THE ECONOMIC GROWTH OF NATIONS: A NEW VISION OF ITS NATURE AND CAUSES?

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FOREWORD TO THE ENGLISH VERSION

This is basically a translation of the work published in Spanish by the Universidad del Pacífico about five years ago: a preliminary synthesis of an idea originally drafted twelve years ago in Oxford while I was studying the mysteries of economic development with a marked practical orientation, and instead, I ended up more concerned with this rather theoretical and even epistemological approach to the problem.

This was originally planned as an initial version of a book to be tentatively entitled "Toward a General and very Long-Term Theory of Production, Economic Development and International Trade: Conceptual Framework and Methodological Basis."

Due to other responsibilities no further development of the already published synthesis has been possible in the past five years. However, the basic ideas presented here, then pretty much out of the stream of neoclassical Growth Theory of a decade ago, are today, I understand, much more akin to new developments.

Due perhaps in part to the fact that countries from Asia to Latin America, from Eastern Europe to Africa, are almost unanimously adopting more liberal economic policies, Economists seem to be in a process of putting aside some of their concerns of the past decades, and turning back to more basic questions, dormant perhaps for many years, and even to the central theoretical question of the true Nature and Causes of the Wealth of Nations.

This work is, I believe, an attempt to answer this question in a different way, which I hope is today more in line with the concerns of economists than ten years ago. For example, a special article in "The Economist"* surveying recent developments in Economic Growth Theory entitled "Explaining the Mystery" points out, first, that about long-term economic growth - the leit motif of the present work- economists clearly have insufficient knowledge" ; that neoclassical growth theory, devised after Solow's work in the fifties, has been "patently inadequate" in explaining actual facts and influencing police making; and that this situation is now changing with the work of Romer (started in 1983) and his colleagues, as well as with that of Maurice Scott. They have in common, as this work does, the idea of making technological progress endogenous to their theories and not exogenous as in neoclassical theory. And they apparently succeed in proposing "a radically new theory of growth" that "fits the facts". In a time when "paradigm" in a Khunian sense has become a popular word in corporate environments, perhaps it is not too far fetched to look forward to a true change of paradigm in economic theory at large.

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* January 4th 1992.

** "True enough: economists are interested in growth. The trouble is that, even by their standards, they have been terribly ignorant about it. The depth of that ignorance has long been their best kept secret."

The original work of Romer is described mainly as adding a third factor of production, Knowledge, to the classical two factors, Capital and Labor. As it will be shown, the central point of my work is also to add a third factor of production, Steering, to the other two . Another similarity seems to be that both look for an explanation of the "feed back" or virtuous circle effect of technological progress and of development itself.

If as "The Economist* suggests"... Mr Romer's approach is likely to form the basis of mainstream thinking on growth during the coming years" I hope my work can be a useful conceptual contribution to this thinking, certainly acknowledging it is only a starting point far from the difficult technicalities involved in growth theories and even more from the complexities of analyzing imperfect competition. The original and deep motivation of my work has been to contribute to achieve a better understanding of the real process of economic growth, adding the perspective of a first hand experience in entrepreneurial and managerial activity, as well as in Government, in a third world country under very extreme economic hardship, with the objective of reducing through a better and more generally accepted theoretical framework the so frequent and costly mistakes of policy makers of third world countries and even of international institutions that assist them. I am sure this improved theoretical framework would also help achieve better global agreements on trade, financing, technological management and related issues that will promote a more equitable distribution of wealth worldwide.

I have made very few changes in this English version and I have included only an occasional footnote (the original notes appear at the end of each chapter) to point out possible links with the few recent developments I have had a chance to learn of, through the last five years while I have been apart from almost all academic activities.

Finally, I would like to express my deep gratitude, to the Rockefeller Foundation for having invited my wife and myself to their Research Center in Bellagio where I wrote most of the first Spanish version, to my friends and colleagues whose suggestions and observations have done much to improve it, to my assistants and secretaries, to Caroline Palma for a very professional translation, and in a very special way, to my wife Cecilia whose participation, encouragement, advice, typing, editing and display of patience during almost twelve years has certainly gone far beyond her most recent contribution in editing and reviewing this English version.

INTRODUCTION

This essay grew out of a long-standing desire on my part to find a satisfactory explanation for the differences in levels of economic development, a concern which later led me to look into the theories of Production and International Trade. This interest in accounting for the monumental economic differences existing, which was a major topic of discussion in economic writings of the early fifties (1) is very aptly put by Trygve Haavelmo. In his book entitled "A study in the Theory of Economic Evolution" (2) the author states, after maintaining that economic theory has attributed considerable importance to short-term problems, while neglecting to explain the economic differences between less and more developed areas, that" ...if we have, side-by-side, two large economic regions of which one has a per capita national product several times as big as the other, there must be a tremendous and therefore presumably detectable difference in the 'causal factors' at work in the two cases." (3)

The main purpose of this essay is to provide an explanation for these major differences by identifying the causal factor of economic progress. The choice and definition of these factors is to be accomplished in an unorthodox way.

Haavelmo also suggests -and I would tend to agree with him- that if an adequate theory is proposed to explain these differences, it would be much easier to corroborate than is usually the case with economic theory. In this connection, he states: "I would venture the guess that there is really a much better chance of significant economic results if we turn to theories that have as their objects of explanation the really big dissimilarities in economic life." If this is so, economics, as a true science, is far more feasible.*

Although it might appear overly ambitious, my intention in this investigation is not to establish just another economic model but, rather, to propose a conceptual framework (4) that would substantially alter the conceptual framework being used to analyze problems of economic development. This conceptual framework should also be helpful in probing problems of production and international trade, which I consider to be closely tied in with the larger issues of economic development.

This broad undertaking basically entails questioning the concepts of Capital, Labor and Wealth as normally used with a view to putting forth a series of different concepts by returning to the classical economists' tendency to place emphasis on the production structure of wealth. This idea is perhaps most explicitly borne out in the writings of List (5), who shows unceasing concern for a nation's "productive capacities."

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* * Though it was not universally acknowledged a decade ago, today the superiority of a market economy in promoting development is not any more discussed in earnest. However, in spite of this advance, still much work, remains to be done, and probably under an innovative approach, to explain causally these differences through a proper theory; even more, I think it is possible that a radical change of paradigm in economic science will be needed. Anyhow, as it will be explained, it is my belief that at least a renewed set of fundamental variables is needed.

To facilitate the presentation of a number of ideas I have resorted in some places to the vector concept and have employed some of the most elementary notions of vector analysis with the conviction that this will help to clarify the presentation.

I have also attempted to analyze the proposed conceptual framework from the methodological point of view and have obtained some interesting results. This analysis constitutes a significant part of the study, that I have tried to sum up in Chapter 4.

In trying out a new approach to the problem I realize that I run the risk of overlooking a basic aspect of it and inevitably a number of questions arise: Has this approach been used before? Is it truly different? Could it be of some value?

I don't have a final answer to these questions but over the seven years in which I have searched through the literature at my disposal I have been unable to find any formulation which in my judgment bears a similarity to the proposal that I set forth here in.*

In fact, the very reason I am trying to publish ideas that may appear to be premature -given my individual research which has up to now been conducted on a rather isolated basis" is precisely to reduce the obvious risk to the lone thinker of unknowingly entering a blind alley or taking a course that has already been charted. It is extremely important for me to find out whether there is truly a fundamental difference in the conceptual framework I am proposing and whether that framework is of any value. I can see no other way to answer these questions than to request a constructive evaluation of these ideas, which have aroused the interest of a number of people, by publishing this paper.

The organizational structure chosen for this work is a two- part presentation, in which the first three chapters set out the author's ideas in a general way and the last three take them up in greater detail and summarize them.

The first chapter introduces the vectorial notation* and presents, from a variety of angles and making use of numerous examples, the central ideas of the proposal: a redefinition of the concept of wealth and of the causal factors of that wealth through the use of vectors and by reconceptualizing those causal factors.

The ways in which the idea presented can be considered innovative are summarized in the second chapter. And finally the third chapter compares our proposal with other approaches of economic theory.

Then we thoroughly consider these ideas from two outlooks. The fourth chapter supports them from the methodological viewpoint, while the fifth dwells more fully on the proposed conceptual framework, with emphasis on its two key aspects: the selection of the causal factors and their measurement.

As I mention in the prologue this has probably changed with the work of Romer and colleagues whose work I have not yet had a chance to know first hand.

The actual formulation of a theory of economic development shaped within this conceptual framework -- a matter which is touched upon very fleetingly in this fifth chapter -- is left for a second study. Our presentation is brought to a close with a summary chapter setting out the conclusions.

In view of the fact that new concepts are being introduced, it may be noted that we are deliberately reiterative in this presentation; although this may bother some readers, it has been suggested to us as the most adequate procedure for transmitting as fully as possible our proposal as it now stands, while we are well aware that the degree of synthesis herein could certainly be improved.

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* I have not been able to do without this vectorial notation even though I am aware it is seldom used in economic literature and thus it impairs somehow the readability of this work. Unfortunately, I know of no other way to describe curves in space, besides surfaces, a basic need of my proposal. To first help grasp this vectorial notation in two dimensions, the first chapter starts with some examples of its application to well known economic identities to usher in the rest of the work which permanently considers three dimensions.

NOTES

(1) Works pre and post-dating this period most certainly included similar concerns. To cite only two examples, a quarter of a century earlier Wesley Clair Mitchell had stated: "There are few problems that are more fascinating, more important or more neglected than the rates at which development occurs in successive generations or in different countries." Business Cycles, National Bureau of Economic Research, New York, 1927, page 416. Cited by Meyer and Baldwin in Economic Development. J. Wiley, New York, 1957, page 3.

A few years later John Hicks, in his essay "National economic development in the international setting" says: "I shall accordingly begin by discussing the causes of undervelopment, and the prospects of removing it, as seen against the background of the world economy as a whole. Simply as such, it is one of the greatest of all economic problems. It is not now of much importance, in terms of human wealth are (whatever it may be in terms of power politics), that the real wealth of the richer countries should be greatly increased; what is mainly important, for them, is that they should keep what they have gained, and should not be plagued by fluctuations in trade, by inflation, and by unemployment. But in the poorer countries there is still an acute need for economic progress in the older sense-simply for more real wealth. Why is it (the main question on which we must first make up our minds) that wealth has become distributed so unevenly among the nations of the world?" J.R. Hicks, Essays in World Economics. OUP, 1969, pages 161-162.

For his part, Arrow, in his 1973 presidential address to the Association of American Economists underscored the fact that: "The unequal economic development among countries and among the groups and regions of a given country constitutes a second rather complex problem for neoclassical theory." Kenneth Arrow, "Limited Knowledge and Economic Analysis". The American Economic Review March 1974, presidential address to the 86th meeting of the Association of American Economists, 1973 (cited by R. French-Davies).

(2) T. Haavelmo, A study in the theory of economic evolution Contribution to Economic Analysis III. North Holl and Publishing Co, Amsterdam, 1954.

(3) P.T. Bauer can be cited, as skeptical of an approach of this kind: "A recurrent theme within the general field of economic development is the quest for a fundamental cause or causes of development, and in particular for reasons explaining why some countries were caught up in the stream of material progress sooner than were others. The attraction of this quest is hard to resist and it directly and indirectly exercises wide influence. I was much attracted myself by this set of problems:... I now think that this may be largely a fruitless quest. Often, without realizing it, one is enmeshed in problems of causality, in problems of causes and in intractable problems of distinguishing between causes and effects, especially in the field of human attitudes and social institutions. This sort of quest may be as stifling to progress as was the quest for final causes in the natural sciences from Aristotle to the seventeenth century." Economic Analysis and Policy in Underdeveloped Countries. CUP, London, 1957. Page 32.

(4) Like Haavelmo, I have defined "conceptual framework" as the set of concepts chosen as "causal factors" in association with the concept "Wealth". In a recently published textbook on the history, philosophy and logic of science, which is cited further ahead (G. Gale Theory of Science, page 72 and following and page 134) the terms "conceptual grouping" or "conceptual structure" are used instead. Perhaps "conceptual scheme" would be equally appropriate.

(5) F. List, Sistema Nacional de Economía Política Spanish edition of his Das Nationale System der Poltitischen Oikonomie (Berlin, 1841). Translation and prologue by Miguel Paredes Marcos, Madrid, Aguilar S.A. Eds., 1955.

CHAPTER 1

A FIRST LOOK AT THE CONCEPTUAL FRAMEWORK: THE CAUSAL FACTORS OF WEALTH

The purpose of this chapter is to introduce the ideas we consider innovative in the proposed conceptual framework without, for the time being, dwelling more fully on them. Accordingly, we shall attempt to present this overview in broad outline through schematic proposals and examples. In Chapter 5 we shall take up the ideas set forth here in greater detail.

First we will briefly define wealth as the value of the production structure. Then, and only as a starting point, we will present the idea of wealth as a vector without introducing yet any change whatsoever in the traditional framework of economic theory: The two traditional factors of production, Capital and Labor, will be treated as vectors rewriting the standard macroeconomic identities in this notation. The sole objective is to link in a straightforward way the forthcoming analysis using vectors in three dimensions to the presentation that is usual in an Economics textbook.

Only then the key idea of this study, a rethinking of the causal factors of wealth, shall be presented in a variety of ways and from different angles. This factors are taken up as vectorial quantities. To this purpose is dedicated the best part of this chapter. In the light of this approach technological progress and the capitalization of the human factor shall be dealt with as two essential components of economic activity which should be explained endogenously within the proposed conceptual framework. Lastly, the practical application of the proposed scheme shall be discussed in two specific cases.

1.1. The idea of Wealth as value of the production structure (1)

The first aim of this study is to propose a new conceptual framework making it necessary for economic analysis to take into consideration at all times the production structure underlying the production process; in an analysis that is dynamic the involvement of the structure in production not only results in goods and services being produced but in its own transformation in the process. Our aim shall be accomplished by making the concept of wealth equivalent to the long-term value of the production structure, while consistently pointing up the difference between its human and material components. In this endeavor vector analysis shall be shown to be a useful tool.

All of this is to be illustrated by a very simple numerical example in two dimensions employing the concepts of Capital and Labor as usual in textbook economic analysis, using the vectorial framework to a) consistently register and point out the difference between the material and the human components of the structure; and b) to show at all times and simultaneously the stocks that really constitute the production structure distinguishing them from the flows that are produced and either consumed or invested.

Let us imagine any product whatsoever denoted by P with a value of 7 units. As we have set ourselves the task of distinguishing between the human and the material components involved in the production of wealth, let us assume the following, to use the terminology of Georgescu-Roegen which differentiates between the Flows and the Services rendered by Funds: (2)

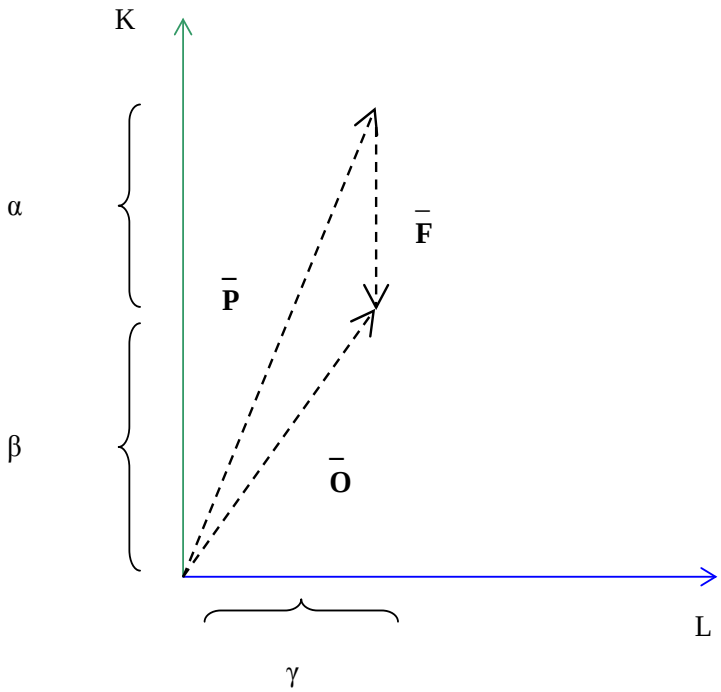
- In the first place 2 material units participated in the flow and these constitute the raw material input for the process (symbol F). They are depicted as "α" in Graph 1

- Second, 3 material units, depicted as "β", contributed as a service of the Capital Equipment Fund.

- Last, as a Labor Fund service 2 human units took part (depicted as "γ" in said graph). The total value of the product shall be 5 material units and 2 human units, to be represented by the vector **$\bar{P}$,** showing the extent to which both human and material factors were directly involved.

Nonetheless, the added value (symbol O), which is what really interests us as the contribution of that production unit, shall be represented by the vector **$\bar{O}$** in graph 1, so that:

$$\bar{O} = \bar{P} - \bar{F}$$



GRAPH N° 1: Output $\bar{O}$ is equal to the product $\bar{P}$ less raw material $\bar{F}$.
They are all flows (discontinuous lines).

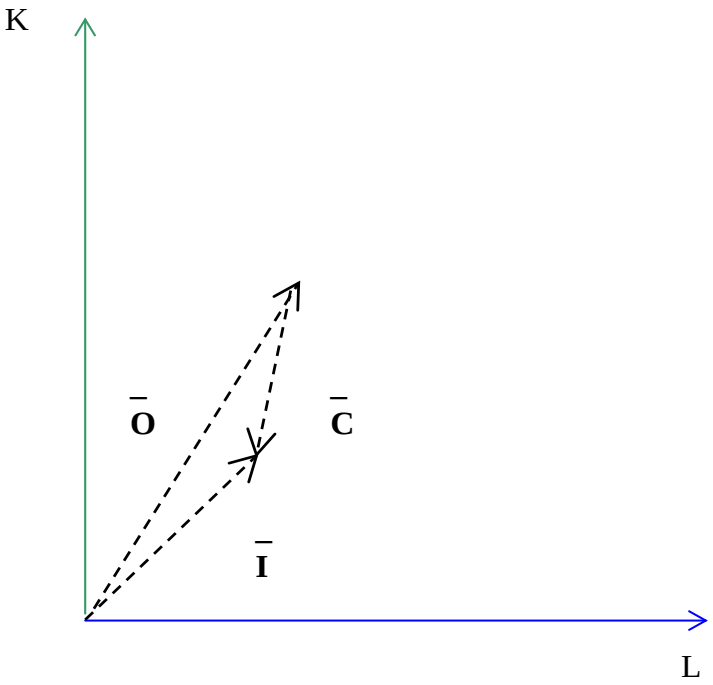
The contribution of that production unit to the output shall be this added value which shall be entered in the usual manner, assuming that the units are homogeneous, as 3u + 2u = 5u. (3)
Of this vector **$\bar{O}$** a certain portion shall be given to society for consumption (C) and only

one part shall be saved and earmarked for investment (I), which, in turn, shall go to augment the production structure both as to human and material elements. Let us assume that only two units of this added value, one of each kind, are invested; we would then have:

$\bar{I} = \bar{0} - \bar{C} = 3\bar{i} + 2\bar{j} - (2\bar{i} + \bar{j}) == \bar{i} + \bar{j}$; in which

$\bar{C} = 2\bar{i} + \bar{j}$ (4)

This investment is the element that is going to alter the production structure (for the moment we won't consider the physical wear and tear of the elements). The above is demonstrated in graph 2.



