Aspects of the social and economic evolution of the globalized society

Dan Constantinescu

University POLITEHNICA of Bucharest, Faculty: Material's Science and Engineering, Department Materials Processing and Eco-metallurgy, Bucharest, Romania.
Corresponding author: D. Constantinescu, danco@ines.ro

Abstract: The present paper analyses a global social-economic dynamic model regarding the momentum of the technical economic development. The evolution of the natural resources used for the industries and the agriculture strongly influences the globalized society. In the same time, the evolution of the population as number of individuals as well as the life quality, determinate many aspects of society. The article refers to a possible model of the "global society", considering zones at different level of development. It is also necessary to consider the aspects of the "ecological footprint". Analysing this aspects, a structure of a model can be proposed. A parameterization of the model is also possible. The conclusions in the present article are obtained from the analysis of the technical and economical evolution, as well as the evolution of the environment.
Key Words: model, technical development, economical development, environment, ecological footprint.

Introduction. Although many technical developments had been made already in the 18th and 19th century, like steam engine 1782, railway 1835, motor car 1862, electric motor 1866, the industrial large-scale production did emerge just a few generations ago. In the second half of the 20th century automation in the area of process and production industries caused a significant improvement of the working conditions and also contributes to raising standard of living in the industrialized countries (Welfonder & Frederking 2002). During the last two decades broad use of information technology has also led to the automation of office- and engineering-operations (Leisinger et al 2002).

Modern communication and traffic technology caused the globalization of business transactions during the last decade (Welfonder & Frederking 2002). However, the always faster development and spread of the industrial production combined with the worldwide use of industrial products causes an extensive use of the worldwide remaining raw material and energy resources as well as a steadily increasing environmental pollution (Constantinescu 2015).

Therefore the question concerning a reasonable and *sustainable further* development of the industrial society is important for the engineers, too. For this purpose holistic (www.dexonline.ro) and long-term considerations of the industrial, environmental, and population future trends are required. It is necessary to update the set goals. It is quite better than to have no targets.

Besides the magnitude of verbal contributions and simulation studies already carried out to this thematic, there is the concrete question for Control-Engineers and for the Environmental-Engineers, whether they could specifically contribute to the solution of this interdisciplinary subject. Just Control-Engineers are able to analyze the momentum of complex technical processes and they are also able to control processes being structure or event-instable by implementing proper stabilization and limiting control-concepts. Following this basic idea, a supranational social-economic dynamic model has been developed allowing qualitative analytical investigations as well as quantitative simulation studies (Welfonder & Frederking 2002).

Structural and functionality of the model. The holistic model is structured hierarchically and divided into different supranational economic/population like "Romania" and "European Union" for example (Figure 1).

