

PROGRESS AND SUSTAINABLE DEVELOPMENT

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Abstract

The progressive nature of scientific research is probably the most impressive example that can be given for the term "progress". With a much larger opening, going to social, we can say that there is the belief by which subsequent ages are improvements of the previous ones.

From a strictly logical point of view of progress, it can be both good and bad. But usually when we talk about the progress of civilization, human nature, we refer to good progress: increasing knowledge in all areas, increasing political freedoms, technological development and economic prosperity - towards the general welfare achievement.

Innovation creates a process of creative destruction. It results that any technical progress passes through the disappearance of old processes and replacing them with new ones. The new capacity must be built, a process that takes time and especially the preliminary phase of the new technology entering in production is not exempt from difficulties. Recognizing this essential aspect of technological evolution requires another representation of the technical progress and also of the production.

Key words: progress, research and development, creative destruction, competition, sustainable development.

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Introduction

If until 300 years ago, the word "progress" in relation to technic, science and society did not exist, beginning with the twentieth century it became a real emblem. In Encyclopedia of Diderot and d'Alembert published between 1751-1772, progress was used only in cosmology (the progress of the Sun on the ecliptic) pedagogy (to make progress in a discipline) and music (the wrong progress of the notes).

Condorcet, 1780, defined progress as being the development of the order, but the biological order, an order defining human nature and on which the new political order could be establish. The biological metaphor, paved the way for the word "evolution" imposed here by Herbert Spencer, 1870. From now on we can talk about Progress (with capital letter), being then converted to "scientific progress, technical progress, social progress, moral progress" etc.

The progressive nature of scientific research is probably the most impressive example that can be given for the term of progress. With a much larger opening, going to social, we can say that there is faith by which subsequent ages are improvements of the previous ones. But these improvements may cover only limited aspects, such as the degree of spread of scientific knowledge or moral aptitudes of human beings, according to the Oxford Dictionary of Philosophy, 1999.

From a strictly logical point of view of progress, it can be both good and bad. But usually when we talk about the progress of civilization, human nature, we refer to good progress: increasing knowledge in all areas, increasing political freedoms, technological development and economic prosperity - towards the general welfare achievement.

Auguste Comte, recognizing the full value of "industrial and technological evolution", considered that the main object of human advancement lies in "continuous

amelioration of our own natures, whose outstanding attributes are: intelligence, spirituality and sociability".

Analysis of Technical Progress

Technical progress - is approached from different and complementary perspectives in economic analysis, as taking into account the conditions of access and the effects they cause, or achieving conditions.

The economic analysis of technical progress is usually made with the help of instruments related to the analysis in terms of balance. Analysis consists in the determination on the long-term effects made by the use of new products or new production methods, upon the performance of the economy, but without providing the means to explore the development of the innovation process itself.

Technical progress is measured by the productivity increases, by the fact that starting from the same general factors, it is possible to produce a larger quantity of goods. On the other hand, technical progress may also cause the relative decrease in the price of new goods, or increasing their quality, in all cases leading to increased profit on one hand and benefits to the consumers, on the other hand. All these lead to economic performance.

In all these representations, technical progress has certain properties. First, it is instantaneous, not resulting from any learning process that would have been carried out in time. Once introduced a new technology, it is immediately and fully mastered. (Fritjof Capra, 2004)

The access to technical progress is a matter of incitements. A new technology will be chosen because it is superior in terms of a given criteria of performance: efficiency, saving energy and raw materials, unit cost, productivity per employee etc.

From this perspective, productive resources (raw materials, fuels etc.) have a generic aspect. They exist and are defined independently of the production processes in which they are used, and regardless of the chosen production techniques. For this reason, they are freely available for various uses, the only obstacles consisting in the existence of regulations that hinder their mobility, therefore barriers to free competition.

Technological Progress, the Result of Research

In the spirit of this analysis method, the activity of research and development (R & D) is designed like any other production activity model, focusing on how its results are used.

The research and development activity determines the appearance of new techniques, technologies and new products, in a very precise sense: the more concerns for R & D are more consistent, the more unit costs associated with the new techniques will be higher, but shorter term to the appearance on the market of the new products.

Consequently, technological progress, including the economic effects resulted, is based on incitements to Research and Development, incitements which depend on the conditions of ownership of research results, but also on the competition conditions.

Standard understanding of technical progress seems to favor the innovation of process, at the expense of the innovation of product, inclusively of new intermediate products. Such a view can be operated in a context of systematic growth of the company or of the economy, when the research and development activity (invention, technological innovation) and the production activity are well coordinated, and required resources are always available.