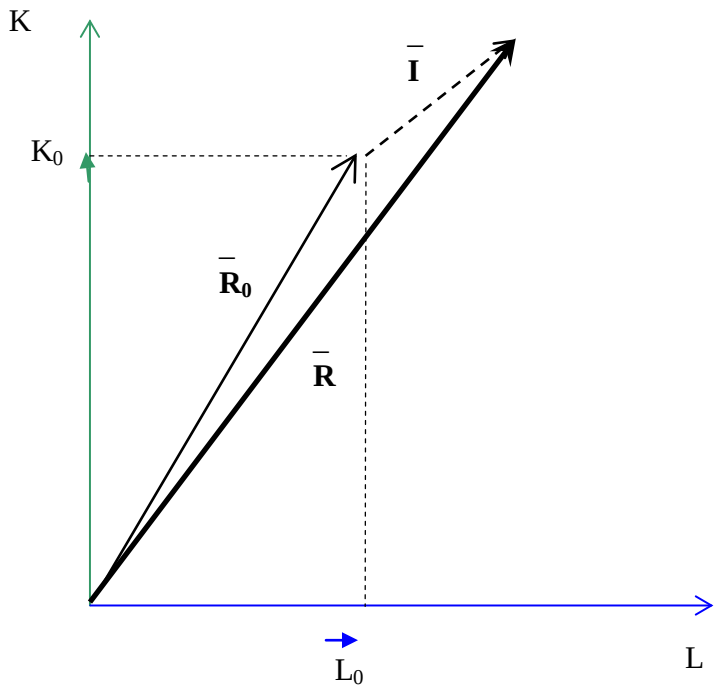
GRAPH N° 2: Investment $\bar{I}$ is equal to output $\bar{O}$ less consumption $\bar{C}$. They are all flows (discontinuous lines).

Up to now we have been using only flows which we assume refer to an annual period. But during the said year what was the value of this production structure and how has that value evolved? If the wear and tear of the factors has been left aside, then the value of the production structure would be the result of the present value of the services which both the material and the human components are able to generate during their economic lives.

This is shown in graph 3, where the vector $\bar{K}_0$ denotes the present value of the capital stock of that production unit (including its working capital) and the vector $\bar{L}_0$ stands for the present value of the fund of laborers who are employed. (5)

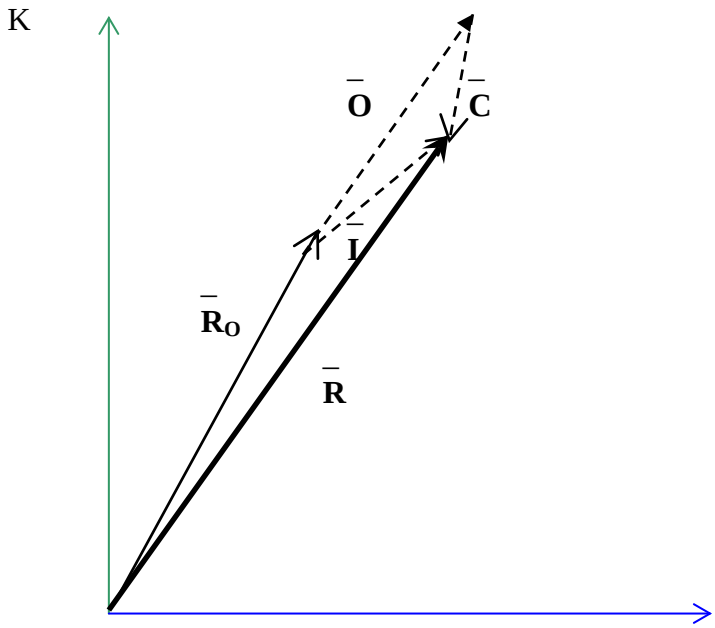
To this value one must add the investment for the period, which gives the following:

$$\bar{R} = \bar{R}_0 + \bar{I}$$



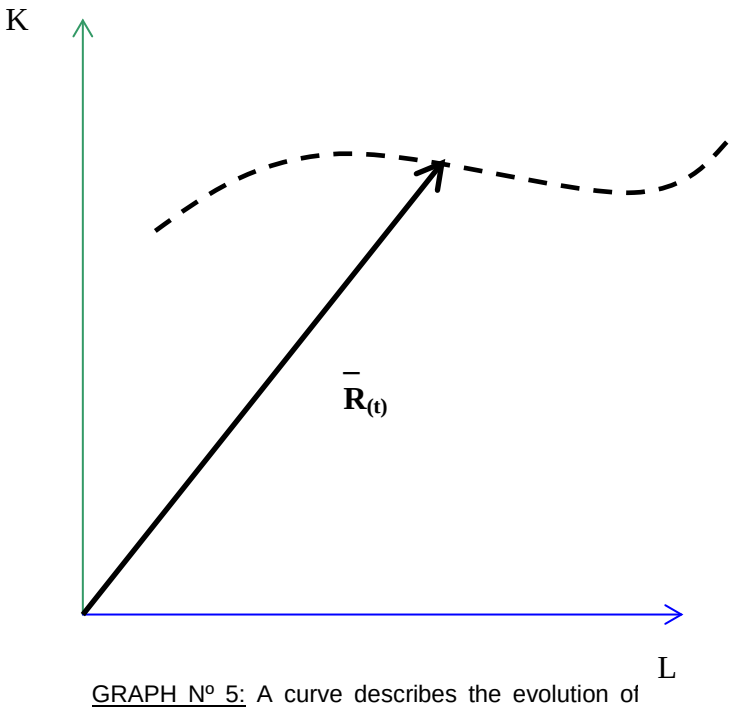
GRAPH Nº 3: Wealth $\bar{R}$ is equal to wealth at the beginning of the period $\bar{R}_0$ (vector capital stock K_0 plus vector L_0, the present value of the fund of labor) plus investment I. The difference between stocks R and R_0 (Full lines) is the flow I during the period (discontinuous line).

The advantage of using this vector representation method is that it allows the same graph to depict the stocks taking part in the production process, (which are represented by the unbroken lines, $\bar{R}$ and $\bar{R}_0$, and the flows being generated $\bar{O}$, $\bar{C}$ and $\bar{I}$. Furthermore, it always distinguishes between the human and the material components fulfilling therefore the conditions we have imposed ourselves. Thus, we can fully specify the economic process of this production unit in a given annual period, as may be observed in graph 4.



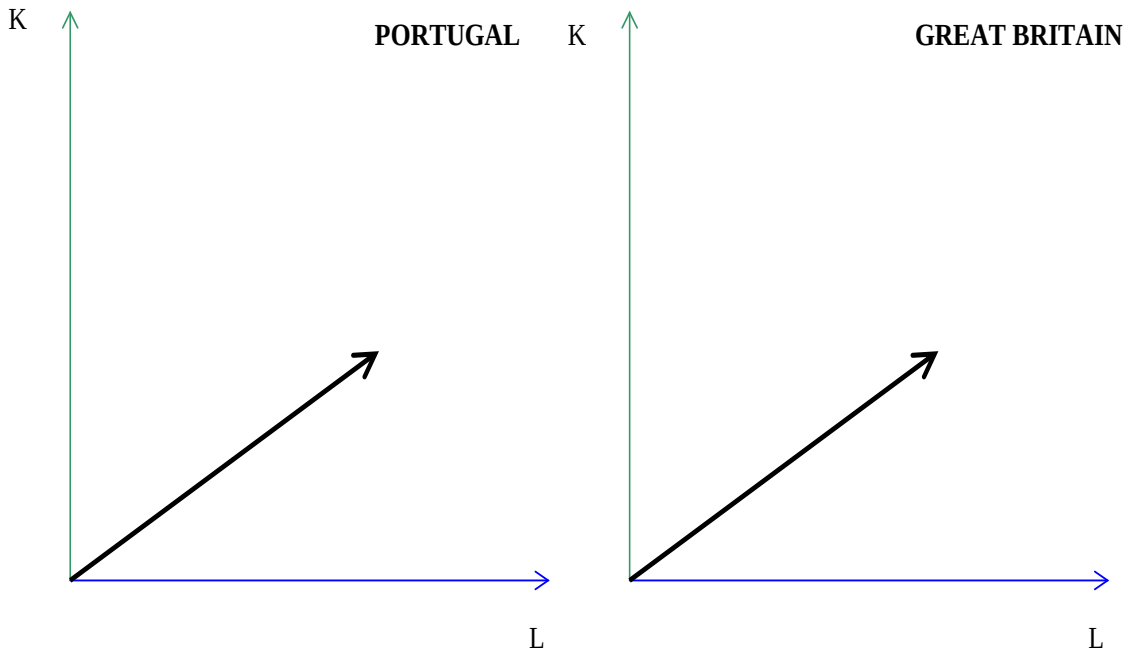
GRAPH Nº 4: A summary of the production proces showing both the production structure (full lines) and th flows produced (discontinuous lines) combining Graph # 2 and Graph # 3.

What we would like to propose is that, using this analysis as a basis one can clearly visualize the course of development of a production unit or the economic development of a country by considering that $\bar{\mathbf{R}}$ is a function of historical time $\bar{\mathbf{R}}(t)$, which represents the production structure and, hence, the wealth of this production unit or country in the long term, as may be observed in graph 5.



GRAPH Nº 5: A curve describes the evolution of wealth **R**(t) in historical time

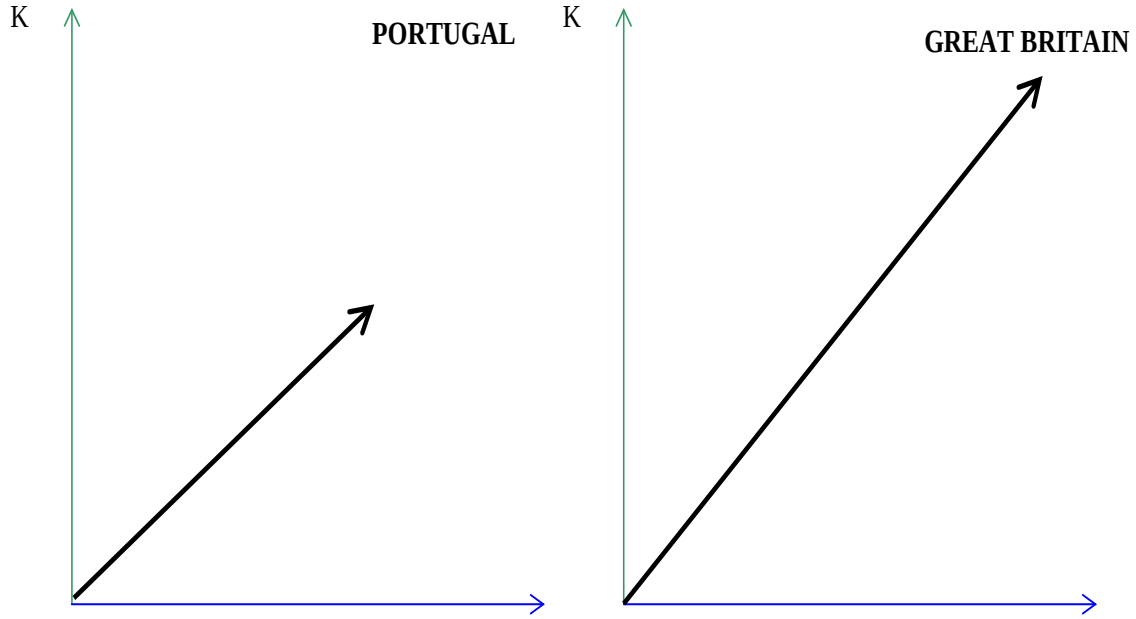
We will now try to apply this analytical procedure to a very simple example involving two type of countries that we will use through the chapter: Laboralia and Industralia. Trade between this two economies will be briefly analyzed now and will be repeated within the new conceptual framework and in greater detail at the end of the chapter. Let's take up the classic case of the exchange of Portuguese port for British knitwear, assuming that at the outset the situation was the same for the two countries, that they each had dedicated the same amount of wealth and with similar material and human components (equal production structures) to this trade. (graph 6)



GRAPH Nº 6: Equal production structures are shown for Laboralia i.e. Portugal and Industralia i.e. Great Britain at the beginning of trade between the two countries.

The product flow which each country allocates to this exchange shall have the same equivalent value -- that is to say, they trade a certain value in knitwear for an equivalent value of port. Obviously this trade is clearly more beneficial to the two than the alternative of not producing these goods and trading them.

But what will happen to the production structures of the two countries? Because of the differing potentials for augmenting the productivity, on the one hand, of wine grape growing, and on the other, of the manufacturing of knitwear, after a long period of time the production structures shall be different. The reason for this is that knitwear production requires a capitalization of both the human and the material factors, as well as the incorporation of steam power, specialization, and so forth (this, despite the fact that the trade in the two products has always been equivalent). This is reflected in graph 7.



GRAPH Nº 7: After a long p of trade production structures of both countries have evolved qui ferently. Industralia will be far wealthier in per capita terms.

At the end, per-capita-wise, England shall obviously be "richer" than Portugal despite the fact that the trade was equal and benefited both countries according to their "comparative advantages."

Although with this proposal and this simple example we have introduced the concept of the Wealth vector **R**(t), we are still operating with the classical factors of capital and labor as normally employed in economic theory. The difference lies in the fact that instead of graphs of counterfactual relations, we are trying to present factual relations in reference to a given economic structure at a specific moment in historical time. Thus far, however, we have not altered the traditional conceptual framework insofar as production factors are concerned. One may feel that the vectorial representation offers no advantage, but we have wished to introduce it in its simplest form because it will be helpful in explaining the central idea of our proposal, as we will now show.

So much for this brief introduction to the vectorial notation in two dimensions. From now on it will be used in a three dimensional space.

1.2 The key idea: the rethinking of the causal factors of wealth

The central idea is to find a single series of a few causal factors or resources that may account fully for the "wealth" of a given economic unit and its course of development over

time -- the process of its accumulation. But Wealth is certainly to be construed as more comprehensive than only material abundance. Wealth in this study is the vectorial sum or resultant of the "presence" of these few resources or causal factors, as valued over the long term. Accordingly, "economic development" which is only one of the various facets of the overall development of society (6) is considered to be the increase of this Wealth, with Wealth being synonymous to the availability of all of the causal factors of production. (7) Among these causal factors of production we shall give much more importance to the human than to the material factor.

The same idea may be presented from a different outlook. An "Economic Space" is to be defined in which each of the causal factors or resources is a dimension of this space, so that the entire economic activity of a given economic unit (country, region, enterprise) may be defined completely (at a certain moment in historical time) by its coordinates or dimensions in that space; in this way any explanation or theory on the evolution over time of this economic unit could be made without having to turn to other residual external factors as causal elements for these would, by definition, be the sole factors involved. Any other variable which might be introduced into a theory formulated within this conceptual framework would have a regulative effect on those causal factors, but not a causal effect per se.

The net economic effect of human activity for each production unit would thus be that of continuously altering the amount of each causal factor existing at that moment in time -- changing its position in the economic space as defined above (usually upward, but also downward in the event of a dispersal of wealth).

These resources or causal factors proposed differ from each other; although they are to be measured in the same units, one cannot replace another except over time and through the economic production process itself.

This fact makes it necessary to adopt the device of considering these causal factors, not as scalars, the tendency in economic theory, but as vectors -- in other words, as directed quantities within this economic space. In this way the differences between the causal factors chosen can always be recorded; while at the same time their variation in terms of historical time is shown in a synchronized way.

Although we are going to initiate our analysis with four factors by adding another to the three classical ones (Land, Capital and Labor), for purposes of facilitating the presentation and analysis it would be advisable to immediately restrict these causal factors to three (if a space of more than three dimensions is considered this ceiling could be surpassed, but at the cost of making the analysis considerably more complicated). We have achieved our aim by grouping Land and Capital together and employing per capita values.

The vectorial sum or resultant of the "presence" of these resources, dimensions, elements or causal factors, valued over the long term, then, constitutes "wealth" as we have defined it. As a result, any explanation for the variations in this wealth, for its increases or decreases - that is to say, any theory that is formulated thereon - should be devised on the

basis of these three causal factors. They will be affected, so to say, by the application of coefficients or regulative factors reflecting the efficiency with which each element is used or the influence of other non-economic aspects which will undoubtedly be involved in the economic process.

Accordingly, the entire course of historical economic development of a given economic unit should be explicable exclusively in terms of the accumulation or dispersal of these three causal factors of production. This implies the self-imposition of an extremely severe restriction, but it enables one to envisage the total economic activity of the world's countries as a closed system, which obviously facilitates its analysis*.

First I'll outline and briefly explain the proposal in a few propositions, then formalize it for purposes of comparison with the traditional conceptual framework; later it shall be illustrated by a number of examples.

a) To return to the three classical factors of production, Land, Capital and Labor, we propose that a fourth production factor be added for the economic analysis of recent centuries, at least insofar as long-term problems are concerned, and this factor is to be called "Steering". The other three factors are redefined as specified further on.

b) The term Steering would apply to all human resources (normally called talent) devoted to invention and innovation, to the establishment of enterprises and to their management, to the governing of a country and to the specialized transmission of knowledge, to leadership and to the regulation of society -- in short, to steer; it shall be denoted by the letter L".(8)

c) Labor is the traditional factor which contributes mainly effort and skill and which represents the greater part of the human resource with the obvious exclusion of what has been considered and grouped under Steering. The difference between Labor and Steering is, of course, arbitrary (and perhaps tends to become nebulous as one moves toward a post-industrial society) although today there is a very marked difference between these two factors at the world level. L' shall stand for Labor.

d) Capital shall be restricted exclusively to its material components and shall be denoted by the symbol KI. Both energy and information of a material nature are encompassed under this factor.

e) Land is employed in its usual sense of Natural Resources.

