

**Information and Communication Technology in economy:
From Diminishing to Accelerating returns.**

Pedro Hernández Pena
phernape7@uoc.edu

Abstract

The well known "law" of diminishing returns introduced in the 19th. Century has been put in troubles in the present digital age where the fact of producing one or a thousand products containing the same software is almost constant and the revenues increase exponentially. Anyhow, some economic facts keep the theory in the papers, at least till now.

The law of Diminishing Returns was introduced in the 19th. Century by Ricardo, Thünen and Malthus as a result of the worries on the fact that the land was a factor of production in limited supply. In order to increase output from agriculture, farmers would have to farm less fertile land with more intensive production methods and both things meant less returns from the same work and costs. As an example consider the extraction of a mineral, let it be gas. The first ton has an associated cost of extraction of 1€ in a determined gas field. If we now want to extract another ton of gas the cost of extraction will be a bit greater, let it be 1.5€, because we will have to pump from a deeper position or because the gas will be not as pure and will be mixed with other components of the deposit and must therefore be separated. So, the marginal cost of the supplementary ton of gas is 1.5€. If the extraction of gas in the field is continued, this marginal cost will grow steadily, giving the commented law.

From the economic point of view this law considers that all the other factors of production remain constant and so, only one of them is analysed. We can consider the case of economies of scale, i.e. the main set of factors are increased, and the result are very different: a decreasing of the average cost of production can be seen. This is the case of the industrial age, where the build of great factories, mills, and specialization of work was intended to follow these economies of scale that provided the reductions of costs. In the late industrial age some improvements to these economies of scale are introduced giving place to flexible production and the reduction of stocks and superfluous.

In the knowledge economy things appear a bit different. Romer uses a metaphor to show up the difference. He says "The paper that makes up the cup in the coffee shop is a thing. The insight that you could design small, medium, and large cups so that they all use the same size lid -- that's an idea. The critical difference is that only one person can use a given amount of paper. Ideas can be used by many people at the same time." The fact is that ideas, i.e. Knowledge and information can be used by a lot of people at the same time and the distribution costs of ideas and knowledge is steadily approaching to zero, as the ubiquitous Internet connections show. In the same way software, one of the main goods of Information Technologies can be copied and distributed without limitation at a almost null cost.

Ideas, though, must be had by someone and the skills of people, and people itself, are limited by nature. In its theory of 1956 Robert Solow analysed the growth theory and introduced a factor in the neoclassical theory that was related with the technological progress. Romer went a bit further and gave to this "technological change" the character of endogenous. In his paper of 1990 developed a model that explained economic growth with this new factor and the main conclusion he extracted was the high dependency of technological change, and thus economic growth, with the stock of human capital of nations.

So, economic growth is strongly related with the skills and competences of people and this wealth must be enforced to grow. Although one of the main reasons for globalisation has been the increasing of the market dimension and volume, one of the first consequences was communication and interchange of ideas and people. It is not casual that the most

open country in the past century, United States, became also the most prolific in ideas, science and technological knowledge. In Rosenberg's paper on Karl Marx thoughts about economic role of science, he says that from Marx's point of view the application of science to the productive process meant get rid of the human, take the true tool from the hand of the man because science can only apply its technology to impersonal machinery. Now, and after the former comments, this is absolutely different. Again the human being comes to the very center and represents the point of investment, in training and personal development, to achieve the goal of knowledge creation and information processing as to improve his skills and give value to the environment (network) he belongs.

In its encyclopedic work, Castells shows how the network configuration of society, from enterprises to neighbourhoods, is a consequence of technological change. Communication and Information Technologies give the possibility to people of distant places to get in touch and share its knowledge, empowering their possibility to have new ideas and share them and that this is the main change provided by them. This focus is different from Mokyr that states that is the change in commuting and the (present) atypical jobs that are consequences of the revolution we are involved in and the place where the changes will take place.

Information and Knowledge, therefore, is the new good in the postindustrial society. The main features of this good are the possibility to reproduce at a diminishing marginal cost, through the fast evolving Technologies of Information and Communications, and the need for the production of this good of a greater amount of human capital. An important consequence of this is that although reproducibility is cheap, it can be not desired. If exists the possibility to access to all the produced information and knowledge and no returns can be obtained from the very first production of this knowledge that, don not forget, has an elevated cost of production because the limited amount of human capital, there are no incentives to do it and economic growth can be compromised. This is the main cause of the need of intellectual property rights and patent laws that assure not just an earning from the paternity of an idea but the monopolistic situation in the start of the exploiting of the idea. This controversial issue, as appear in the work from 2002 by Romer, is a doubled-edge knife because if tough laws are redacted, innovation and creation can be reduced and again, economic growth compromised.

Kurzweil, among others, in his controverted Accelerating Change theory states that the characteristic evolving times of the nowadays changes follow an exponential law, similar to that of Moore's Law that states that the number of transistors in the computer chips double every eighteen months, giving an exponential law. Thus, some others like Joel de Rosnay have compared the different ages of evolution, Biological, Mechanical and Informational to the different paces of change.

This theories come from the previously presented facts of the new goods of informational age. Although at first sight it is true that an "informational product" can be exploited to a level that no former product could be done, it is also evident that the rate of commoditizing of these products is so high that the investment in research, development and innovation to improve them is of an amount that sometimes it balances the previous features. Whether this theories or models are right and foresee the future evolution of economy or not, it is sure that the present goods of the informational age are by nature different from the former and represent challenging issues in the economic work of the present.

References

- "A Contribution to the Theory of Economic Growth", *The Quarterly Journal of Economics*. Robert M. Solow, 1956.
- "Increasing returns and Long-Run Growth", *Journal of Political Economy*. Paul M. Romer, 1986.
- "Endogenous Technological Change", *Journal of Political Economy*. Paul M. Romer, 1990.
- "Economic Growth", *The concise Encyclopedia of Economics*. Paul M. Romer, 2007.
- "Karl Marx on the economic role of science", *Journal of Political Economy*. N. Rosenberg, 1974.
- "The Rise of the Network Society, The Information Age: Economy, Society and Culture, Vol. I." *Cambridge, MA*; Manuel Castells, 1996.
- "Economic History and the 'New Economy'", *Papers from NABE*. Joel Mokyr, sept. 2000.
- "When Should We Use Intellectual Property Rights?", *The American Economic Review*. Paul M. Romer, 2002.