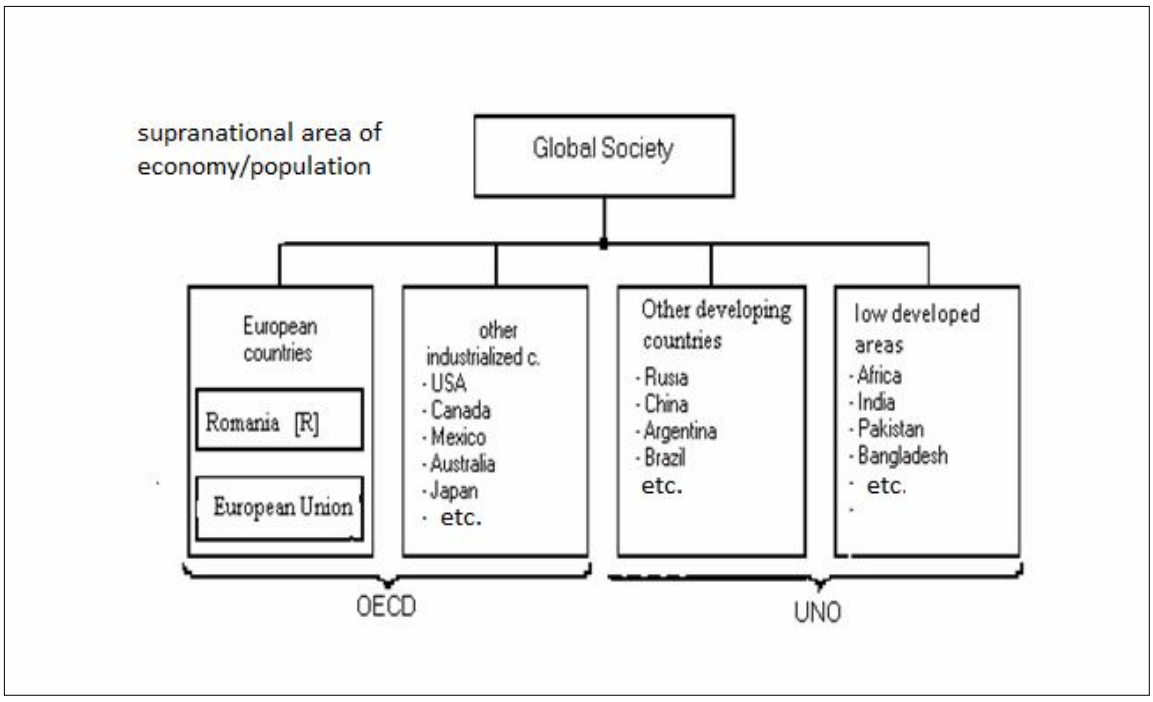

Figure 1. Overview about the global model (after Welfonder & Frederking (2002)).

Every supranational/national area of the model is subdivided following national economical criteria, into the sectors "Households", "Enterprises", "Banks/Insurances", and "Public Authority/Government". All these sectors are strongly interconnected (Statistical Yearbook, New York 2017).

Balancing and parameterization of the model. Realistic data specifications for the input (C_{in}) and output (C_{out}) variables as well as for the internal variables of the model are determined using time dependent data series from statistical yearbooks.

The calculations are designed in such a way, that not only the internal balances of each sector (C_{yield}) model are coherent, like:

$$C_{yield} = \sum C_{in} - \sum C_{out} \quad (1)$$

but also the couple balances between the different sector-models, e.g. concerning the labor income (Welfonder & Frederking 2002).

The same idea is applied to import and export flows between different supranational/national model areas (Eurostat 2018).

To make the data consistent, regression curves must be calculated, using the least square method, depending on the period, but not less than two periods. Afterwards the two regression curves must be fit together by corresponding adjustment. Comparing the regression curves of the single variables the related model parameters can be identified, too. For this it is possible to use the "square method".

Analyzing the momentum of technical and economical evolution. The momentum of the technical/economical evolution is caused by strong positive feedbacks inside of the whole system. These positive feedbacks are partly based on technical reasons and partly on business and national economic reasons.

The momentum caused by technology must be investigated by means of the increasing rationalization in the sector "Enterprises". All multi-faceted influencing factors of rationalization are summarizing - in the sense of a global consideration - by the mechanization and automation degree separately for production as well as for services (for example $\eta_{mech/aut}$).

Qualitative considerations. Most of the profit yield, C_{yield} (equation 1), is reinvested in new manufacturing and office buildings and especially in more effective industrial equipment. The resulting increase of the automation degree η, leads to an increasing order flow of production, "O" (Figure 2 and Figure 3) and therefore to an increasing gross income C_{gross}.

It results a *positive feedback loop* (Figure 2). On the other hand, the increasing automation degree "η" leads to a reduced workforce, "W" (Figure 2) and to a reduction of the compensation of employees $C_{w,s}$. This gives also a *positive feedback loop*. Both positive feedbacks result in climbing profits in spite of increasing capital expenditures to improve η.

To this it is necessary to add some border conditions (Figure 2 and Figure 3):

- border condition 1: Workforce W * = constant, O *~η
- border condition 2: Production output O * = constant, W * ~1/η
- realistic case 3: $O^* \sim \sqrt{\eta}$; $W^* \sim \frac{1}{\sqrt{\eta}}$ (Welfonder & Frederking 2002)

Which of the two feedback loops ("production increase", prod O* or "workforce decrease" W*, will be more influenced by the automation degree η depends on the market demand as well as on the tax burden and wages.

The automation degree η has increased with time and it continues to grow. The production output increases linearly whereas the total annual working hours decrease reciprocally to time. The real system behavior is determined by time series published in the statistical year books and after-wards approximated by regression curves.

Figure 2 and Figure 3 show the increase of the production-automation degree η concerning the sector "production" within the sector "Enterprises" (Welfonder & Frederking 2002).