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* We believe this approach which amounts to use in Economics an Euclidean metric similar to that employed in all classical dynamic analysis of physical systems opens a fruitful space for the formulation of sound theories and the corresponding statistical analysis. Another interesting attempt of modeling economic systems upon a physical analogy but emphasizing measurement is J. Rospigliosi's Ritmo productivo y Administración (Productive Rhythm and Administration), 2nd Congress of Industrial Engineers, 1982. See also "Quantum-Economics: Theory of Value", a proposal presented to The Rolex Award for Enterprises 1993", developing his proposal further on with the metric of modern physics.

f) For purposes of simplification only, to reduce the causal factors to three, the concepts of Labor and Capital as redefined (only material) shall be grouped under a single causal factor, known as Material Resources and represented by K'.

g) Our postulate is that this conceptual framework as defined by these three factors should be sufficient of itself, without having to turn to any other causal factor (technology, organization, education, entrepreneurship, information, residual, and so forth), to allow for any long-term economic analysis to be made within its confines.

h) It would perhaps be preferable to call the result of economic activity, or Output (symbol 0), the Economic Resultant, for it encompasses not only the goods and services produced, but also the net qualitative modification of the production resources, especially the human ones.

i) The historical process of economic accumulation of interest to us in the analysis of economic development is not limited to the traditional factor Capital (construed in the broadest sense one may wish), but materializes in an accumulation of each of the three proposed factors, k', I' and I". The aggregate factors resulting from the accumulation shall be denoted by k, p, and s (Accumulated stock of material resources per capita, Per capita historically developed productivity, and the Accumulated steering capacity per capita).

To give a clearer idea of what we understand to be a traditional conceptual framework and compare it with the proposed conceptual framework, we shall summarize what has been stated thus far as follows:

A. Traditional conceptual framework

1. Production factors:
   T (land);
   K (capital) ; (in the usual analysis this category encompasses the previous one) ;
   L (labor);
   Others (technology, organization, education, entrepreneurship, information, residuals, and so forth)
2. Result of the economic activity = Output = O
3. Investment = I = O - C
4. Historical accumulation: K (in a broad sense), with growth being defined as $K = K_0 + I$

B. Proposed conceptual framework

1. Production factors:
   T (land)
   K_I (capital, defined as being purely material)
   L' (labor, redefined as being only productive)
   L" (labor that is creative and enterprising)
   Others: by definition, not acceptable

And, lastly, for purposes of simplification, T (land) and K_l (capital, defined as being material) are grouped together and replaced by :

K' (material resources)

The factors, then, have been changed into:

Production factors =

K' (material resources)
L' (productive labor)
L" (creative-enterprising labor)

Causal factors of production stated as vectors:

k' (t)$\bar{\mathbf{i}}$
l' (t)$\bar{\mathbf{j}}$
l" (t)$\bar{\mathbf{K}}$

2. Result of the Economic activity, = $\bar{\mathbf{O}}$ (vector) = Economic resultant
3. Investment = $\bar{\mathbf{I}}$ (vector) = $\bar{\mathbf{O}}$ **-** $\bar{\mathbf{C}}$ (vector)
4. Historical accumulation: **R**(t) (vector) =

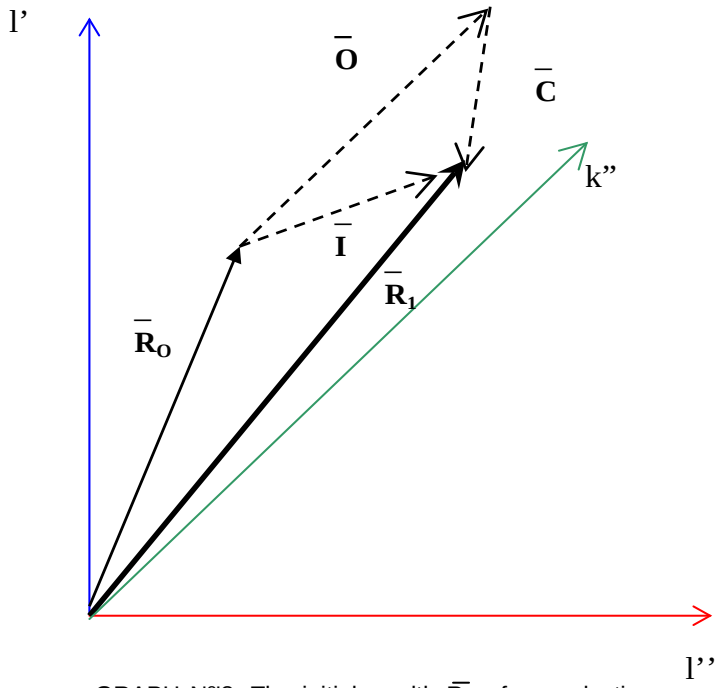
k(t)$\bar{\mathbf{i}}$ (stock of material resources per capita corresponding to k') +

p(t)$\bar{\mathbf{j}}$ (Per capita historically developed productivity, corresponding to l') +

s(t)$\bar{\mathbf{k}}$ (Accumulated per capita Steering capacity, corresponding to l") (9), growth, thus, being defined

as $\bar{\mathbf{R}}$(t) = $\bar{\mathbf{R}}_{\mathbf{0}}$ + $\bar{\mathbf{I}}$

Let's go back to our first exercise and take it to three dimensions. A production structure which over a period produces $\bar{\mathbf{O}}$ and invests $\bar{\mathbf{I}}$ shall progress from value $\bar{\mathbf{R}}_{\mathbf{0}}$ to value $\mathbf{R}_{\mathbf{1}}$, as shown in graph 8.



GRAPH Nº'8: The initial wealth $\bar{R}_o$ of a productive u will increase over the period to R (Stocks in full line) because part of its output $\bar{O}$ is not consumed as C but invested as I (Flows in discontinuous lines). All quantities are shown as vectors in a space of three dimensions k', material resources, l', labour, and l'', steering.

If this production structure is that of a country, the evolution over time of its wealth, in other words, the value of that production structure shall be denoted by $\bar{\mathbf{R}}(t)$.

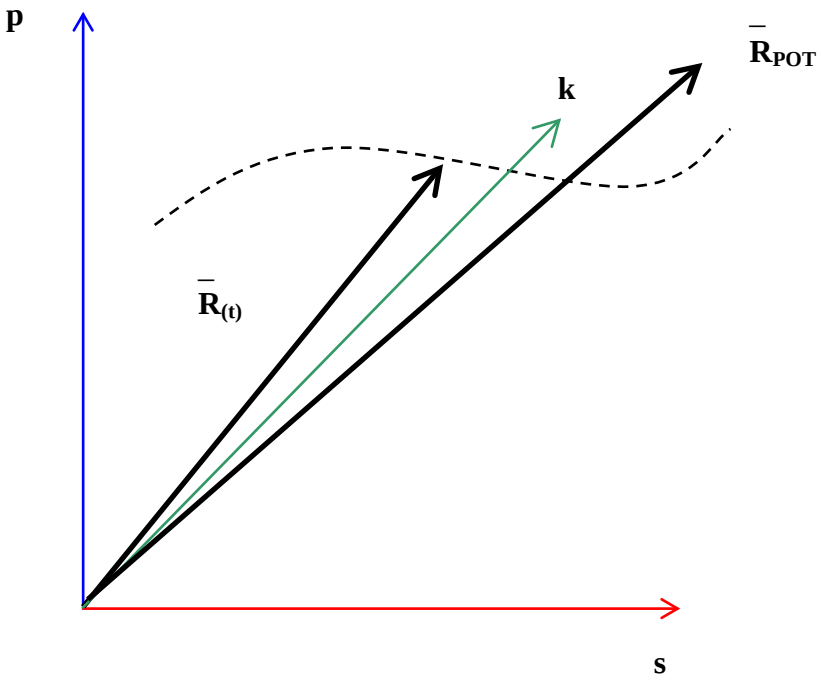
We have tried to indicate this process in graph 9, where the coordinates have been clearly marked for the effective measurement of each of the three dimensions that would have to be included, such being:

-Material resources per capita	k
-Productivity per capita	p
-Steering per capita	s

These stand for the material resources, productive human resources and creative-enterprising human resources accumulated by a production unit, society or country. (The fact that the values are given on a per capita basis is underscored).

It is evident that $\bar{\mathbf{R}}(t)$, the real and historically produced Wealth is always very inferior to the Potential Wealth, $\bar{\mathbf{R}}_{\mathbf{POT}}$, which could have been hypothetically produced. Real Wealth is produced by these three causal factors. As economic activity is a human and social endeavor, these factors are eminently "disturbable" in themselves, because behind each causal factor there are human beings exercising their freedom (directly in "p" and "s", and through property and control in "k"), but above all, because they are "disturbable" in their mutual relationships, which are eminently "social relationships" (10).

At a macroeconomic level, a theory yet to be construed which will explain in all cases this insufficient growth (for most of humanity) of **R**(t), d**R**(t)/dt, in terms of the three causal factors and other economic indicators that will reflect this regulating, limiting, or "disturbing" effect, will be precisely a Theory of Economic Development.



GRAPH Nº 9: The three dimensions k', l' and l'' of the previous graph are replaced by corresponding aggregated dimensions k, p and s expressed in per capitas for macroeconomic analysis. The evolution of wealth R is a function of t, historical time, and describes a curve whose values are much smaller than those of $\mathbf{R}_{POT}$, the potential wealth that the same causal factors if "undisturbed" could generate.

A similar explanation of this "disturbances" at the microeconomic level of the firm would be the corresponding Theory of Production. In establishing the interrelation of both theories the phenomena of economic intercourse between large economic unities should be considered besides aggregation. A Theory of International Trade coherent with the other two should explain this phenomena.

I would like to illustrate what has been said thus far by a very simple example. Assuming we have three products from different countries, Laboralia (A), Industralia (B) and Postindustralia (C), and that they all have the same value in a given place, say New York. One is a dress made from hand-woven material (it could be any unskilled labor-intensive product); the second is a man's suit made from fine state-of-the-art machine-made material (it could also be any mass produced industrial product); and the third is a personal

computer (which could be any high-technology product).

The flows of resources assumed to have been involved in the production of each of these items are shown in the following table, with values being expressed in no particular currency ($).

(l) PRODUCT	(2) PRODUCTION	(3) VALUE IN N.Y	(4) COMPONENTS	(5) KIND*
A (fine quality dress)	Hand-Made	$ 300	$ 100 of wool and leather $ 190 of labor $ 10 of talent	1 2 3
B (good quality suit)	Industrially manufactured	$ 300	$ 100 of wool and cotton $ 80 of machinery $ 70 of labor $ 50 of talent	1 1 2 3
C (personal computer)	High technology	$ 300	$ 50 of raw material $ 50 of machinery $ 50 of labor $ 150 of talent	1 1 2 3

* Kinds 1, 2 and 3 will be explained in the following paragraph

By each of the components numbers have been given, indicating the generic kind of resource (approximately the causal factors defined earlier) involved, as follows:

- Material resources (1)
- Productive human resources (2)
- Creative-enterprising human resources (3)

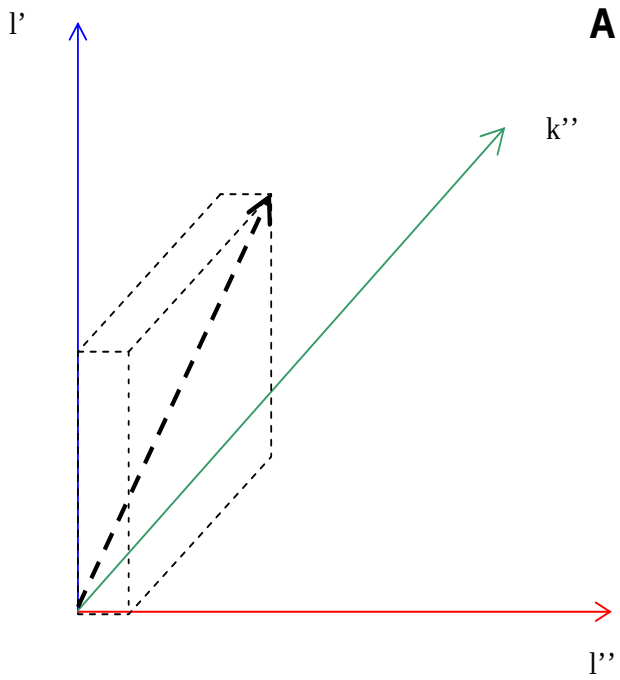
Material resources are construed to mean all kinds of inputs, whether they be land, natural resources, fixed capital incorporated in machinery or fixed plant and equipment, power, financial resources, tangible information resources incorporated in material means and, in general, any kind of material resource whatsoever.

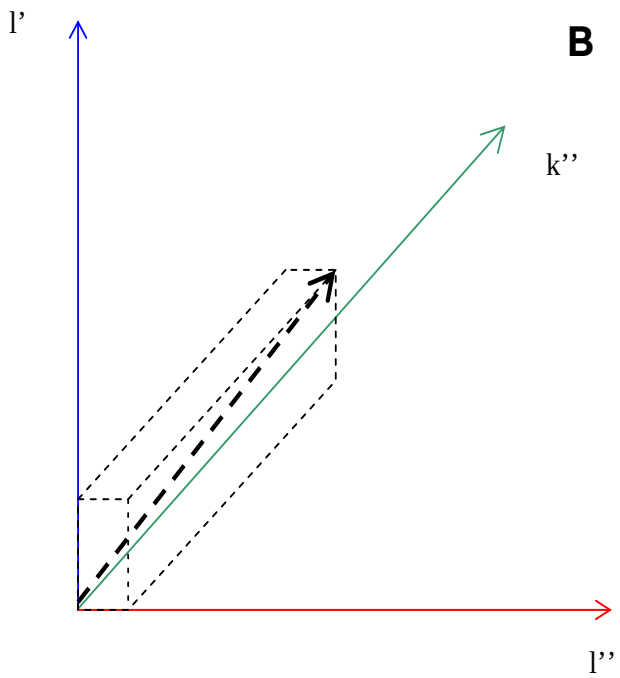
The directly productive human resource is the traditional homogeneous labor, except that that part of human involvement in the production process which could be called "talent" has been excluded: This does not mean that the labor factor does not also include an appreciable amount of talent, but that its presence is far superseded by effort and acquired skill.

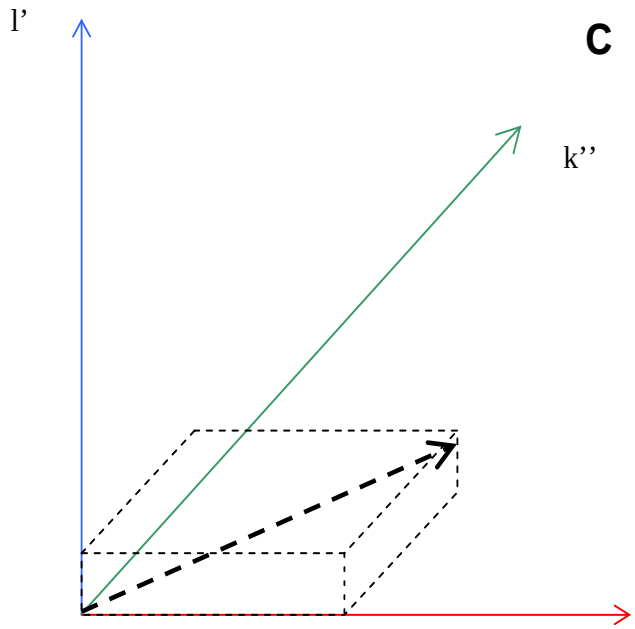
For the time being the creative-enterprising human resource is considered to encompass all kinds of creative and managerial labor that participated, with an economic result, in the various phases of production up to the arrival of the cited products at the market.

It is extremely important to emphasize that the three components into which each of the products has been divided are truly and absolutely homogeneous, for "1" covers all of the material resources used in those items and "2" and "3" are also truly and objectively human resources, which have deliberately been subdivided to separate those which are defined as creative-enterprising human resources from those which are not.

If we approach this example from a tridimensional viewpoint we can see that each one of these three elements, while at first glance has the same value (11) in actual fact it differs as to its composition, such being reflected in the three different vectors (graph 10).







GRAPH Nº 10 The three products of Lab Industralia and Postindustralia, A, B and C, g the same monetary value reflect the different proportions of each causal factor involved in its production, corresponding to their respective production structures.

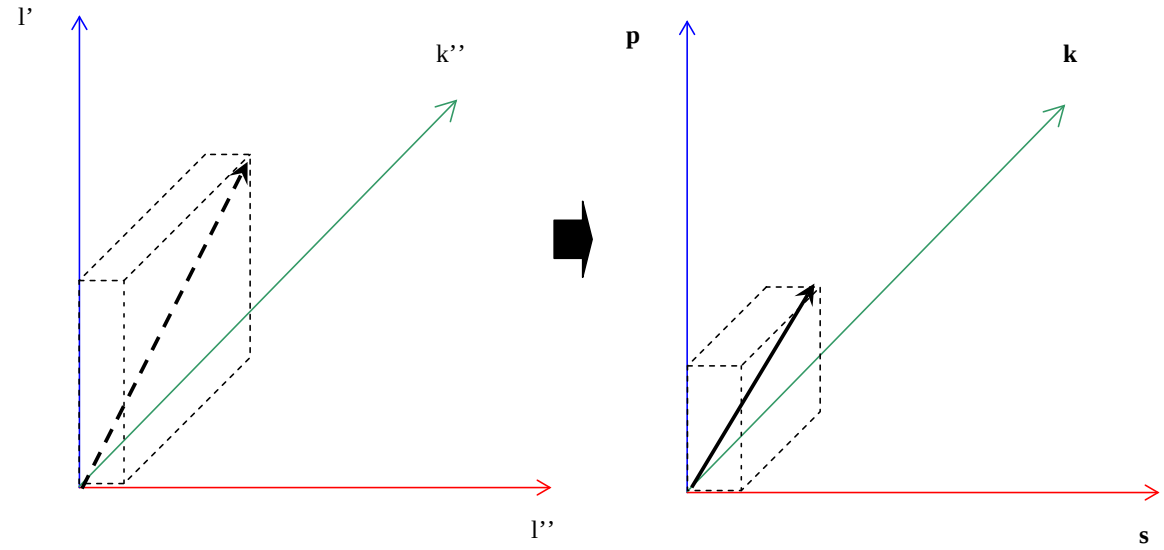
We'll now add to the previous table, of which we'll cite only columns 1, 4 and 5, a sixth column showing proportionally the length of time people had to participate in the process in order to produce the three items and place them in the market. For purposes of clarification column 7 contains the inverse -- the number of units of products A, B and C that would be obtained through a day's work devoted to their production by resources of kinds 2 and 3.

