterized by a slope decrease. The implementation of innovative technologies is specific to this pattern, which had as a goal the optimization through automation, miniature and technology consumption implemented during the previous stage. Most of the *revolutionary technologies* implemented in this stage are concentrated especially in the IT field and its adjacent areas. It

¹¹ As the *anticipation of the future* will understand any exercise of forecast, foresight, prognosis, prediction, etc.

¹² Eduard Cornish, (2004)- *Futuring – The exploration of the future*, World Future Society, Bethesda Maryland USA, p. 16

becomes very difficult to talk about future anticipation on a long term or even on a medium term. The degree visibility of the future decreases.

The **IVth pattern** is characterized by the continuous implementation of revolutionary technologies, by the closeness to the limit of conventional resources, by the exponential explosion of virtual space and IT, by the attempt to “humanize” the robots¹³, by the development of the bioengineering. The fourth stage is the most unstable and dynamic due to the continuous renegotiation of the ULCRC. In brief, this is the most complex stage and it is characterized by man’s effort to bring to life the matter. To conduct realistic projections of the future, as forecast is considered, is almost impossible. The environment becomes very unstable. The importance of qualitative models in the exercises of future anticipation increases. The linear modelling is not useful anymore and the use of non-linear¹⁴ models is recommended. Even the short-term anticipations are put to question. Due to the advanced technologies correlated with the process of information globalization we are subjected to a firing of information and technologies that society does not have the time to capitalize on and to adjust to (Friedman Th. L (2001), Scholte J. A. (2000)). In this stage it is necessary, more than ever, to prioritize the technological progress. The lack of resources is felt both at material and human level.

If in the Ist and the IInd stage, the *accuracy* of the results of future projections was a priority, in the IIIrd and IVth stage, the main goal is to use *flexible*¹⁵ and environmentally-*adjusted* methods of future anticipation. Thus, it becomes important to foresee in time a break in the RC evolution and to be prepared for it, than to obtain a real, still a lagged value.

During this time, the results of future anticipation are used as rough guide and the assimilation of the new ULCRC in the anticipation process becomes important.

According to the last pattern, the reaction speed of the economic system should be better and better.

We foresee that, in the future, despite the present globalization effort, the *trend of the economic system* will be of component *disintegration* and *autonomy*, which will improve the reaction times and will enable the *integration* and *experimentation of the new technologies* in a much shorter period of time, thus eliminating the crises due to a *rigid, high inertia, structure*.

The present crisis might be the consequence of the existence of a *too rigid* economic system that allows the perpetuation of the crisis impact in all its components.

In an articulated system made up of autonomous parts, the crisis propagation would have reduced the reaction times of the system and would have eased its revival. The trial and error *learning* is essential for the present systems and represents their self-adjustment capacity.

5. CONCLUSION

Without having the pretension to be a panacea for all the problems the future unveils to us, the foresight exercises prepare mankind for the contact with the future, offering one or several potential variants of the future, chosen from a variety of desirable future variations.

The foresight rather represents a definition, selection and implementation process of a possible *desirable future* than its *estimative method*¹⁶.

The foresight has a participative side, and more and more often, a collaborative one.

¹³ Lev Grossman, 2045: *The Year Man Becomes Immortal*, Time, febr (2011), <http://www.time.com/time/magazine/article/0,9171,2048299,00.html>, vizualizat pe 23 februarie 2011

¹⁴ Theodore J. Gordon, Jerme C. Glenn, Ana Jakil, *Frontiers of future research*, *Tecnological Forecasting & Social Change* 72 (2005), 1064-1069

¹⁵ *Flexibility seen as the speed of adaptation methods to anticipate future environmental change, both in terms of outcome and process of their implementation.*

¹⁶ Kerstin Cuhls, (2003), *From Forecasting to Foresight Process-New Participative Foresight Activities in Germany*, *Journal of Forecasting*, 22, 93-111 (2003)

In the foresight exercises the participant is not only the spectator of the phenomenon evolution, as in the case of forecasts, he is also involved in the making and implementing the decisions even if, in most cases, these are only virtual. The major effect on the participants and beneficiaries of the foresight exercises is a psychological one. In their subconscious, subroutines are written, which make them act far more efficiently in real situations similar with those met during the foresight exercises¹⁷.

As a disadvantage of the foresight exercises we should mention that they do not aim to foresee exactly the future projections, but rather to explore, to model and favour the desirable and possible variants of future with a favourable effect on the society (Martin B. R., 1995).

The foresight exercises, even if not having the capacity to generate accurate projections of the future, will help in *correlating the present technologies with the future needs of the society*.

As the shark condemned all his life to move in order to live, mankind is condemned to perpetually make a foresight exercise in order to be able to renegotiate its ULCRC, and therefore, to be able to extend its life.

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