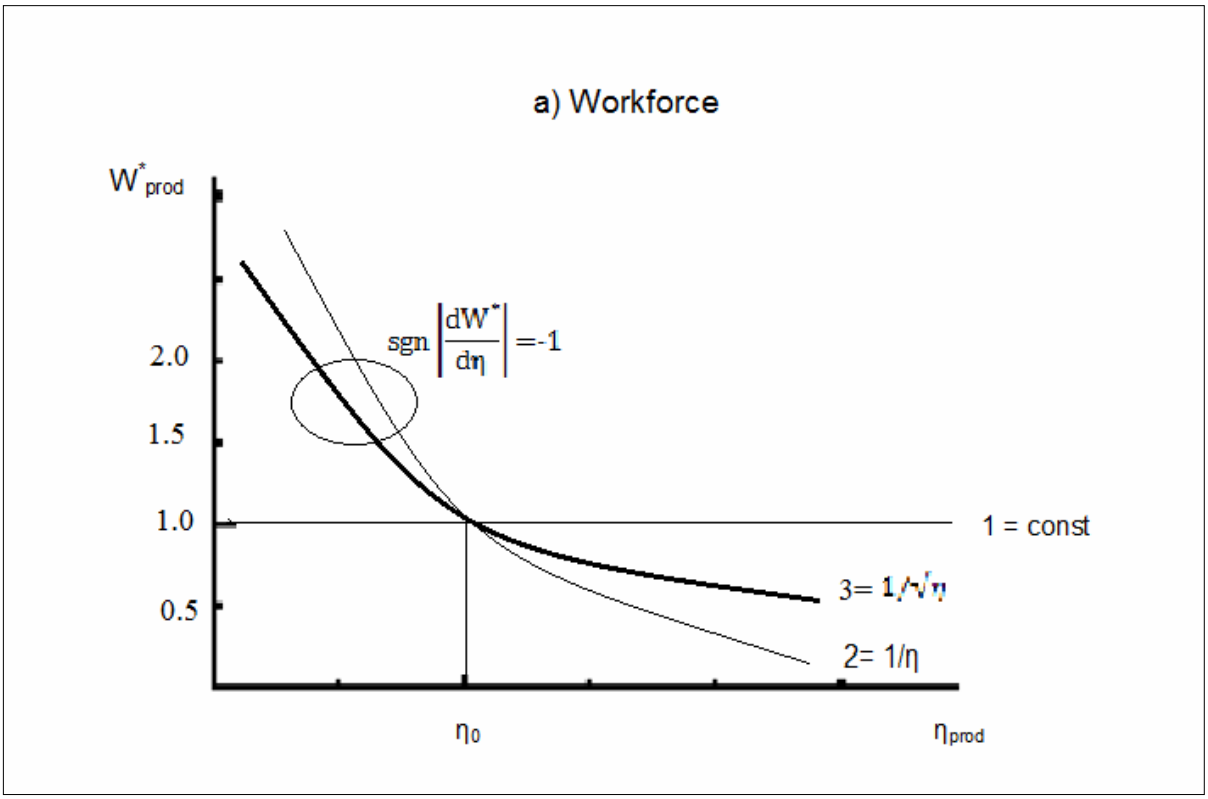

Figure 2. Production-automation degree correlation when analyzing workforce.