(l) PRODUCT	(4) COMPONENTS	(5) KIND	(6) DAYS OF WORK	(7) OUPUT PER DAY
A (fine quality dress)	$ 100 of wool and leather	1		
	$ 190 of labor	2	10	1/10
	$ 10 of talent	3	1/10	10
B (good quality suit)	$ 100 of wool and cotton	1		
	$ 80 of machinery	1		
	$ 70 of labor	2	1	1
C (personal computer)	$ 50 of talent	3	1/20	20
	$ 50 of raw material	1		
	$ 50 of machinery	1		
	$ 50 of labor	2	1/10	10
	$ 150 of talent	3	1/100	100

The reason for adding columns 6 and 7 is to be able to show, at the same time, both the flows and the production structure underlying the production process. Accordingly, let's see what would happen in the long term in the three hypothetical countries, each of which is devoted exclusively to the manufacture of one of these products, A, B, and C. Since, by definition, we always represent a country's production structure in per capita values, in order to be able to plot it we need to know the ratio which is set out in either of these two columns. The resultant is shown in graph 11.

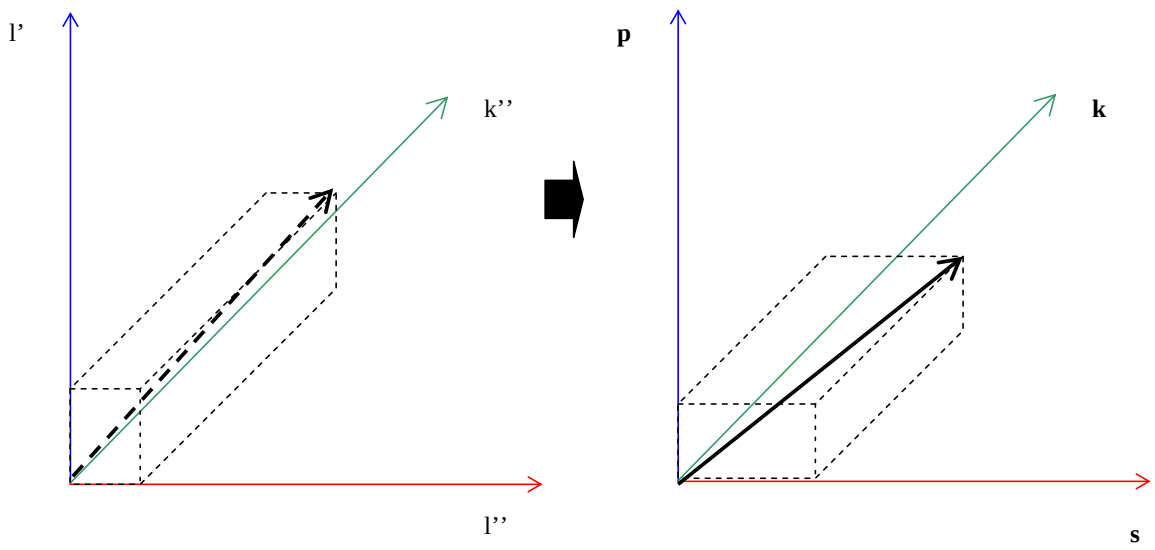
FLOWS **STOCKS PER CAPITA**

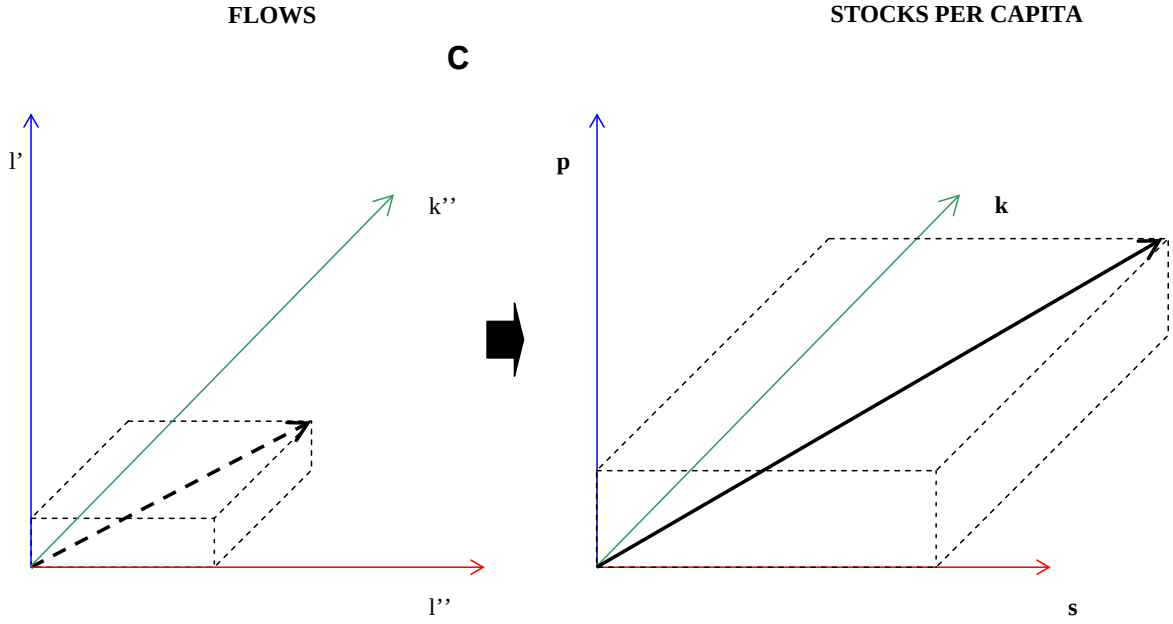
A



FLOWS **STOCKS PER CAPITA**

B





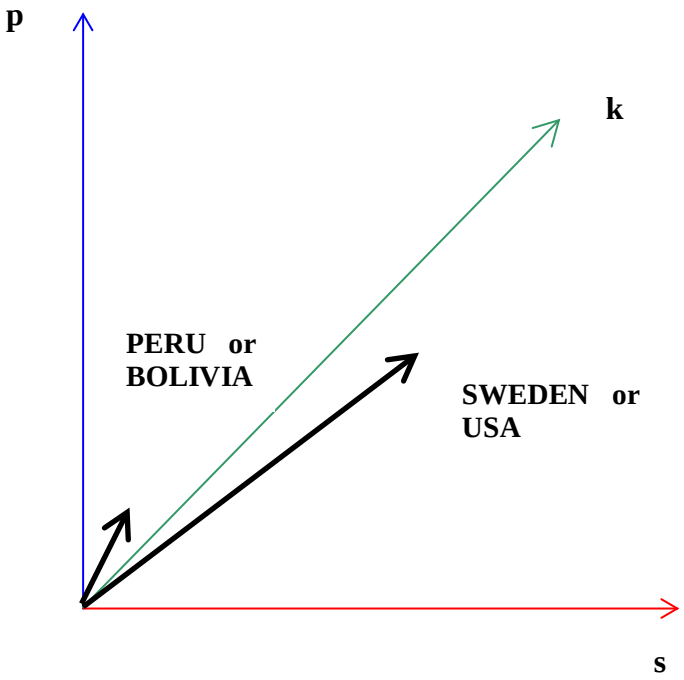
GRAPH Nº11: The equally valued products of the three countries Laboralia (A), Industralia (B) and Postindustralia (C) and their corresponding production structures show dramatic differences in per capita wealth for each case.

These graphs merely reflect the well-known fact that the output of one day's work, and consequently of a given worker, shall be completely different and growing, in structures A, B and C, although their products may be worth the same today. (12)

What is to be concluded is that were these structures A, B and C correspond hypothetically to those of actual countries, an enormous difference would exist between each production structure or, rather, between their productive capacities, which will determine their future economic activity. (13)

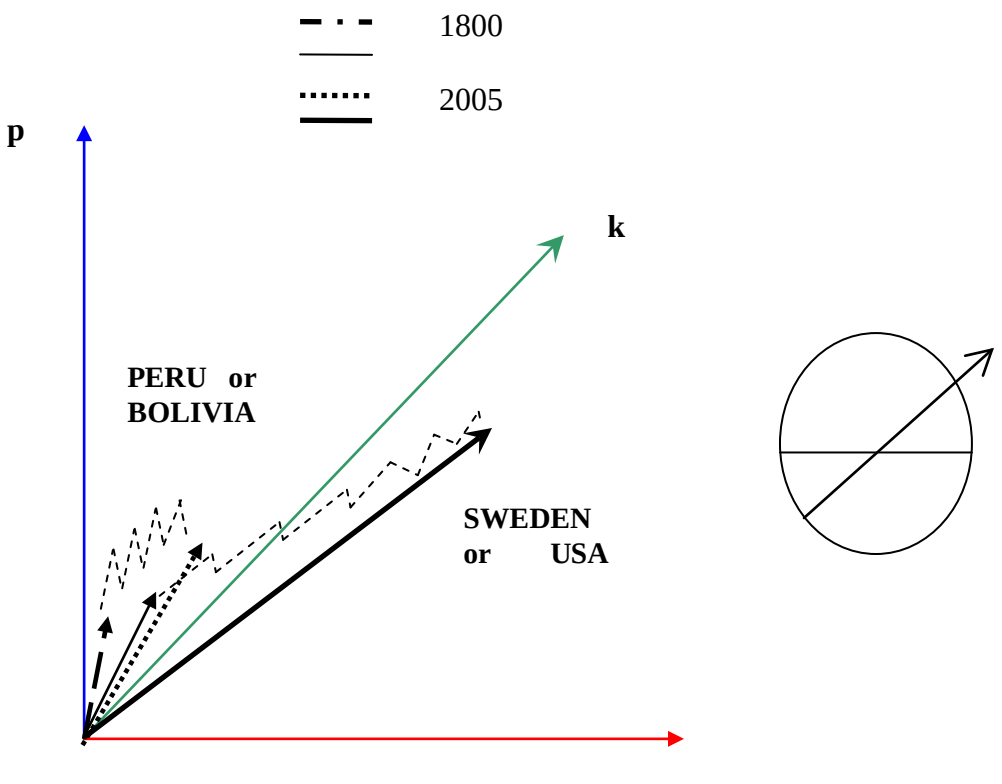
To make these ideas more understandable we shall give some other examples.

a.- Using the same approach of plotting in a three-dimensional space the "wealth" of any economic unit whatsoever, and particularly of a country, the following graph (graph 12) shows the probable differences existing in 1985 between the structures of an Industralia type of country such as Sweden or U.S. and those of another of the Laboralia type such as Peru or Bolivia, where the greater part of the production is still highly low-pay or low yield labor- intensive.



GRAPH Nº 12: Comparative production structures or levels of per capita wealth of countries of the Laboralia and Industralia types.

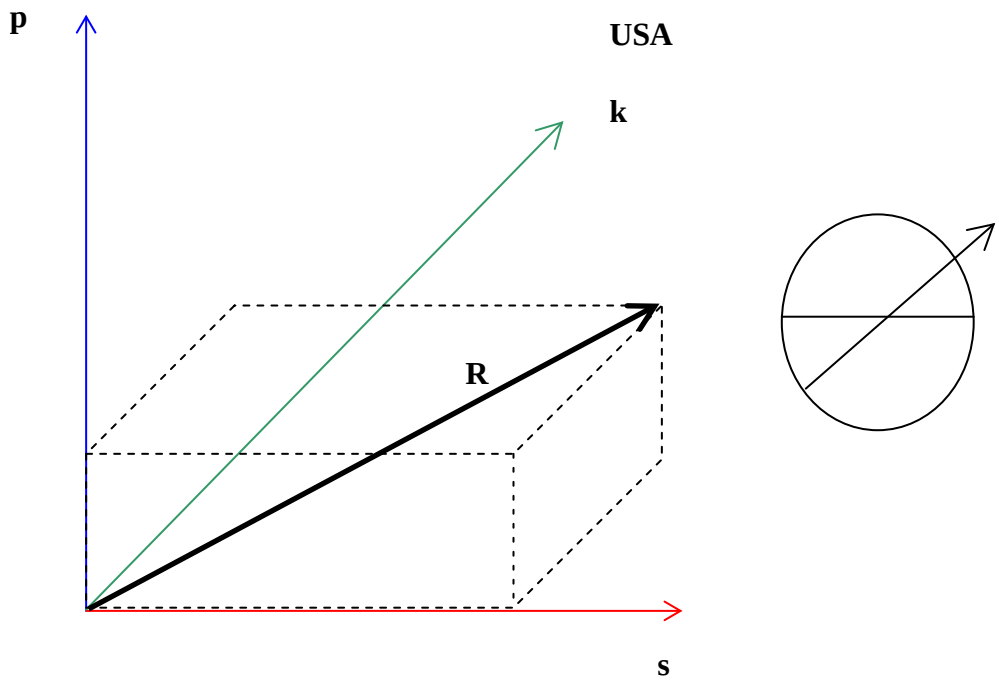
b.- As a second example it would be interesting to imagine the positions of these two different countries Industralia and Laboralia -say the U.S. and Peru-in the same economic space in 1800 and the course they would have had to follow to achieve their existing situation; this is shown in figure 13.

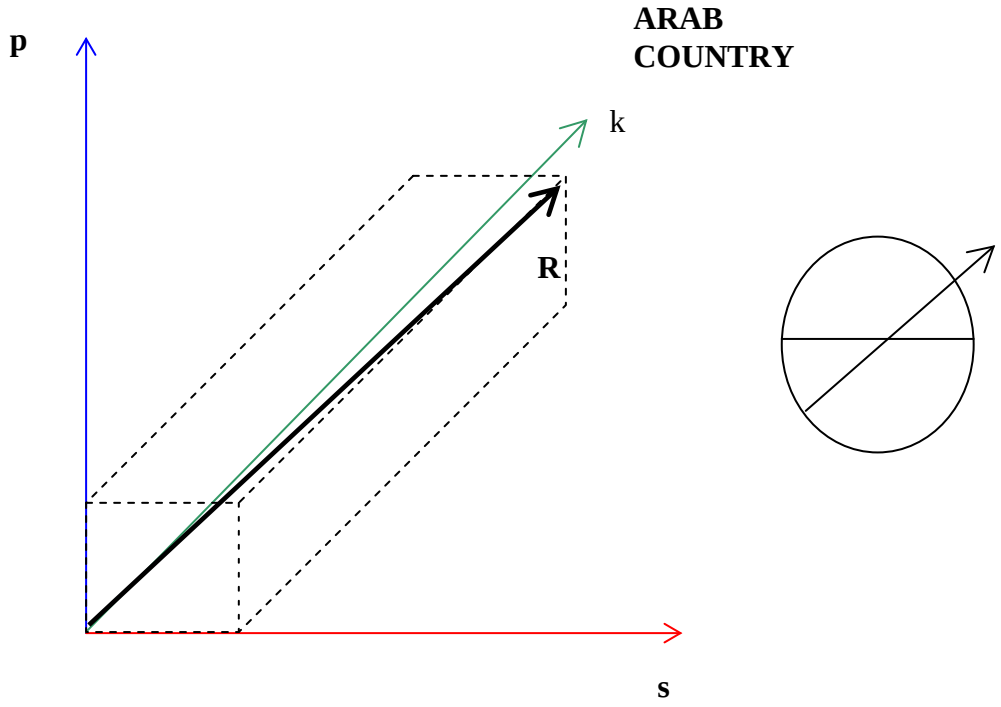


GRAPH Nº 13: Evolution in about two centu ɔf the production structures of countries of the Laboralia and Industralia types, depicting each trajectory as a curve in space, and showing that from very similar starting points outcomes in per capita wealth can widely differ.

c.- Lastly, to illustrate the different dimensional values that wealth can assume in a country we shall compare two levels of absolute per capita wealth that would be almost equal, as could be those of the United States and an Arab oil-producing country.

But, as may be noted in graph 14, the structures or components of wealth, in the two cases, would be totally different from one case to the other and that of the U.S. would certainly be much closer to the "technological north" as plotted on the right-hand side. (14)





GRAPH N° 14: Difference in productive structures between countries with similar levels of per capita Wealth in absolute values but very different productive structures, the first with a strong Steering s and good Productivy p, and the second possessing mainly valuable Material Resources, k.

To bring this section to a close we shall take up the two aspects which we feel should be explained as endogenous elements within the proposed conceptual framework: technological progress and the creation of human capital.

The proposed conceptual framework should, then, be considered to already encompass all references to technology or technological progress, a concept which is not acceptable as a causal factor inasmuch as it consists of machines, formulas or processes (material resources), as well as technical production know-how (productivity) or, mainly, what we have termed Steering, which covers persons who have invented, pioneered, organized and directed, demonstrating a proven skill for doing so. Explaining and reflecting the process of technological change as an element endogenous and essential to the economic process is one of the aims of this new conceptual framework, but by specifying and breaking it down into its causal factors: primarily the creative-enterprising human resource and, to a lesser extent, the directly productive human resource.

Technology by itself is unable to control the complex economic process as far as it is an eminently social phenomena. On the other hand, technological change could be an important source of social problems. It is evident and it is increasingly being included in widespread analysis of the corporation that the ethical dimension of a wise and fair management -and this could be extended to the whole economic activity- is not only something essential but that it shows up increasingly in long term results of the corporation. This ethical dimension is again mainly a responsibility of the leading managerial resources. We stress that the variable technology, as such, is unacceptable as an independent causal factor for the given reasons and especially because of methodological considerations which will be referred to later.

The concepts of Productivity and Steering also take in all concepts of human capital, except that it is more explicitly and clearly differentiated from capital of a material nature. It is also a specific aim of this conceptual framework to attribute far more importance and precision to the involvement and influence of this human factor in the economic process, as one can clearly see

Generally speaking, then, most of those reasons which are normally used to explain the residual should be incorporated within the conceptual framework itself and no residual should be able to be accepted as an explanation of or justification for discrepancies with empirical results.

As a last observation in this section it should be pointed up that the selection made of the causal factors is nothing other than a revealing within a theoretical system of actual facts of real life and everyday criteria for action which managers and statesmen as a whole and, in general, those who in practice have to take action, consider obvious and plain common sense, for it is on their basis that they act. If this is true then it shows that we are moving in the right direction for, unlike the theorist, the man of action cannot afford to be significantly wrong in his judgments, for society's mechanisms would quickly take care of letting him know his mistakes, and usually a very high personal cost.