The method allows to identify properties of some trajectories of development and technological advancement, taking into consideration their nature and the functioning of markets. (Mihai Mihăiță, 2011)

Evolutionary Analysis

Innovation creates a process of creative destruction (Joseph Schumpeter). It results that any technical progress passes through the disappearance of old processes and replacing them with new ones. The new capacity must be built, a process that takes time and especially the preliminary phase of the new technology entering in production is not exempt from difficulties. Recognizing this essential aspect of technological evolution requires another representation of the technical progress and also of the production.

The specific contribution of the evolutionary analysis of technical progress, lies in the observation that in the economic sphere, new technologies do not appear fully formed and mastered, but in a form that will evolve over time depending on the constraints and incitements determined by the own development of the company that, relying on research – is trying to win the competition on the market.

Innovation is no longer reduced to the adoption of new technologies, innovation being the process by which technology is developed step by step, starting from an initial impulse (as response to specific economic and technical issues), impulse with which production company structures acquire new characteristics more performant.

Not all conceivable developments are possible, on one hand due to various constraints, but also due to the opportunities that occur during the process of innovation. Therefore, technical progress is in the same time both cumulative and localized - specific to each company.

Thus, if a technique "A" is preferred to technique "B" at moment "t", then future development will be operated beginning from the chosen technique (A). From that moment, the way of development being chosen, it is totally inefficient to return and choose the other technology (B) even if the new conditions of the economic environment would prevail its choice.

The experience accumulated in a particular direction, with all the employed resources, makes impossible such a return. This way it results that technological opportunities, are local in a great part, specific to the management of each company.

New explorations are always made close to what already exists. Therefore it has to do with the nature of the previously accumulated competences and which delineates the field of possible actions. Therefore, often "revolutionary ideas" are not understood, far exceeding their time. They are not understood by contemporaries.

On the other hand, technological opportunities of each type of activity are influenced by what can be extracted from the technological knowledge of the related activities (suppliers and customers), which further strengthens their local character.

The local dimension specific of the technological changes, has several consequences. First, technological knowledge have a largely tacit character, making this way, the object of a full ownership without always necessary to resort to legal projections.

The essential reference to technology and its development along a certain path creates the impression of a kind of technological determinism, which is reflected especially by the existence of restrictions on the last portion of his development.

Such a view of technical progress, leads to taking into consideration in the development of production, together with technologies evolution, and the organizational forms, management decisions contributing to define the boundaries of technologies development.

Economic analysis puts to the fore a question of viability in choosing new technologies, sending the core analysis of technical progress, as initiated by Adam Smith himself - the father of modern economics. In this analysis, technical progress is equated to wealth creation, which comes in turn from the successful articulation of the division of labor (the default increases productivity) and expanding markets.

Competition, Key Factor of Technological Progress

George J. Stigler, holder of the Nobel Prize in Economics - 1982, said: "Free competition is the situation on the market which provides the greatest possible satisfaction to the consumers, because in fact, the products of the bidders are addressed to them. Exceptions are pollution taxes and restrictions - which are set by the state "... arguing that large monopolistic companies, should be removed from the market by competition, because the fixed costs of production that remain too high, companies that endures thanks to "the principle of monopolistic survival". In other words, it is vital for the interests of these large monopolistic companies to maintain high barriers at the entrance on the market of new competitors, to prevent other new competitors to settle on that market.

As regards state intervention, it is very costly, by awarding compensation for consumers (in case of inflated prices), also being costly for firms that use these products as inputs to production.

The protection of certain industry, or of a company through state subsidies, generally leads to lower competitiveness, decrease accompanied (paradoxically) by increasing in time of the prices of realized goods.

Industries where technological progress is significant, are almost always market structures with competition (imperfect - oligopoly), competitive market dominated by a few large companies, these financing powerful research and development sectors.

Most often, *competition* comes as efforts to create new better products and new ways to find more productive modalities and less expensive to produce goods already in production.

Performance, namely *competitiveness* - represents the ratio between the quality and the price of the products. Competitive market eliminates the poor quality products or the ones priced unreasonably high, the presence of competition being as shown before, favorable to the consumer.