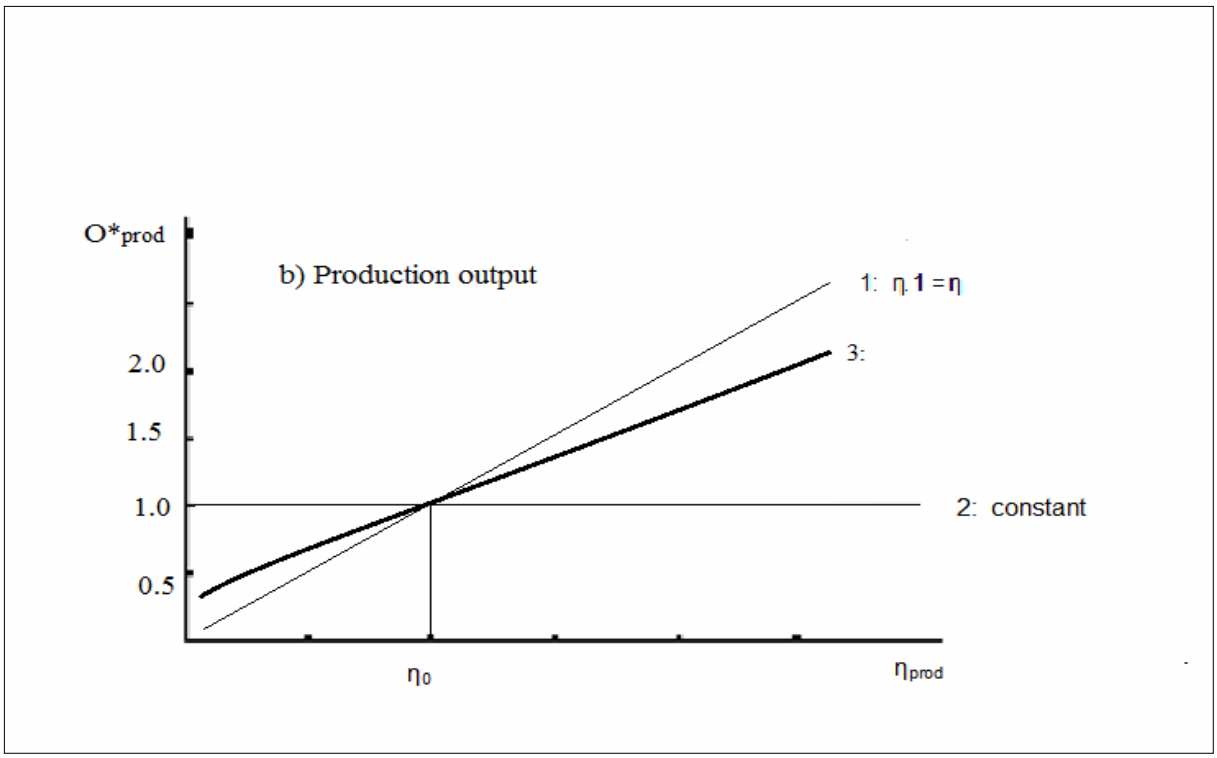

Figure 3. Production-automation degree correlation when analyzing production output

(3: $\sqrt{\eta \cdot \frac{1}{\sqrt{\eta}}} = \sqrt{\eta}$).

Positive feedback loop in the global society. The interest to be paid or received for credits represents a further positive feedback loop in a global society. The ever increasing poverty of poor households/nations and the ever increasing wealth of rich households/nations can be considerate a specific aspect of the society (Brown et al 1988). This widely known social effect accounts mainly for the big gap between the developing and underdeveloped countries and is also responsible for the fact, that developing countries are not able to pay back their debits.

Some solutions are possible? Due to general competitive struggle the companies have nearly no stability insuring possibilities to lessen the momentum of the technical / economic development. Only social contributions and the option of donations are certain ones to overtake social responsibility. Also the governments have only limited possibilities to reduce the momentum taking financial measures. These are mainly the collection of taxes as well as of social contributions. Therein the governments have the task to redistribute the social contributions and part of the tax receipts with regard to social needs. To such social outlays there are also belonging subventions to the developing less developed countries in form of developing aid as well as by lengthening or canceling of credits.

However, the finally decisive and effective possibilities for lessening the momentum of the technical economic development are of global nature. Figure 2 shows the increase of the production-automation degree η at concerning the part sector "production" (each time area "manufacturing"), within the sector "Enterprises" in developed countries (between 1980 and 1999).

A global point of view. Some studies (Welfonder & Frederking 2002) show that only 1/6 of the world's population earns 4/5 of the worlds gross domestic product. These numbers are equal to a difference in standard of living of 16:1 between the industrialized countries and the developing/ underdeveloped countries.

From some points of view concerning a “reasonable further development of the global society”, two additional factors with also integral or in the long-term even exponential behavior have to be taken into consideration. The two points of view are:

- the increasing cutback of resources and the increasing environmental pollution;
- the increase of population as a consequence of economical poverty of less developed countries;
- the increase of population as a consequence of economical poverty of the less developed countries.

Both influences have strongly increased since 1950, since the beginning of the industrial process automation (Brown 2004).

Is it possible to solve the problem? To solve the problem of a fast growing population (at this moment, the global population is 7,684,169,000) (http://www.poodwaddle), or at least to weaken this fact an intensive encouragement and further evolution of the developing and low developed countries (Figure 1) is urgently necessary. Then based on past experience (Pinstrup-Andersen & Cohen 1999; Leisinger et al 2002) a voluntary reduction of birthrates only seems to be possible with the people’s hope in mind to have a realistic chance to escape from the persistent poverty and dreaming to achieve better education and more economic wealth.