Finally, and to close this section we shall try to summarize and outline the information that has been given thus far in the summary table below.

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	EXISTING CONCEPTUAL FRAMEWORK			PROPOSED CONCEPTUAL FRAMEWORK			
	PRODUCTION FACTORS		HISTORICAL ACCUMULATION	VECTORAL COMPONENTS	CAUSAL FACTORS OF PRODUCTION	COMPRISED OF	HISTORICAL ACCUMULATION COMPONENTS OF WEALTH
	VERSION A	VERSION B					
Material resources	K (includes land)	K (includes land) and human capital	k	$\bar{i}$	K' (Material capital)	Natural resources Machinery Energy Financial resources Information	(Per capita accumulated material resources)
Human resources	Other (residual, etc.)	L		$\bar{j}$	L' (Productive human resources)	Effort skills	P (Per capita historically developed productivity)
	L			$\bar{k}$	L'' (Creative-enterprising human resources)	Talent Creativity Entrepeneurship Guidance	S (Per capita Steering, historically retained)

1.3 The practical difference between Productivity and Steering.

Up to now we have approached our idea from a purely theoretical viewpoint. But would it be possible to easily visualize in aggregate terms the breakdown we have made in human resources if we looked at the matter from a practical point of view? Can this breakdown and the proposed approach in general help us in analyzing a specific phenomenon? We shall try to answer these two questions in this section and the next.

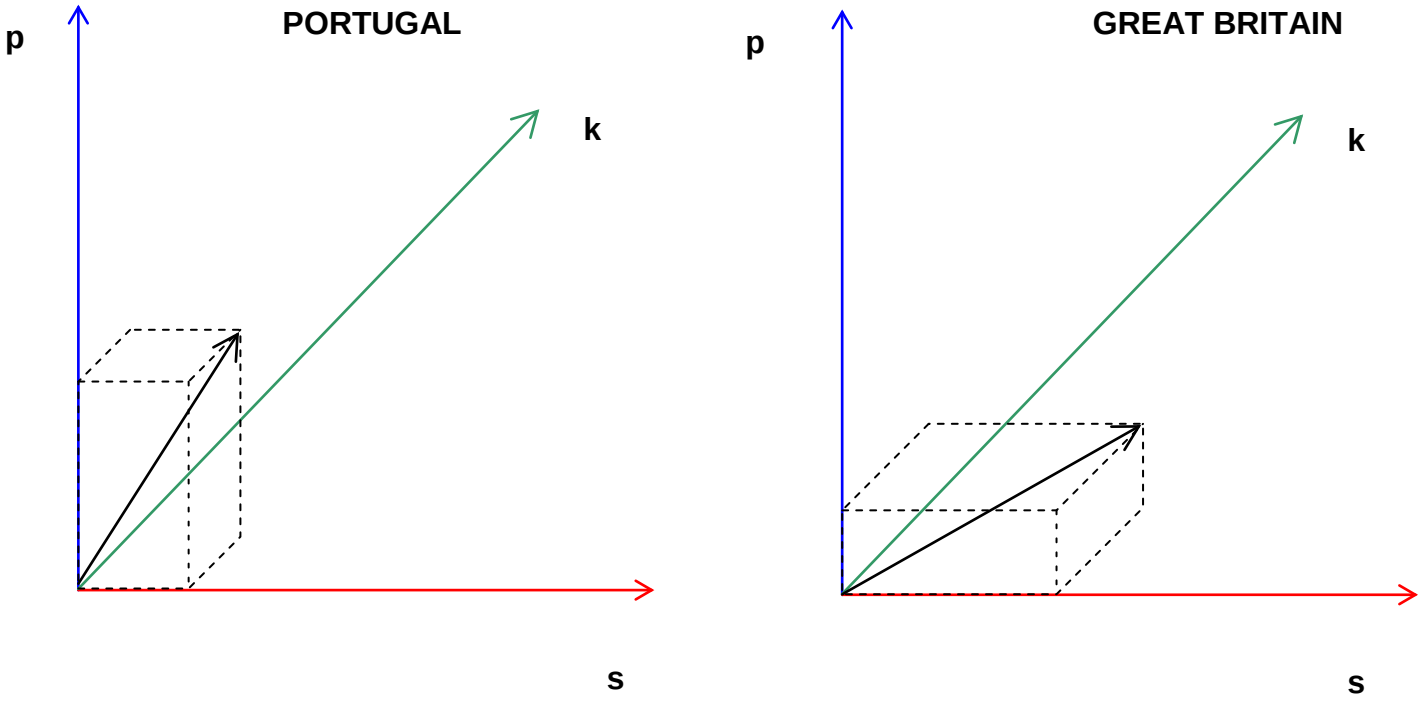
We believe that the conceptual difference between Productivity and Steering (between p and s) is expressed in a real and tangible difference between the two factors, "p", shown in per capita values, is more or less constant for a country or it is most unlikely that it will drop sharply, at least in the very short term. "s", on the other hand, is by definition extremely mobile and may rapidly move from one country to another; therefore, it is capable of increasing or decreasing very swiftly and significantly, even in per capita terms (in fact, I sincerely feel that this would be the critical factor in any theory to be devised because of its shortage in the world today).

Stated otherwise, even in the presence of extremely marked migratory phenomena according to the scales prevalent in the second half of this twentieth century, and especially because mass migrations are no longer acceptable, "p" cannot vary abruptly in per capita terms. Nor would major wars, widespread starvation or other calamities cause it to do so significantly, "s", on the other hand, is capable of migrating or remaining put, dropping significantly in value over a very short period or ballooning rapidly. (I believe that while trying to construe a theory, these rapid variations in "s" will be precisely the main reason for variations in "p").

1.4 The case of international trade

I believe that the examples given clearly show that the conceptual framework proposed is well-suited to dealing with production problems at the microeconomic level when approached in terms of factors k', I' and I''. It is also evident that it is helpful in representing degrees or relative levels of economic development of different countries and that it would facilitate making comparisons among them. Less obvious, however, is the way in which it could be used to help analyze problems of international trade. Let's try to demonstrate this with a very simple example.

We shall repeat the analysis made at the beginning of this chapter, but in further detail. Let's take the classic example of Portuguese wines which are traded for the same value in English fabrics or manufactured goods. We'll explain the situation using the proposed conceptual framework to compare matters at the beginning with the results occurring (in an obviously fictitious description which seeks only to get to the bottom of the matter) over a century's time. Let us assume a point of departure that is more or less common and two structures that are quite similar, graph 15.



GRAPH Nº 15: Trade between two countries of the Laboralia **and Industralia type respectively begins with very similar productive structures.**

At the end of a certain length of time the two countries would have augmented their material resources, but in varying amounts. This would not have given rise to a very significant difference. The important point is that although there would be an inherent potential for enhancing the productivity of wine grape cultivation and the preparation of wine, it would not be very noteworthy. In the case of the fabric industry, however, there would be a great potential for simultaneously:

a.- Applying the factory principle as explained by, for example, Georgescu-Roegen (15) (a linear process instead of a parallel process which would make it possible to put the capital equipment to use continuously and not successively);

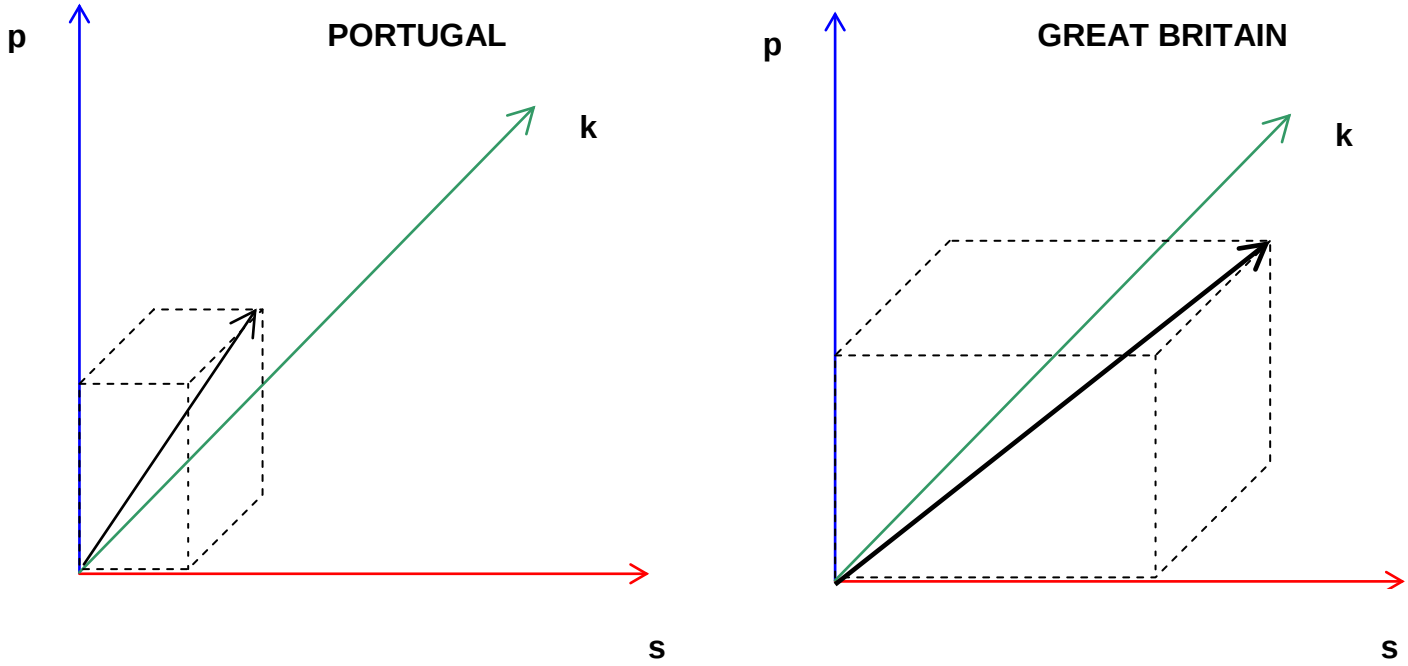
b.- Using either hydraulic or coal-generated energy for production through hydraulic or steam-driven machinery; and

c.- Reaping the benefits of a growing specialization stemming from the technical facilities or demands and from the growth of the market.

For these and surely other reasons unique to the manufacturing process the per capita productivity of the English worker would have been increased to a far greater extent than that of the Portuguese worker.

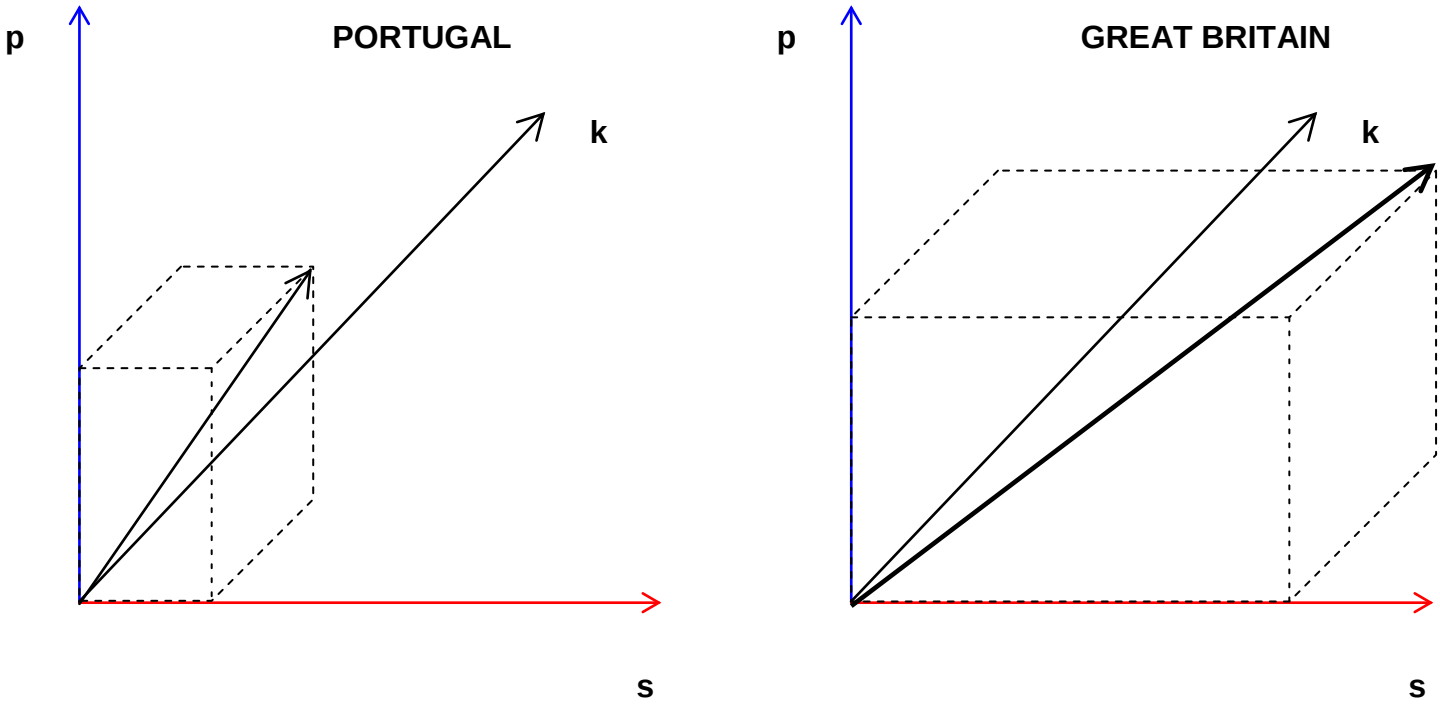
Furthermore the more complex structural organization and the growing need for capital

would have called for a proportionally greater amount of Steering in the English case as a result of the very needs of the fabric manufacturing process. This is shown in graph 16.



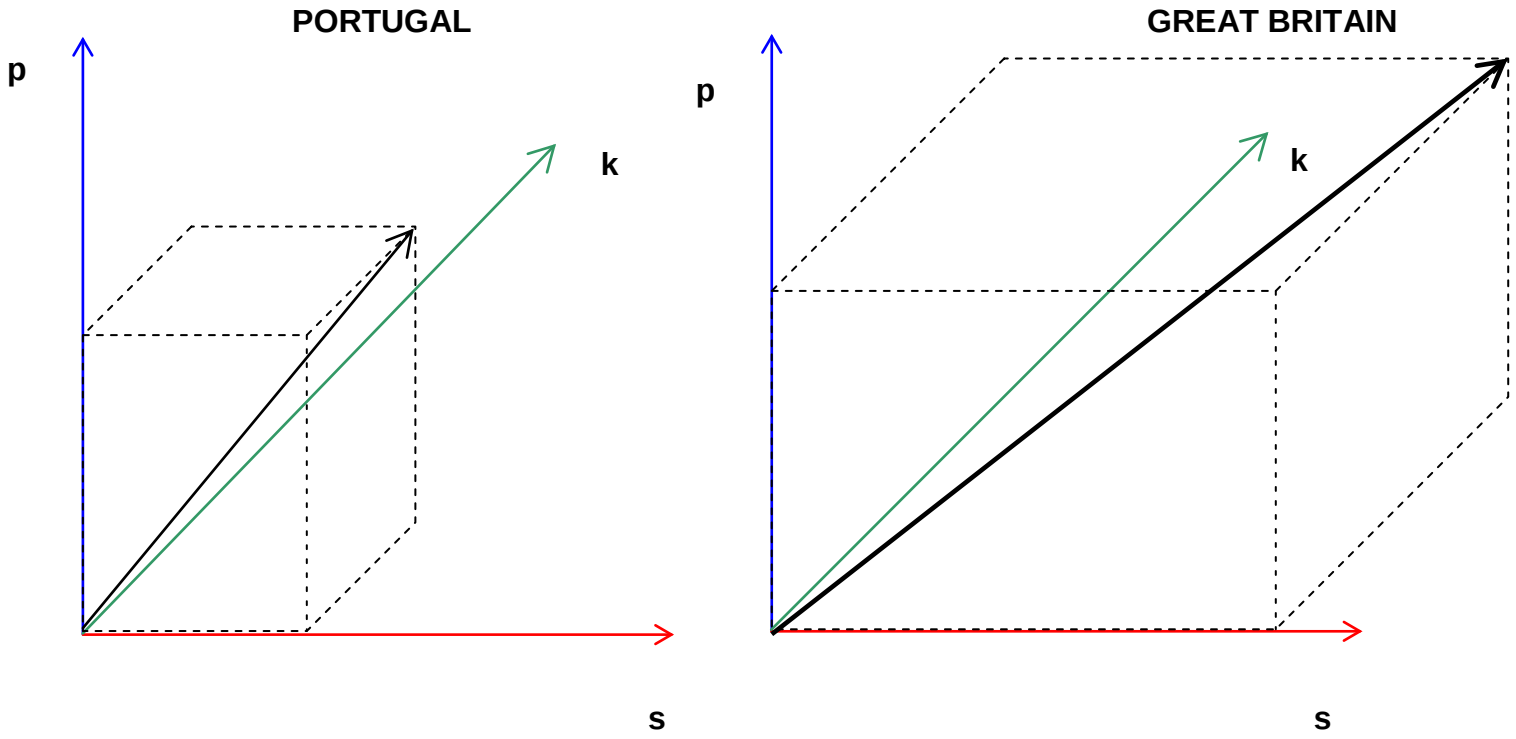
GRAPH Nº 16: Differences in the three factors of production begin to appear, as trade goes on, in favour of the country of the Industralia type.

Inasmuch as the goods would have to be transported, as their production grew, the very same technical principles, skilled labor and Steering that had proven capable of manufacturing the looms and the steam engines, would soon be capable as well of building steamships which, over a given period, would far surpass the Portuguese ships initially used to move a value in goods equal to that of the English. The shipbuilding would have, once again, enhanced English productivity and Steering, as well as its material resources, as demonstrated in graph 17.



GRAPH Nº 17 A process with a feed back effect among the three factors of production enhances the differences between the two countries.

By this time the difference between the two countries would be significant. The country responsible for transportation would soon find itself in a position of having to build up a powerful fleet which, irrespective of any aspirations for conquest --and even more so if such are present", would open up new possibilities for benefiting from the products and markets of other latitudes. At the same time, this would require more sophisticated government action and a more serious and effective diplomacy than that of other countries. The result would be an increased Steering per capita but, above all, would be conducive to technical and university education which, through interaction with the manufacturing industry and thanks to its support, would advance strongly. Technological progress would spiral and soon the difference between the two countries would be abysmal, as may be noted in graph 18.