World-class companies allocate substantial sums for Research and Development: (R consisting in looking for new ideas, products and performant processes, and D consisting in improving the existing products or making other products more and more competitive), this way innovative firms succeed to maintain themselves on the competitive market or, even to impose as leaders on this market, investments in R & D being an essential element, profitable. (Eugen Remeș, 2011)

Competition and *technological progress* (result of the R & D activity) have the following features which makes them operable in tandem:

- Industries in which technological progresses are extremely fast, usually face high fixed costs, determined precisely by the R & D costs (see example of pharmaceutical industry and the automobile industry, where new products are more expensive), this being another feature which determines the limitation of competition, not all making towards high research costs,

- In order to cover the cost of R & D and thus to stimulate innovation, inventions are protected from competition (competitors from the market), through patents and licensing system, licenses role is precisely to limit competition,

- Thirdly, industries characterized by rapid technological progress, are also those where the benefits obtained as a result of increasing experience in the use of new production technologies, leading to costs which then decline rapidly.

All those shown, by relatively high amounts needed for R & D performant activity, through the protection system of inventions and of new technologies etc. restrict the entrance of new firms on the market, thereby reducing competition - thus large companies protecting efficiently their performance, implicit their dominant position on the market.

"Progress" in Terms of Monopoly and Oligopoly

Competition - motivates firms in the development process of new products and new technologies, less expensive in the production of goods.

Conversely, a *monopoly*, without competition can afford to make excessive profits without innovate, by selling paradoxically, low quality products at high prices.

It is well known the concern of the companies with monopoly power, to seek to stifle innovations of the rivals that could reduce their market share. In conditions of limited competition (*oligopoly*) companies spend significant resources, as shown, to reduce or eliminate competition, recovering then by raising the prices.

Such expenses may increase profits of these companies, but unfortunately waste other resources that could be used to increase product performance and consumer welfare. In an imperfect competition (monopoly or oligopoly) firms are often tempted to increase the quantity of goods produced to stifle competition, and these companies can achieve the competitive advantage, not by lowering their costs but increasing the opponent's costs (for example by seizing all suppliers of utilities, or distribution facilities etc.). (Mihaela Steț - 2011)

Another way for companies to keep their monopoly position is by bribing influential people in Government decisions and politicians who maintain restrictions regarding competition. But, all these activities have as a result a social loss!

Finally, we can say that in the absence of competition, it is difficult to judge whether managers are efficient or not.

Opinion about Engineers and Economists

The Engineer – is the founder / creator of tools, technical and technological equipment and the handler of all these, in order to achieve the goods necessary to people, his genius making possible technical progress having at basis the progresses in science domain.

The Economist - gives the overall vision for economic development, through specific knowledge in the areas of production and marketing, seeking efficiency criteria - in fact, profit maximization under competition conditions.

The connection "economist-engineer" is essential in improving the technical and economic performance for the benefit of society, its progress and achieving the ideal of general welfare. Research, aimed mainly at the optimization of resource use by more efficient technologies, promoting economic models (and them) more efficient, the result being increasing labor productivity and competitiveness of firms, under the new requirements defined by the sustainable development process, in which the criteria for economic performance began to be eclipsed by the stringency of regulations imposed by the need to protect the natural environment - for future generations.

Engineering scientific research, along with that of the exact sciences, aimed at improving working tools and equipment as well as the investigation, addressing both their form and function, as well as the intimacy of the structure, chemical and electrical processes in atomic and molecular level, lately research moving more in the privacy of life structures, by amazing genetic engineering achievements.

Economic scientific research, mainly aims to find new economical models to enhance organizational efficiency, study consumer behavior, and firms on the competitive market and the state's role in this area, the effects of economic factors on innovation activity tendency etc.

Sustainable Development in the Context of Economic Development

Environmentalists, and not only them, cannot agree with the actual development, an economy of waste. How much could man evolve in the optical deformation about

this world, it can be "seen" very well out of the most contentious contradiction of contemporary society, namely: the environment is part of the economy or the economy is part of the environment?

Economists - see the environment as a subsystem of the economy.

Environmentalists, on the contrary - see the economy as a subsystem of the environment.

The way the two sides of the ones who fight for the progress of society (those who produce and those who are watching more closely at Planet Health) and watch the current economic development, is shown in Table 1. (Mihai Berca - 2003)

Table 1. Development in the vision of the engineers and the economists, respectively of the environmentalists

Economists and Engineers	Environmentalists
- note that the global economy has increased 7 times since 1950, and the global income increased from 6000 to over 50,000 billion \$	- note that this increase is "combustion product" of huge amounts of fossil fuel available at very competitive prices
- note prices still low in grains, fruits etc. and food sources is not yet a major problem of the near future. In developed countries obesity is a health problem	- observe water levels, which are declining in key-countries producing food, more than 1 billion people now being fed with grain produced by "forced" consumption of exhausted groundwater
- consider the market globalized as a guide (approvingly) of decisions of constant development of economy, this being the current view in the domain	- observe a market that does not tell the truth. Example: not included in the price of fuel the healthcare costs for treating respiratory diseases caused by air pollution etc.