In the poor countries a change in parents mind is needed as well:

- from their old fashioned naturalistic supply statement: “The more children we have the less difficult our old age feed and lodging supply should be.”;
- to the more modern monetary supply statement: “As the children’s supply costs money, the less children parents have as more money they can spare for their own old age support.” The required increase of subsidies, which will be the precondition for such a change in mind, can easily be paid by the industrialized countries, when regarding the following global statement (Brown 1996).

The conflict between poor and rich countries can’t be solved by weapons, at least not in the mid-term. Therefore one concrete proposal is that the industrialized countries should reduce their military production from at present 2% (Welfonder & Frederking 2002) of the global gross domestic product as far as possible and should increase their subsidies correspondingly from at present 0.2%. Further on they should stop to transfer older weapons to the poor countries – up to now partly masked as subsidies.

Therein it has to be regarded, that such a hopeful development – if at all possible – will only have a long-term effect, as to be seen by the simplified population model (Brown 1998; Constantinescu & Caraba 2004). Further on, an increase of the production and output by the up to now poor countries without qualified redistributive measures will lead to a dramatic increase of resources consumption and environmental pollution.

Therefore well directed ecological support is necessary to control the acting influence. To reach this goal, a better consciousness by the population, by the managers as well as by the politicians is necessary including the limited results of the world climate conferences. Such an urgently required understanding is only achievable by holistic thinking having in mind the developing of a model that may solve this problem. The cost of the environmental protection measures, which could e.g. be coordinated by the United Nations Organization (UNO), should mainly be covered at present and in the near future by the industrialized countries for they have mainly caused the already existing environmental problems.

With the ongoing development the previously poor countries should also participate in the worldwide costs for environmental measures.

The role of the industrialized countries. Under such circumstances enterprises within the industrialized countries would have to transfer a fraction of their investments intended for production improvements to environmental protection measures. In the same way the enterprises and private households should pay high rates when exhausting non-renewable resources further on. The resulting income of rates can be used for a higher portion of regenerative energy production as well as for an improvement and a wider application of material recycling measures. As a consequence of this, the

investment and production expense for both measures concerning the environmental and resource protection would result in a reduction of the further increase of the automation degree and therefore also lessen the momentum of the technical and economical development.

Quantitative considerations are also necessary. The previously discussed interactions are to be reproduced and refined quantitatively. For this, using a sensitivity analysis, possible actions should be examined. Thus, for example (Brown 2004; Lovelook 2006):

- effects of government control actions like tighten the environmental restrictions, reducing expenses for the armed forces, etc.;
- changing of goals by negotiations between employer and trade union with regard to salary, working time and employees;
- attitude change of the people's behavior concerning birthrates.

Conclusions. When we travel in different zones of the planet, we may often discover a lot of aspects which may change our initial opinions and pre-established points of view. In many cases, one has to put a lot of effort in order to differentiate between traditions, scientific knowledge and reality. The reciprocal impact of a geographical site, with a bordering environment, as well as the human industrial activities, is certainly a very remarkable one.

It is necessary to take into account a lot of global evolutions, if we want to understand the reality and to grasp our eco-cultural evolution, our environment and probably our daily life.

In this case, a sustainable social economic evolution of the globalized society will only be possible by global analysis, global thinking and corresponding measures, priory to be activated globally, by an international organization. However, the measures should not only be supported regionally by the highly developed nations but by the great majority of all nations.

We can appreciate that, the ecological mark, together with the evolution of the automation came to be considered as the most modern solution of analysis and that it enjoyed, despite the disputes it created, an intense publicity and great approval. The ecological mark of the population evolution can be defined in a few terms as the terrestrial and water surface productive from the biological point of view, which is necessary for the production of resources meant for consumption and assimilation of the waste produced by this population, regardless of the localization of the respective surface. In order to achieve this goal, a general change of views towards the world-wide existing social economic and ecological problems is necessary, taking particularly into account the further development of the information and automation technologies as the main motors of progress.

There are also obvious and important correlations which can be established between the values of the ecological mark, the biodiversity and the information activity. As the human ecological mark increases, biodiversity decreases. In the same time, also the engineers have to broaden their thinking, from the hitherto well known views, like functionality, efficiency and profitability, to a globalized view, regarding additionally the world sociability.

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Author:
Dan Constantinescu, University Politehnica of Bucharest, Faculty of Materials Science and Engineering, Splaiul Independenţei 313, Bucharest, Romania, e-mail: danco@ines.ro

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