GRAPH Nº 18: At the end of a century the benefits of trade have accrued to both countries but differences in their per capita wealth have become overwhelmingly in favour of the country of the Industralia type.

Throughout this process the value of the goods traded by the two countries would have been set by the market at exactly the same amount so the two countries, theoretically, would have benefited equally from the trade. Without a doubt, in absolute terms Portugal would be in a far better position after the trade than if it had not entered into it at all. But this is not necessarily true in relative terms, for the gap between the two countries would certainly have widened and England would objectively speaking have assumed a position of economic supremacy over Portugal. This is not to say that we are arguing against international trade, or that we deny its undoubted advantages, provided that these are clearly understood by both nations thanks to an accurate theorizing of the process, but our thesis makes it possible to explain the historical changes in the terms of trade on a causal basis.

As a possible aftermath one can conceive of an even more adverse situation for Portugal, with the hypothetical discovery in time by a Cambridge professor of a chemical process for making a first class port from wild blackberries; this has fortunately not happened although in other cases, such as those of saltpeter for use as a natural fertilizer, and rubber, in Latin America, it has.

Thus far we have tried to show very schematically that the proposed conceptual framework appears to be well adapted to, with one and the same approach, considering three kinds of interlinked problems which we have sought to analyze on a long-term basis: production, economic development and international trade. Over the rest of this study we shall delve deeply into the first two problems, leaving the third for a later work.

The next chapter shall be devoted to considering the possible novelty of the proposal in a more orderly and systematic way.

NOTES

(1) It should be stressed that this idea is not new. List, in the work previously cited, speaks of the nation's wealth in these terms: "in all latitudes and in all ages the intelligence, morality and activity of the citizens have been closely linked to the welfare of the Nation and its wealth has increased or decreased in accordance with the greater or lesser amount of those qualities in evidence." Op.cit., page 103.

(2) In his "Theory of Production," Georgescu-Roegen distinguishes between two elements. The funds are construed to be all elements which enter and leave the production process, for example, land, labor and so forth. The second element, the flows, are the elements which enter or leave the production process; these are, for the main part, inputs, or the product itself. The only way funds can be involved in production is as services. Georgescu-Roegen, The Entropy Law and the Economic Process. Chap. IX, Harvard University Press, Cambridge, Massachusetts, 1971.

An elementary and graphic explanation can be found in the work of Adolfo Figueroa "Algunas notas sobre la Teoría de la Producción" Serie de Ensayos Teóricos N. 1, Set 1973. Publicaciones CISEPA, PUC.

(3) Equivalent to the scalar product of vector $\overline{O}$ by vector $D = \overline{i} + \overline{j}$ (a "diagonal" at 45 ° whose absolute value is the square root of 2) . The scalar product of the two vectors is equal to the product of the multiplication of the modules by the cosine of the angle which they form. Stated otherwise:

$\overline{\mathbf{O}} \cdot \overline{\mathbf{D}} = |\mathbf{O}|\,|\mathbf{D}|$ x cosine (of the angle between $\overline{\mathbf{O}}$ and $\overline{\mathbf{D}}$).

Therefore, the scalar product of $\overline{\mathbf{O}}$ and $\overline{\mathbf{D}}$ would be:

$$\sqrt{(3^2 + 2^2)} \times \sqrt{(1^2 + 1^2)} \times \text{COSINE}\ (10^o)$$

3.61 X 1.41 X **0.98** **= 5.00**

This is what is done in traditional economic theory when it lumps as Output the value added both by material and human factors considering them as something homogeneous; conceptually, this would be to project $\overline{\mathbf{O}}$, or its components over the axis at 45 ° over which most of traditional economic analysis which frequently ends up in a single dimension would ordinarily take place.

In other words traditional economic theory employs a certain metric and we are proposing to use a different one: The euclidean metric which has been so fruitful in the classical explanations of the physical world. It could eventually be made even more complex if it is deemed necessary to go beyond this to the spaces of modern physics. See also footnote in Page 16.

(4) These three units shall, in accordance with the economic, political and social systems, be divided among wages, interest and royalties or profit and these, in turn, shared in one way or another among the various social actors.

(5) Present value is defined as the summation of all of the possible income flows to be obtained, brought

forward to the present by applying discount rate "i"; as a result, we have:

Present value of the capital stock: $Kp = K \left[\frac{1 - (1 + i)^{-n}}{i} \right]$

Similarly the present value of the cost of labor would be

$$Lp = L \left[\frac{1 - (1 + i)^{-n}}{i} \right]$$

(6) Not necessarily the most important, but the most critical for the underdeveloped countries at this moment.

(7) In amounts above the minimum proportions required to continue producing at a certain moment in history.

(8) Investment in human capital has an influence on both the labor factor and Steering. It is for this reason that when measuring them the portion affecting each factor shall be considered separately.

(9) So that the consumption needs of each individual person may be implicit in them.

(10) This valuable idea was suggested by Professor Leonardo Polo.

(11) One is now better able to understand why it is essential to use vectorial notation.

(12) The value shall be calculated in a way similar to that indicated in note 3, as the scalar product of anyone of the three vectors, let's say $\overline{\mathbf{A}}$ for vector $\mathbf{D} = \mathbf{i} + \mathbf{j} + \mathbf{k}$ (a "diagonal" vector whose absolute value is the square root of 3 and is oriented in such a way that its three director cosines are equal).

(13) To return to List, we insist once again that this concern for production structures dates way back in economic writings. He maintains that: "Adam Smith's well-known work is entitled "The Nature and Cause of the Wealth of Nations". The founder of the reigning school indicated exactly in that way the dual viewpoint from which the economy of nations should be approached, as should that of individuals. The causes of wealth are very different from the wealth itself...The ability to create wealth is, then, infinitely more important than the wealth itself." Op. cit., page 123.

(14) By "technological north" one should understand the path set by the country which has the most advanced technology in a certain field.

(15) R. Georgescu-Roegen, "Process in Farming vs. Process in Manufacturing: A Problem of Balanced Development": Chamberlin's New Economics and the Unit of Production, in Monopolist Competition Theory: The economics of production". American Economic Review. May 1972. Adolfo Figueroa, Op. cit. page 5.

CHAPTER 2

POSSIBLE NOVELTY OF THE IDEA

In which aspects could this conceptual framework be considered new? I shall try to review them, even at the risk of being somewhat repetitious.

1.- The components of the conceptual framework that is, both the set of causal factors and the "product" or resultant of the economic activity, the output are in some measure conceptually different from those used previously. The technological change must be explained within the conceptual framework and as part of the economic process. The idea of Human Capital is incorporated, but in a different sense. Wealth or the value of the production structure is created through the accumulation of the three causal factor or inputs.

2.- These causal factors are of necessity functions of historical time -real time- and never non-temporal amounts; the course of development of wealth within a supposedly valid theory should be fully explicable by variations (which must be established) in the three causal factors; if one wishes these may be affected by coefficients reflecting other social phenomena or the working efficiency of a given factor. All courses of economic and historical development of any unit of analysis whatsoever should be explicable in terms of the accumulation or dispersal of these three sole factors, to wit: material resources and human resources, the latter classified into two kinds as explained below.

3.- In defining the conceptual framework far more importance has been placed on the explicit performance of the human being than has traditionally been the case in economic theory, whether classical, neoclassical or Marxist. The emphasis should be shifted from the goods and services produced, and from the corresponding transformation and accumulation of material resources, to the qualitative change in the human agents involved, organized for production as families, enterprises or nations. For this reason there is a proposed differentiation of human resources into two kinds, with the leadership role, entrepreneurial labor, invention, innovation and so forth being stressed and set apart. To sum up, the three causal factors shall accordingly be Material Resources, Labor and Steering, always considered on a per capita basis.

4.- The permanent presence of at least three inputs or causal factors, even after having simplified matters as much as possible, makes it necessary to always employ a three-dimensional space in which both inputs and outputs are dealt with as vectors or "directed quantities" and not scalar amounts, for the reason given.

5.- The emphasis of the conceptual framework is clearly placed more on the creation of wealth than its distribution or the analysis of the optimum conditions for producing and trading such goods.

6.- The purpose of the proposed conceptual framework is to furnish the necessary concepts for the development of theories to explain fully the economic, historical and true course of development of the economic units, whether such be firms in a Production Theory or

regions or nations in an Economic Development Theory; International Trade Theory shall also be influenced by these new approaches. As shown in the foregoing chapter, this last theory should also be adjusted to account for the dynamic effects of trade on the countries' production structure.

7.- Economic development is not construed solely as a build-up of capital, either in a broad sense or merely a material one, which could be assimilated to the denomination of growth, nor is it considered in a broad and comprehensive sense as the totality of the social, economic, political and cultural development process. Economic Development is understood to comprise one of the multiple facets of a highly complex process of economic, political, social, legal, ethical and cultural change, whose economic component is isolated mentally and exclusively for purposes of analysis. This does not imply in any way whatsoever that in the description and understanding of Development the economic aspect should be given more importance than the rest, nor that this facet could or should be isolated when analyzing society with a view to taking some sort of action, as is usually the case. (1) It is only with the aim of understanding and explaining it that economic activity is conceived as a social process which, in addition to generating a change and producing an accumulation of material resources (and a redistribution of the goods and services produced among the economic agents), also brings about significant changes in quality of the human resources involved as economic agents. These latter changes (whose consequences are indeed broader than its economic effects) should be capable of being measured and their contribution to the total effect of economic activity in society should be taken into account equally as much as the changes or variations in the material resources involved, especially when dealing with problems such as those of economic development and production in the very long term.

Hence economic development is understood to mean the simultaneous growth of all of the causal factors of production (in such a combination, predetermined for each moment in history, that a minimum amount of each of these factors is essential to make the economic unit under analysis viable in a competitive world). There should, as a result, be a biunivocal correspondence between the growth of the factors and the growth of what we have defined as "wealth". This is clearly different from the "parabolas" of the modern neoclassical Theory of Economic Growth, as well as from the globalizing views of economic development, according to which the economic aspect should not be separated, even if for analytical purposes only, because of the extreme complexity of the social process. These points are better analyzed in the following section.

In emphasizing once again that the aim of the study is merely to explain and understand one of the many facets of a highly complex social process and asserting very explicitly that no rules of behaviour of any kind may be deduced directly from this understanding or explanation, for operating in a real society (because all of the other social, legal, ethical, cultural, political and historical factors should be taken into account in each case), one has the conviction that this isolation or separation of a single facet is legitimate, and may prove fruitful as well, as the example-filled history of science is well equipped to show. Otherwise, the task of explaining such a complex social phenomenon would turn out in practice to be unattainable in the current state of development of the Social Sciences.

NOTES

(1) In this case the other social, political, legal, cultural and especially ethical dimensions should be considered in the analysis previous to the decision leading to action. Here we are deliberately making an abstraction to isolate the economic facet, on which the other facets undoubtedly reflect, just as this one is reflected on all the others.

CHAPTER 3

DIFFERENCES AND SIMILARITIES WITH OTHER AREAS OR APPROACHES OF ECONOMIC THEORY

Another way of distinguishing the purpose of this study is to fix its limits with areas of Economic Theory or with specific aspects or approaches of it, while seeking to point up the possible differences or similarities. The grounds for the following assertions would have to be established in far greater detail and we shall leave such for another essay.

1.- The attempt to propose a new conceptual framework that would review the causal factors of Wealth, and the latter in itself, could be inscribed within the terminology used at one time by Hicks in his study "Revolutions in Economics" (1), in a return to the Theory of Wealth of the erstwhile classical authors (that he calls Plutology) which was in some measure replaced by the distributive biases of Ricardo and Marx and definitively by the transformation of the economy into a science of economic intercourse (that he calls Catalactics), starting with the marginalists; this latter approach, which is still current, has, according to him, permeated all economic theory of this century, colonizing both Welfare Economics and the Theory of Growth. (2)

2.- As regards the latter, although a certain affinity could be discerned with some of the approaches at their origin in the 1950's, it is clear that by the '60's the Theory of Growth had taken a different course becoming a Neoclassical Theory of Growth which could at best be described as parallel. Its immediate aim is not to arrive at the best possible explanation for the historical experiences of economic growth and it explicitly sets aside the problems of development of the backward countries. (3)*

3.- The divergence from the concerns of Development economists, at least over the last three decades, is perhaps even greater. In this study we are skeptical of the possibility of obtaining acceptable theoretical results from the isolated treatment of specific aspects of the very broad and complex task of achieving economic development ("The piecemeal approach of Development Economics") (4); we are even more skeptical of the possibility of grounding on scientific bases proposed Strategies for the Economic Development of a given country unless one has a scientifically-based Economic Theory that is coherent and fully corroborated by facts. If such does not exist, as seems to be the case, then it would be preferable to admit the fact and to actively seek out one (a true all encompassing Theory of Economic Growth that fits historical facts) rather than to work with substitutes as if they were scientifically based and not merely simple tools to be used in the absence of something better. (5).

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* **As** mentioned in the prologue the work of Paul Romer and colleagues in the past decade seems to be a radical and influential departure from Neoclassical Growth Theory. There seems to be similarities between their approach and the ideas in this work.

4.- As stated, there is a very obvious difference between the proposed approach and globalizing views of economic development such as those of Perroux, those which have developed around UNESCO, or those of Celso Furtado (6), which call for a new conceptualization of economic development, but by visualizing it, even for strictly analytical purposes, as much more than a phenomenon that is primarily economic (which is doubtlessly quite true); as a result they emphasize the need for spanning the gap and receiving contributions from other social sciences.

This work, on the other hand, intends to abstract the economic facet from the highly complex phenomenon, exclusively for purposes of analysis and understanding. Making the problem more complicated will most likely lead nowhere, as shown by the results of scientific research in other fields.

5.- There is an even clearer distinction between the proposed framework and the Marxist approach to problems of Development and, in general, the entire body of economic theory of this school which denies the possibility of encountering causal factors which are independent of the social order of the historical process, or of the stage of evolution of that social order -in other words, variables capable of explaining the production process in any kind of society. We feel that within this Marxist approach causal variables cannot be applied which of themselves are able to explain the historical effects, without always taking into consideration the distribution of the product and the surplus among the different social groups or classes and which, as a result, do not make all economic phenomena dependent on the system under which the economic activity is carried out (both from the standpoint of the worker's relationship with the means of production and from that of the appropriation of the surplus). On the contrary, the proposed conceptual framework seeks to explain the production process over the centuries, abstracting the sociopolitical system under which the economic process evolves.

6.- The foregoing does not mean at all that the resulting distribution of product or wealth, under one or the other system, cannot and should not be borne in mind when devising a theory, but that it is not one of the causal factors of wealth, although it may have a distinct regulating effect on it. Similarly, as Hernando de Soto's "El Otro Sendero" (7) shows very well, the legal and political regime that is on the root of what he calls Mercantilism has profound negative regulating effects on the level of development but neither is it, notwithstanding its importance, a causal factor in the sense we are using the term.

7.- There is complete agreement between this conceptual framework and the concept of "capitalization" of the human factor, and also in regard to the importance of the latter. In fact, it is this that has been attributed a priority role, but perhaps it should have been termed "human enrichment" in order to leave the word "capital" once again to refer to material aspects only.

This human capitalization or enrichment should, further, be divided conceptually into a general increase in productivity (which would cover investment in general education and in training, as well as the results from investments in health or nutrition, and so forth) and the enhancement of Steering which, although also influenced by education

and training, is determined to a far greater extent by another series of more complex social factors already indicated. But not only is there a problem of creating this element, but also of retaining it and putting it to full use (as it may easily emigrate or remain inactive or unutilized in the absence of favorable conditions).

A more detailed analysis of this general aspect of human capital may be made by commenting on the works of Theodore W. Schultz (8), who states that a hallmark of the modernization of the economies of high and low income countries is the decline in importance of land, simultaneously with the growing significance of human capital, knowledge and skill. He goes on to add that"... natural resources, physical capital and labor are not enough of themselves to develop high economic productivity. Human capacity is essential to the dynamic development approach." The proposed conceptual framework is aimed in this same direction but, however, our approach appears to go beyond the bounds of Schultz's work in that it permanently incorporates the human factor in its analysis and goes so far as to make a conceptual distinction within that factor in order to enhance the precision of that analysis.

8.- There is certain agreement with the features which Kurt Doppfer in his book "Economics in the Future" proposes for a new economy when he highlights four characteristics which, were they to develop, would constitute a new economic paradigm, and with which the new framework coincides with the first three. In the first place, a new basic theoretical proposal is needed, stemming from an observation of the present environment. In the second, the economy should have a long-term outlook and events should be viewed with a historical perspective. In the third, the orientation of economics should encompass the observation and evaluation of a large number of empirical elements which would serve as the basis for the formulation of new hypothesis and new theories. And last, an economic policy outlook is needed in order to be able to apply the theory to actual conditions (9). This fourth characteristic would only become possible within the new framework at a later stage, after a proper theory has been devised and corroborated.

9.- There are also coincidences between the concept of Steering and several other specific proposals that should be mentioned. Luigi Pasinetti in "A new theoretical approach to the problem of economic growth" refers, although very superficially, to the industry oriented learning process which leads to the progress of societies.
In his proposal for a pure production model he states: "All commodities considered are produced, and can be made practically in whatever quantity may be wanted, provided that they are devoted to the amount of efforts they technically require. Limitations of course exist, but not in the material world: they only reside in the knowledge and power of activity of Men."(10)

There is apparently a closer agreement which we have thus far been unable to explore further, with the concept of "inmaterial capital" ("Fahigkeits Kapital"), proposed in a manuscript (only known by indirect reference) of Professor Kneschuarek of St. Gallen (11).

Lastly, as the quotation from Galbraith to be discussed in Chapter 5 shows, his concept of "organized intelligence" is certainly quite similar to Steering. (12)

NOTES

(1) Sir John Hicks, "Revolution in Economics", in Method and Appraisal !n Economics. Ed. Spiro Latsis, 1976.

(2) Sir John Hicks, Op. Cit., Page 215.

(3) The clearest reference made is in the famous survey carried out by F. Hahn and R. Matthews, "The theory of Economic Growth: A Survey", Economic Journal. December 1964, pages 770-772., where they point out the change that has taken place since Abramovitz's survey.

(4) An example of this approach could be that used in the book written by Pan A. Yotopoulos and Jeffrey B. Nugent, Economics of Development. Empirical Investigations. Harper and Row, New York, 1976.

(5) See for example what Tom Stonier of the University of Bradford says in that regard when he points out that "one of the great tragedies of our time is that we have not yet developed the theory to cope with economic realities." In Wealth of Information, a profile of the post Industrial Economy. page 150, Thames Methuen, London 1983.