An economy tolerable for the natural environment: *eco-economy*, requires the establishment of the formulation of economic policy based on the principles of ecology. Eco-economy involves constructive collaboration of the engineers, economists and environmentalists. For now, they do not see contemporary society from the same perspective!

The welfare and the development of this society will be guaranteed only if the economy will be structured on a more efficient exploitation of natural resources in harmony with nature.

The trend should move towards an economy based on renewable energy sources, the use of raw materials available everywhere, on the constant recycling of materials harder to find, and better management of food resources, technologies aimed at reducing consumption of raw materials and energy, from which to derive minimal amount of waste "that does not affect" as much as possible environmental quality. (Lester Brown - 2002)

But above all, *sustainable development* must be understood in all its dimensions: human, economic, technological and environmental.

There are no total "clean" technologies, but only less polluting, fuels use, the need of chemicalization of agriculture, producing various synthetic products etc. as large as our desire would be, will cause further pollution in all its forms and so, further damage to the environment.

It is not possible the total renunciation to chemical fertilizers and pesticides, given the growing demand for food for a population of the planet, more than 7 billion

and higher productions cannot be achieved without these pollutant "ingredients". Moreover, it is well known the alternative of the development: acceptance of a lesser or higher degree - depending on the situation – of pollution and therefore, discomfort.

Although our choice should be very simple and clear, yet no one gives the importance that the environment should have, as an essential support of our life. (Joseph Stiglitz, 2005)

Environmental policy, covers generally the following objectives:

- Environmental protection,
- Improving the quality of the natural environment and therefore living conditions,
- Rational use of natural resources, eliminating waste,
- Promoting international environmental protection standards.

The adoption of sustainable development policies, impose a special role of the state.

The nature, the scale and the foreseeable consequences of the measures arising from the sustainable development policies, cause a significant involvement of the state, but not in the dictatorial sense, but as a regulating factor. (Viorel POP, 2009)

Some ways in which the state must exercise these tasks are:

- The restoration of relations between the main activities of the national economy: industry, agriculture, construction, transport etc.,
- The need to coordinate efforts to avoid waste,
- Environmental education aiming to respect the natural environment, improving the environment quality and avoiding waste.

Environmental Education

Environmental education has become one of the strategies for sustainable development that enjoys wide recognition. It is incorporated as a separate chapter in the "Agenda 21" and enjoys increasing attention from policy makers at local, national and international level.

Environmental education is defined as being the process by which values are recognized and concepts are clarified, to be able to develop skills and attitudes necessary to understand the relationship between: man – the culture to which he belongs - and biophysical environment.

Environmental education also includes practicing decision-making and the formulation of an own conduct code for ensuring proper environmental quality with encouraging initiative, sense of responsibility and dedication of all for building a better future.

The objectives of environmental education can, therefore, be described in terms of:

- To expand awareness of environmental issues
 - Formation of a knowledge base, developing skills and attitudes taking,
- and - the active participation of community members in identifying and solving problems.

Environmental education must take into account the environment as a whole, education being a continuous process that occurs both in school halls and outside.

Moreover, education, information and communication, are given priority in achieving community participation in improving environmental conditions, which is one of the fundamental requirements of *sustainable development*. (Viorel POP, 2002)

In schools and universities, environmental education is achieved in particular through curricular activities, including actions on the field. Curricular activities, aim at improving knowledge of the environment. Curriculum is now more well-structured in terms of timing activities, the personnel involved and objectives.

Environmental actions, whether they take place within the educational institution or outside, can provide ways to relate the environmental knowledge with a particular system, very often this being the educational institution, or the life support system in general.

If until 1990, in Romania there were no Specializations referring to "Environment" and "Sustainable Development", today we have in academic specializations nomenclature over 15 specializations, including:

- Environmental science,
- Environmental engineering,
- Environmental economics,
- Ecological restoration,
- Management of rural sustainable development,
- Engineering and environmental protection in agriculture,
- Engineering and environmental protection in industry
- Renewable energy systems engineering,
- Biotechnical and environmental systems engineering etc.

Environment - is becoming more and more integrated into our education at all levels, becoming a component of training. Environment is part of the curriculum of all forms of education, to form the environmental education of pupils, pursuing the respect for the natural environment, improving its quality and avoiding waste of any kind.

Progresses to be made relates to the practice of "green economy" involving both producers and consumers, progresses being primarily in the potential area of Eco technologies, highlighting the role of natural resources and environmental management in general, in terms of economic performance, especially in a change policy and industrial development with a strong dimension of environmental protection.

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