(6) Francois Perroux, Pour une Philosophie du Nouveau Developpmement, Aubier-Les Presses de I'UNESCO, 1981.
Xavier Greffe, Report on the analysis of InternationalTransfer of Economic Knowledge. UNESCO 1978.
Celso Furtado, Prefacio a Nova Economía Política. 2a Ed. Paz e Térra, Rio de Janeiro, Brasil, **1977.**

(7) Hernando de Soto, El Otro Sendero. Ed. Barranco, Lima 1987.

(8) Theodore Schultz, Investing in People. University of California Press, Berkeley and Los Angeles, California, USA.

(9) Kurt Doppfer, Economics in the future: Towards a new paradigm. London, The McMillan Press Ltd., 1976.

(10) Luigi Pasinetti, "A new Theoretical Approach to the Problem of Economic Growth", in Semaine d'etude sur le role de l'analyse econometrigue. Pontificiae Academiae Scientiarum, Scripta Varia, 1962.

(11) Franz X. Stirnimann, in Die rolle des Aktienmarketes in der Langfristigen Wirtschaftiichen Entwicklung Kolumbiens: Eine empirirische analyse refers to Francesco Kneschaurek's manuscript "Die Lehre von der wachsenden Gesellschaft", on page 7.

(12) See note 7 in Chapter 5.

CHAPTER 4

THE METHODOLOGICAL BASIS FOR THE PROPOSAL

We have tried to give an initial picture of the proposed conceptual framework (to be developed in greater detail and depth in the next chapter), using for that purpose economically-oriented approaches and outlooks. We have not yet touched upon the methodological aspect referred to in the introduction and which will now be taken up.

The discussion of methodological aspects is considered important for three reasons. First, it constitutes a significant part of all of the work done and appears to be coherent with the conclusions reached via analysis from an economic viewpoint. Second, the discussion of these so-called methodological aspects can perhaps help to clarify the proposed concepts. And third, if one accepts the fact that a more or less radical change in the usual conceptual framework is being proposed, then it would appear to be desirable to back it up by criteria that are not economic, as some of its implications are perhaps not easily acceptable at first sight.

This methodological basis for the work should be developed in considerable greater detail in a future essay. At this time, however, we would like to present only the main findings of this analysis to help complete the overall picture we are seeking to give in this first essay, and leave the detailed grounds for it to a later time.

We would like to refer to four main aspects: (1)

4.1 The state of development of the social sciences from a methodological viewpoint

Nagel states in his work "The Structure of Science" that some of the social sciences are, within the panorama of scientific development in general, in a stage through which other sciences mature today passed many years or centuries ago, as the case may be. This constitutes the stage of struggle to achieve useful and reliable formulations of kinds or classes of human beings and social institutions as a step prior to a stricter theorization.

In keeping with that judgment, the relevant methodological concerns for long-term aspects of economics are considered to be those which other sciences shared in their early stages. Thus I believe the problem we are examining, and in general many problems being faced by the social sciences, are far closer to the problems confronted initially by more mature sciences or, at least ones involved in a more rapidly maturing process than that of the social sciences; these were early stages during which efforts were concentrated on selecting by different means basic concepts on which to theorize.

Furthermore, the current methodological concerns of the mature sciences are not, for the time being, considered to be very relevant to the social sciences when, as in our case, our concern with long-term problems makes our main aim that of explaining a reality. This is not necessarily true when the prime concern is, rather,

to predict in order to be able to act in other words, to theorize on a reality because of the necessity of acting on it, even though this may be via incomplete or not very satisfactory explanations (as inevitably happens in many other kinds of economic problems).

We feel that what Nagel asserts agrees fully with our attempt to establish a new conceptual framework (by redefining Capital and Labor and adding Steering), as this consists basically of making changes in the classification of entities considered acceptable up to now as the main variables of the analysis, for the idea is that a new classification, using the different concepts proposed, may help to better describe and explain reality.

Nagel's idea, which obviously refers as much to the social sciences as to the more mature ones, is worth reproducing in part as follows: (2)

> "...The discovery and classification of kinds is an early but indispensable stage in the development of systematic knowledge; and all of the sciences, including physics and chemistry, assume as well as continue to refine and modify distinctions with respect to kinds that have been initially recognized in common experience. Indeed, the development of comprehensive theoretical systems seems to be possible only after a preliminary classification of kinds has been achieved and the history of science repeatedly confirms the view that the noting and mutual ordering of various kinds "a stage of inquiry often called "natural history"- is a prerequisite for the discovery of more commonly recognized types of laws and for the construction of far-reaching theories. Modern physics and chemistry did not come into being until after such preliminary classifications of kinds (whose beginning are lost in primitive antiquity) were accomplished; traditional botany and zoology consist largely of specifications and subordinations of kinds; and <u>some of the social sciences are still struggling to achieve usable an reliable formulations of kinds of human beings and of social institutions.</u> The recognition of different kinds or classes goes hand in hand with the subordination (or inclusion) of one kind or class within the other."

My belief is that by attempting to reclassify the factors of production into Material Resources and Human Resources and then further break down the latter into two (Productive Human Resources which give rise to Productivity and Creative-Enterprising Human Resources which generate Steering), in other words, in proposing a new conceptual framework, one achieves what Nagel considers to be a necessary stage in the development of any science.

We are fully aware, as is Nagel, of the enormous differences existing between social sciences and "hard" or more mature sciences, but this proposal is inherent to any scientific approach, irrespective of the subject matter involved or of the philosophical view of the different philosophers of science at this time in regard to the matter (3).

4.2 A new methodological approach to social sciences from a neorealist outlook

In choosing the variables for the proposed conceptual framework and in visualizing the way these variables could be used to develop an economic theory capable of explaining long-term phenomena, we have followed very strictly the proposals of a new current of the philosophy of science (one of whose most important exponents is Professor Harre of Oxford University) which we could term neorealist (4). It may be described as a philosophy of science which questions the main approaches used by science since the eighteenth and nineteenth centuries and in the social sciences up to the present, all of which, for purposes of simplicity, could be called very loosely "positivist". Below we explain the two main aspects in which this neorealist approach plays a part:

a. The realist or neorealist position coincides with most of the other scientific approaches in its conception of science as a rationally, objectively and empirically-based undertaking whose purpose is to provide us with knowledge that truly explains and predicts the behavior of nature.

However, in the realist or neorealist approach, unlike those which appear to have predominated in the social sciences, there is an important difference between explanation and prediction. And it is the explanation facet which should be sought as the primary objective of science, with prediction being a derivative or a consequence of explanation. To explain a phenomenon is not merely to demonstrate that it is a well-established case of regularity; on the contrary, one should discover the necessary connections between phenomena by gaining an understanding of the underlying structures and mechanisms in operation. In other sciences this has meant going so far as to maintain the existence of kinds of entities that cannot be observed and of processes with which we are not familiar;
but it is only in that way that we can go beyond the "mere appearance" of things to reach their very nature and essence. Thus, for the realist a scientific theory is a description of structures and mechanisms that can causally produce observable phenomena, a description that permits their explanation. (5)

Another way of presenting this neorealist position is by trying to situate it within a historical context, with all of the oversimplification that this implies. It should be stated that the realist position was systematically articulated by Aristoteles, developed by medieval philosophers and continued up to the scientific revolution of the seventeenth century and onwards, with Locke being an example of a philosopher sharing this approach. The neorealist approach, however, differs from the philosophy developed by Hume and Berkley from Ockam's beginnings and which appears in the field of social sciences to have continued exerting an influence in the nineteenth and twentieth centuries (Hume's influence on Adam Smith is a well-known fact). The realist position is also antagonistic to logical positivism and to the analytical philosophy of Witgenstein, Ryle and Austin.

It is the essence of the realist proposal to consider that it is not enough to merely prove the existence of regularities, although this is certainly necessary, but also to explain them causally "in other words, by identifying what we have

called in our conceptual framework "causal factors"; then, by means of a process of successive approximations the underlying structures of mechanisms in these causal factors are to be unearthed so that the reason for the existence of the regularities might be explained and not merely the fact of their existence recognized.

This criterion involves the imposition of severe restrictions on the entities that may be chosen as causal variables or factors.

The restriction imposed on the causal variables is that of not being able to use any variable as such merely because it is able to explain a regularity; it is necessary also for the structure or mechanism causing the regularity to be explained. To use an obvious example, Residual is not an acceptable causal variable; nor are Organization or Technology because they are variables that are resulting effects, and not causal factors with explicit generative mechanisms.

Generally speaking elements that we could describe as "mixtures of entities" cannot be accepted as factors because their nature is not clear.

Obviously avoiding the use as causal of this kind of variables, whose causal generative mechanism we do not intend to explain as it is only a term facilitating the analysis which does not bear with it a structure that would make it possible to explain its operation (as is the case with the above mentioned concepts of Technology or Organization, for example), is a very important limitation on the choice of variables under this neorealist approach. Here it is worthwhile citing some examples of economic variables which according to this view would or would not be acceptable:

Material Resources is an acceptable variable; its classification as Natural Resources (or Land) and Physical Capital are also acceptable variables (despite the difficulty that could arise in gauging these distinctions, which is another problem altogether).

Labor as a comprehensive description of all human resources present in the economic process is also an acceptable variable.

However, Capital, construed as a mixture of physical or material capital and human capital, would not be acceptable precisely because of the mixture of non-homogeneous resources implicit in this variable and which would make it impossible to unearth its structure and explain its generative mechanisms. (6)

For the same reason a variable such as Technology would not be acceptable either because it is also a "mixed" concept, for technology is incorporated in the material capital, machine or instrument -such as, for example, a computer- or in the minds of persons with a certain knowledge or who have developed the ability to think creatively in regard to a given subject or persons who have a very special or scarce know-how. Thus, there are capital goods which incorporate a certain amount of "technology" or a worker, researcher or executive who knows how to do things. Technology is, as a result, a variable which mixes these two concepts; therefore, it is not a valid or acceptable resource or causal factor.

The proposed conceptual framework strictly respects this limitation as we shall see in the next chapter as we try to delve into the structure and mechanism which generate the proposed causal factors.

b.- The second aspect which neorealist philosophers underscore is the kind of models used by science. To discuss it we should first establish the difference between paramorph and homeomorph. In his article "The Constructive Role of Models", which appears in the book "The Role of Models in the Social Sciences"(7), edited by L. Collins, Professor Harre, one of the main exponents of the neorealist philosophy as we stated earlier, considers the models used by science to be of two kinds as follows.(8)

1.- Those whose purpose is basically to explain a little-known phenomenon by means of an analogy with another better-known process or phenomenon. The latter constitutes the "source" of the model which is, as a result, necessarily different from the "subject" of the model. Harre attributes to this difference between the source and the subject the creative role of this type of model. By way of example, he cites the behavior of a gas, which is considered analogous to the behavior of a group of particles interacting mechanically. We shall call these models paramorphic.

2.- The other kind of model, called homeomorphic, however, is that in which the source and the subject are the same. They are employed in areas that are more representational than creative and their main purpose is to simplify a complex phenomenon and make it manageable. Examples cited by the author: a hydraulic model of an electric network or the model of a vascular system, which are "modeled" on the same kind of system as that under analysis: in cases like this then, the subject and the source are one and the same.

As their role is representational, models of this kind have the merit of being simple, abstract and idealized and in some cases may play a residual creative role when the model makes it possible to envisage relationships not apparent in the original source.

The former models he terms briefly paramorphs and the latter, homeomorphs and he goes on to state that, of course, "sentential models" descriptions by means of some language may be prepared from either one.

What we would like to stress after this long introduction, necessary for presenting the terminology employed by Harre, is the point he makes in speaking of homeomorphs and which I feel would be of considerable interest in our case: "The description of a homeomorph may be treated as a sentential model of the description of its source-subject. I am inclined to think that this is the kind of modeling that is found in mathematical models in economics. The sentences in the mathematical model can be treated as descriptive of a homeomorph of the real economic system. On the whole, economists are not to be thought of as offering descriptions of icons of the generative mechanisms that produce economic patterns."

I consider this description to be correct as to the economic conception of "model". For example, I think it coincides perfectly with the description made by L. Pasinetti in his "Lectures on the Theory of Production", of Ricardo's methodology which clearly demonstrates the mental process of simplifying an extremely complex phenomenon to make it manageable. (9). A further corroboration of the correctness of this judgment is the frequency with which in economic theory references are made to the use of this methodology to explain "stylized facts." (10)

The point we would like to make here, without questioning the usefulness of the homeomorphic model in handling a complex reality, is that another kind of model exists, one that involves a different mental process and whose main purpose is to explain (the paramorphic). The thesis of this study is that to deal with long-term economic phenomena one must look for the explanation by finding the causal factors and their generative mechanisms. In proposing a conceptual model under these assumptions, we consider ourselves to be proposing a model, which doubtlessly is paramorphic, of the economic facet of a more complex social process (the subject), but modeled on a different phenomenon with which we are much more familiar (the source): The trajectories taken in real time by particles (representing production units or countries) in a three-dimensional space in which the components in each dimension are the causal factors, the extent of whose active presence explains their position in that space.

These causal factors are, as pointed out in a) above, in this case entities that really exist and whose generative mechanisms we intend to become acquainted with.

Consequently the emphasis here is not on representing the phenomenon in a simplified way by an homeomorph to make it more manageable. On the contrary, using the paramorph just described we want to be able to explain the phenomenon, taking the necessary steps to end up formulating a theory that can be corroborated.

Only after this theory has been established through its corroboration will it be possible to deduce conclusions from it that may help to make the real situation manageable. We are deliberately leaving this process for a second stage and, methodologically speaking at least, we are still far from reaching it because thus far all we have done is propose a conceptual framework within which to devise hypotheses that will constitute theories if corroborated. (11)

4.3 The inclusion of time

A third methodological aspect which appears to have a determining influence on the analysis of long-term problems -our aim in this case- is the simplification normally adopted by economic theory of not considering the time factor or of introducing it, when necessary, but not considering it to be a matter of historical time; this must

be stopped. Our aim in this study is for the causal factors and resulting variables used in the analysis to be considered at all times as functions of real historical time. Perhaps it would be worthwhile to quote what Celso Furtado pointed out (12) in this regard as a point of departure for one of his analysis, although we do not agree with his proposals and his conclusions, as already stated:

"What concerns the economists are particular social problems that were simplified expressly to be dealt with by certain methods. Generally speaking, this process of simplification consists of eliminating the time factor. The methodological error of this so-called dynamics consists precisely of seeking to reintroduce the time factor while keeping the problems at the same degree of simplification, as if time existed of itself, independently of any content."

The reintroduction or introduction of the time factor should necessarily refer to historical time. (13)

In the case of economics, for the sake of simplicity and considering the availability of reliable information, to understand the phenomena which concern us, it is enough to refer to the last five centuries at the most for it is in these that as a result of the development of navigation and the discovery of America a world-wide economy was formed, primarily because of a process of colonization which has finished today, at least formally.

4.4 The lessons of the beginnings of other sciences

The other valuable source of inspiration for economic theory from the history and philosophy of science is a detailed knowledge of what other sciences did in their very initial stages. Today, perhaps for the first time, we have a more exact knowledge of the facts, as they have been unearthed, not by scientists seeking to bolster their own approaches but by philosophers of science and historians. The analyses made by Dudley Shapere (14) are particularly interesting in this regard.

An example of the usefulness of this knowledge is the analysis of chemistry as a science when, on abandoning the theory of Phlogiston and replacing it by that of Oxygen thanks to Lavoisier, the existing conceptual framework was changed and the course of its development charted. (15)

Another very different methodological aspect which may be interesting to mention in this context is the fact that in our proposal we progress consciously and deliberately to a three-dimensional conceptual framework rather than a two-dimensional one to which, in the final instance and in most cases the analyses of economic theory end up reducing themselves (k, p, and s, or k', I' and I", instead of K and L). In this connection, it is interesting to observe the example of the advances of physics, analyzed by historians of scientific philosophy (16) which give evidence of the following process:

- From the time of the Greeks up to the Renaissance the model of the universe that was used was the Ptolomeic, irrespective of how far away the celestial objects were from the center; in other words, what was important was the form of the trajectories which explained fairly precisely the movements of the planets

around the earth by means of the epicycles but which, when submitted to an in-depth analysis, ended up being a model with only two dimensions, for it was a model which could explain astronomical phenomena in space, irrespective of their distance to the center of the model.

- The conceptual leap signified by the theory of Copernicus and his predecessors and successors constitutes an effective transition to a three-dimensional conception of the universe in which, as is very obvious from Kepler's laws, the distance to the center or third dimension is basic. (17)

- The following step in the theory of physics, to Einstein's conception, is frequently described as the incorporation of the fourth dimension of time as a further variable in the analysis of physical phenomena.

- Finally, as a modern physicist explained in describing the recent evolution of physics at a conference on development and cooperation to an unversed audience, up to eleven dimensions are now being used to try to explain the unified theory of the fields. Said Nobel prize-winner Abdus Salam (18), director of UNESCO's International Center for Theoretical Physics: "Let me, very briefly, say that the idea which is being entertained at the present time to bring about the unification of gravity, electricity and the nuclear force, is to assume that space and time are not four dimensional, but eleven dimensional. And those extra seven dimensions represent electric charge and the nuclear charges. One of the consequences of this will be the detection of the anti-gravity force, now in the experimental laboratories".

What this very rapid review would tend to indicate is that the process of incorporating a further dimension in analysis has been fruitful in other sciences and could also be so in the case of economics.

At least that is our proposal in this study.

NOTES

(1) There are two methodological aspects which have been frequently discussed and which I do not consider to be of any particular interest at the moment for the problem with which we are concerned:

(a) The normative-positive distinction on which much has been written, and

(b) Bringing in to economics the problems of verification and falsification of the kind of analysis made by Popper and the possible changes in paradigms discussed by Kuhn and Lakatos. See in this regard the books by Spiro T. Latsis "Method and Appraisal in Economics" (1976) and Mark Blaug "Economic Methodology" (1980), among others.

(2) In Nagel, "The Structure of Science. Problems in the Logic of Scientific Explanation. Hackett Pub. Co., 1979. The quotation may be found in a note on page 31.

(3) We shall see further ahead that the neorealist philosophical position adopted by this study is critical of Nagel's position which, in more precise methodological aspects, falls, rather, within the broad term of positivism.

(4) Harre's position is discussed briefly, among many others, in George Gale's Theory of Science: An introduction to the History. Logic. and Philosophy of Science, McGraw-Hill Book Company 1979, pages 211 and 212 (and, as I see it, he personally supports that position as indicated in his final conclusion on pages 288 and 289).

(5) This and the following paragraphs rest to a large extent on the analysis made in the first part of R. Keat's and J. Urry's Social Theorv as Science, Routledge & Kegan Paul, London-1975.

(6) See quotation from Harry Johnson at the beginning of the next chapter (note 5, chap. 5).

(7) R. Harre, "The Constructive Role of Models" in The Role of Models in the Social Sciences. 1976.

(8) He defines these models, as opposed to formal models, as iconic, pointing out that they are "things, structures or processes in some kind of correspondence with other things, structures or processes."

(9) Luigi Pasinetti, "Lectures on the Theory of Production", 1972, Pages 8 and following.

(10) We find the following observation made by Solow in refering to the Theory of Growth very interesting: "We are concerned with a drastically simplified history or a "parable", which my dictionary defines as a narration or fictitious allegory (normally something that may happen naturally) that represents moral or spiritual relations. Why not the economic? All one asks of a parable is that it be well stated, not that it be literally true." And on the following page, in referring to Kaldor's "stylized facts", he says: "There is no doubt that they are stylized, but perhaps one would have to ask oneself whether they are facts." R.M. Solow, Growth Theory: An Exposition. OUP, 1970, page 1; Spanish translation in FCE.

(11) Perhaps we should explain now that this study does not intend to go beyond laying the groundwork for an abstract theoretical analysis and at the most establishing the guidelines or the skeleton for a possible theory. A lot remains to be done before we can put to use what is being proposed, if it turns out to have any value; this is especially so if we wish to apply it to a practical case and, even more so, to defining a specific development strategy for a particular country which would necessarily have to take into account not only any proposal of an economic nature, but also the rest of the social, political, cultural, legal, ethical and historical aspects unique to that country, not to mention the short-term economic imbalances that could exist. However, we are not just theorizing for the pleasure of doing so, because it is the experience of science that only after theorizing, corroborating or proving false what has been proposed, improving it and, so, reaching successively a proposal that is fairly accurate in representing the real phenomenon (a process that could take years, lustrums or decades), the theorizing could turn out to be truly useful in practice.

(12) Celso Furtado, Op. cit., page 11.

(13) The simplification of not considering time can occur both in natural sciences and in economics when analyzing short-term phenomena. But even in the natural sciences there are cases of long-term problems (such as theories on the Origin of the Universe, for example, when the time scale is no longer that of mankind, but of the cosmos) where one cannot do without this variable, and this should necessarily be historical time as adjusted to the scale of the reality being analyzed. In all of the social sciences this scale is obviously the time scale of mankind and in our case, as we have already stated, the most recent short period of the last five centuries may be enough.

(14) Dudley Shapere, Conferences at Universidad de Lima, June 1982.

(15) The description of this process is analyzed in detail in George Gale's Theory of Science. McGrawHill, 1979.

(16) George Gale, Op. Cit., Chapters 5 and 9, and Dudley Shapere, Op. cit.

(17) This would be very clear if we think in parametric coordinates instead of the more frequently used cartesian coordinates (x,y,z).

(18) Abdus Salam, "New Frontiers ¡n Science and Technology", in Seminar on Development through Cooperation, Seminar between OAPEC and South European Countries held in Rome at the Palazzo Barberini from April 7 to 9, 1981.

CHAPTER 5

MORE DETAILED DESCRIPTION OF THE CONCEPTUAL FRAMEWORK AND OF ITS APPLICATION

To give a complete definition of the proposed conceptual framework two elements must be discussed more thoroughly: the choice of the causal factors and their measurement. These two subjects shall be taken up in this chapter.

5.1 The choice of the causal factors

The choice of the causal factors of wealth, which have been limited to three for practical reasons, is undoubtedly the first crucial aspect because of the methodological need which have imposed on ourselves to point out the generative mechanisms of those factors. It is not a question of any set of factors whatsoever among many other possible sets, but of the sole set of causal factors to which we are assigning the explanatory value and it is on the latter that we are basing our entire analysis. This set of causal factors and the broader concept of wealth that we have proposed fully define the conceptual framework in question. As a result, we shall explain the reasoning followed in making the choice of causal factors.

5.1.1 The set of causal factors chosen

1.- Only two kinds of resources of different natures are involved in the economic process: human resources and material resources. By interacting the two constitute a source of wealth, but by nature they are different and any breakdown of either one should respect this difference. If we exclude extreme cases which have little relevance in the world today, such as slavery (1), the former have the characteristic of being unable to be possessed but, above all, they constitute both ends and means in the economic process. There is, thus, an essential difference between the two.

2.- Just as classical economics probably quite legitimately and correctly, subdivided material resources into "Land" and "Capital", a distinction which is no longer of any great interest today (but which at that time was quite important in economic analysis), we now intend to clearly break down human resources by separating those which are creative and enterprising (Talent, if you wish) from those which are more directly productive (Labor, if you wish). In this way we are breaking with the trend which, according to Pasinetti, has come down from Ricardo, and even before him, from Quesnay (2), of mixing up the causal factors with the social groups or classes among which the product of economic activity is distributed. Joan Robinson recently stated in that regard: "The moralizing doctrine which still underlines orthodox Western teaching fails to provide the basis for a theory of economic development because of a confusion in its approach. It identifies the sources of income with 'factors of production'". (3) We believe that we have clarified this

confusion here.

3.- There are also a number of different interpretations of the concept of Capital (4), of which the broadest and perhaps the most disseminated since Fisher is that which Harry Johnson describes thus: "Capital in this broadly conceived sense includes not only material means of production, but natural resources, human skills, and stock of productive knowledge according to which the human and non-human factors of production are combined in the production process." (5). For purposes of our analysis we intend to redefine this concept far more precisely and much more restrictively (perhaps returning to more classical proposals) by limiting it strictly to resources of a material nature which, together with natural resources, are grouped under the heading of material resources, k.

4.- To elaborate on what was indicated in point 2, we are aware that in distinguishing between human resources that are directly productive and those that are creative-enterprising -a distinction which results in the concepts of Productivity and Steering- we are making an analytical and arbitrary classification of human resources: but this is one that can be easily measured once a suitable agreement is reached, as was the case, for example, of the distinction between Consumption and Investment or of that which would have been necessary at the appropriate time between Land and Capital (see what Schultz has to say about the matter). (6) We shall discuss this difference further in section 5.1.3.

5.- We are also aware that the idea of Talent or of Steering as a production factor is not at all new in economic writing and that the classical analysis of Schumpeter or of others contained precise forerunners of that concept. By way of a specific example, Galbraith in "The New Industrial State" (7) in speaking of "organized intelligence" is indicating it to be the fourth factor of production. What is perhaps new here is the proposal to broaden the concept and to incorporate it permanently and definitively in economic analyses of all kinds*.

Thus far we have defined three causal factors.

5.1.2 The result of economic activity

From another viewpoint the definition of Wealth is directly linked to the three causal factors chosen. Inasmuch as we are proposing that Production and Output, as well as the increase in Wealth -which is what is saved and invested of that output-are causally merely the result of the social interaction among the only three causal factors defined -the three functions of variable (t)- then Wealth is defined as being the resulting historical accumulation of these three factors expressed as a vectorial function. Thus

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* **As** stated in the prologue, the work of Romer, of which I know only indirectly, is precisely introducing a third factor, knowledge.

$$\bar{\mathbf{R}}(t) = k(t)\bar{\mathbf{i}} + p(t)\bar{\mathbf{j}} + s(t)\bar{\mathbf{k}}$$

where k (t), p(t) and s(t) are continuous functions of historical time.

We consider that we are going beyond this, but in the direction indicated by Georgescu-Roegen when, in criticizing the concept of the production function, he proposed that production should be understood as a "Functional" -in other words, as a function of several functions of real time. (8) We are of the opinion, however, that the idea of the vector, which can be extended if needed to a vectorial field (9) will be far more fruitful. From the methodological viewpoint, as well, it also complies with the rules we have set ourselves, which is not the case with the Functional. As a result, we feel that we are proposing a new definition of Wealth as well*.

Thus far we have described what wealth is and the factors which truly generate it. There are, of course, many other factors which have an influence on economic activity as regulators, increasing or decreasing the value of these causal factors and, as a result, of the Wealth, but according to our terminology these do not constitute causal factors. This term can only be applied to k, p and s. To demonstrate this fact we are compelled by our methodology to go further and detect the generative mechanisms behind the causal factors we have chosen, and to explain them. Only then will we be able to be satisfied with the choice made.

5.1.3 The generative mechanisms

The capacity of any material resource to satisfy a need or to be easily exchanged for something that allows that need to be satisfied, together with an existing shortage, constitutes the raison-d'etre or generative mechanism for the resource's material capacity to constitute wealth. It is easy, then, to accept the fact that any scarce natural resource has this characteristic, even if not allocated to satisfying a need directly or immediately but, rather, to producing something that satisfies that need. The same can be said of any capital good that is expressly produced for this same purpose. This affirmation is also valid for any financial resource that may be exchanged for the goods and services needed for production and, lastly, for the energy and information, whose usefulness in producing at a lower cost is obvious.

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* Thinking of wealth as a field opens up very promising and well known paths for sound theorizing about its evolution and growth.

All the techniques used in the dynamic analysis of physical systems could be used in economics. The works of J. Rospigliosi (see footnote on Page 16) apparently suggest that not only the classical analysis of physical systems would be applicable, but that even the techniques of modern physics, as the title of his second work implies, could be used within the proposed conceptual framework. No such analysis has been so far undertaken. However, this framework was originally modelled on electric fields so the analogy is probably valid.

Furthermore, there are material means for amassing and even hoarding material wealth; therefore, there is no apparent need to dwell further on this aspect, in which there is nothing innovative.

It is, however, extremely important to elucidate the generative mechanism behind the human resources. Inasmuch as both the resources which are directly productive and those which are creative-enterprising-and consequently, Productivity and Steering-are the same nature and can be distinguished for analytical purposes only by their "specialization", the generative mechanism for the two must have the same nature, although its specific characteristics may differ.

From the very first page of Adam Smith's classic book labor is considered to be the source or generating mechanism of wealth. The social mechanism which provides the driving force for this capacity is the division of labor. List points out, however, that it is not merely a question of a simple "division", but that labor is at the same time a "combination or association of activities, of intelligence and of a variety of forces aimed at a production in common". And he goes on to add that "the productive force of these operations lies not only in division but depends essentially on association". (10)

It is this division of tasks and their specialization which, conciliated through organization and coordination, has led to the voluminous increase in the wealth and productivity of mankind. But now that we are going deeper into the search for the true generative mechanism we should ask ourselves: Division and association of what are we talking about? And our answer would be: Of total human motivations oriented toward economic activity.

The main institution in which these total motivations oriented toward economic activity are brought together is the firm. The description of the division and association of labor as a generative mechanism of wealth coincides fully with the very concept of the firm and this, in turn, is grounded, in modern theory, in a broad scope view of human motivations.

If we accept the fact that the firm as construed in its broadest sense is the vehicle most used today by man to put into effect his full motivations, then an analysis of these full motivations within the firm can give us the final answer we are seeking. We feel that the best analysis of the subject is that made by Professor Juan Antonio Pérez López. The first component of motivation is the classical one of obtaining a material return, profit or benefit of any kind, which includes but usually goes far beyond the natural desire to cover one's basic material needs; it encompasses, as well, the aspiration for non-material recognition in the form of praise, prestige, fame, and so forth. He calls this first component extrinsic motivation.

Then there is man's need to satisfy the particular inclinations which set him apart from others. This is a second component of the motivations, which he calls intrinsic motivation. But above these two there is on other: that of being useful to other men, which he terms transcendent motivation. (11)*

I feel that this classification of motivations fulfills the need to consider human motivations as a whole within the firm. Man's complete motivations are the real support for the division, specialization and association of labor and, as such,

constitute the generative mechanism of human resources insofar as the causal factors of economic activity are concerned. What ´s more, we postulate that they constitute the generative mechanism for the action of both the creative-enterprising and the directly productive human resource. The difference between the two lies only in the direction given to the specialization, whether it be toward the performance of a specific given task or toward the general coordination and combining of the efforts of others, the introduction of new ideas, of leadership, of social coordination and, in general, of such tasks which are more complex. While the generative mechanism has to be of the same nature (one kind of human resource cannot have a radically different nature from another) there are evident differences in the degree to which the two kinds of resources apply their motivations to an economic activity.

In the first place the creative-enterprising resource has, on an average, a much greater willingness to take on personal risks (or, better stated, less resistance to such) than the more directly productive resource.

In the second place the creative-enterprising resource has far stronger motivations of personal achievement, recognition and material benefits and normally dedicates much more physical and mental effort to its work (assigning to it a greater priority than to family life, rest, amusements, sports, politics, teaching or any other similar activity). This type of human resource can be said to "like" directing or creating and at times does this with passion.

In the third place this latter kind of resource possesses a far more marked capacity for taking decisions and for leadership.

In the fourth place this group normally shares a more long-term perspective of the problems; it is capable of visualizing and acting in accordance with a more distant future.

In the fifth place, this group has a tendency to be imaginative and creative while the other tends to be more gregarious.

Here we would like to reiterate that in the final analysis the division we have made between the two kinds of resources is arbitrary but, in our judgment, is clearly reflected in any firm or undertaking today. (12)

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* Since the spanish version of this work was published, Prof. J.A. Pérez López has formalized his work publishing a book: Teoría de la Acción Humana en las Organizaciones: La acción personal. Ed. RIALP, Madrid, 1991 (Theory of Human Action in Organizations: Personal Action) and another forthcoming: Teoría de la Acción Humana en las Organizaciones: La acción de las organizaciones humanas, (Idem: Action of Organizations), with a very detailed analysis of his thought of which I know only indirectly. He has also written an introductory text book on Business Management (Universidad de Piura) where he proposes an anthropological theory of Motivation encompassing previous mechanicist and psicosociological theories, proposing an anthropological model of Organizations and a detailed analysis of decision making in an organization.

To sum up, this association of duly ordered "specialized" human motivations is the mechanism which generates the economic activity of the resources directly producing and those creating and directing, operating within an institution which is the Firm; and at a higher level, by the aggregation of these units in the long term and through historical accumulation, it is the generative mechanism of Productivity and Steering which are present and can be expressed in per capita values in any large economic unit (country or region).

We feel that thus far we have covered the three essential conditions for proving that the selection of the chosen factors is methodologically acceptable. (13) We also consider that it is consistent with the most up-to-date managerial theories and is borne out by experience. We therefore consider this conceptual framework to be adopted. Before going on to tackle their measurement, to which we shall devote the last part of this chapter, however, we shall clarify what has been stated thus far by applying it to both the microeconomic field of the firm and the macroeconomic.

We shall delve into these two aspects for the express purpose of explaining the concepts further and of presenting the general idea of how they are to be measured, in the understanding that, without having to go any further, the concepts which we have defined are observable and can be measured with more than enough accuracy for the purposes of any theorizing in regard to the problems which actually arise.

5.2. The microeconomic aspect: the firm

Insofar as the unit of analysis is concerned we feel that a Theory of Production should obviously use the firm as such. (We are certainly not proposing anything new here).

The firm is not merely an organization, but the most important kind of social institution, after the family, in our modern society. (14) For a certain group of persons, who tend to be involved in its establishment or at its head, the firm is the simplest vehicle for obtaining success, profit, power, prestige or importance; and it is these very important personal motivations which, channeled through the firm, have most certainly surpassed in the modern world more traditional means of acceding to such accomplishments, such as theft, or military, political, artistic, academic or intellectual action. This is a historical fact of the greatest significance: Besides the family, the firm is undoubtedly the most important social organization of the twentieth century.

The first essential feature of the firm is that it must generate an added value to society. Here we would like to underscore the difference between "making a firm" or establishing a human organization that is intended to produce an added value to society over the long term, and "making business", which is merely an action carried out to obtain a personal economic benefit by taking advantage of an opportunity.

For many reasons, which we will discuss in speaking of the risk, such as external factors, political or labor interference, or others, not all firms which are licensed as

such are true firms. (15) Nor are some which satisfy market requirements and earn profits, but fail to comply with the essential requisite of generating added value for society.(16) But these differences are irrelevant to us and observing them is utopian for if we are working in per capita values all we have to do is accept the normal aggregation of the values of all of those firms or organizations which produce goods and services, employing market values and leaving aside any bias in the hope that it will not have any major effect on the added value.

A second essential characteristic of the firm (worthy of the name) is its capacity to assume risk. In the modern organization of society the firm has become a mechanism, which has reached very sophisticated proportions in its corporate version, that facilitate risk taking-in our judgment, the hallmark of the very concept of firm, but something which man is very reluctant to do; the firm enables the risk to be assumed by an individual on a limited basis and, moreover, to be expeditiously and reasonably shared among several persons.

One of the most important firm analyses has been built up around this topic of risk. In analyzing the concept of the firm, philosopher Leonardo Polo (17) states that in the last fifty years the social systems of many countries have been blunting this capacity to assume risks, to build up Supply in advance of Demand; the result has been a production system which has been moving away from real human needs and replacing them by a whole series of pseudo-needs, for the satisfaction of which growing amounts of goods and services of a doubtful social value to the world's population as a whole are being produced at little risk and guided only by a desire for profit. The politically organized labor activity stemming from this social scheme has served to strengthen and stabilize it.

In this way a consumer society has been created which, without having been able to satisfy the aspirations of the more prosperous societies (as regards general quality of life and not merely abundance), has through a world-wide dissemination of patterns and expectations of material consumption absolutely incompatible with the production levels of most of the countries, contributed to widening the gap between the rich and the poor countries; not only this, but it has also helped to endow the very notion of the firm in a good many developing countries with overtones of mediocrity and to heighten the inequalities within those countries (as we shall see further ahead this inequality is considered to be one of the "regulating" factors, but not a causal factor, which play an important part in limiting the economic development of a country).

To my way of thinking this revolution of expectations has, as a result of its excessively material orientation and its normally very large imported component, in most of the developing countries and despite its defense as a modernizing and invigorating element of the economies, more negative aspects than positive ones. Nonetheless, it is a fact which must be accepted and which we must try to bring under control for in the medium term it will most likely be irreversible.

To conclude with the microeconomic aspect, and to link it up with the macroeconomic aspect, we would like to repeat that the entire analysis is based on the three causal factors pointed out, material resources, productive human resources and directive-enterprising human resources; these generate a historical accumulation in the firm of the components of material capital, productivity and steering which, accrued at the national level, shall give rise to the per capita

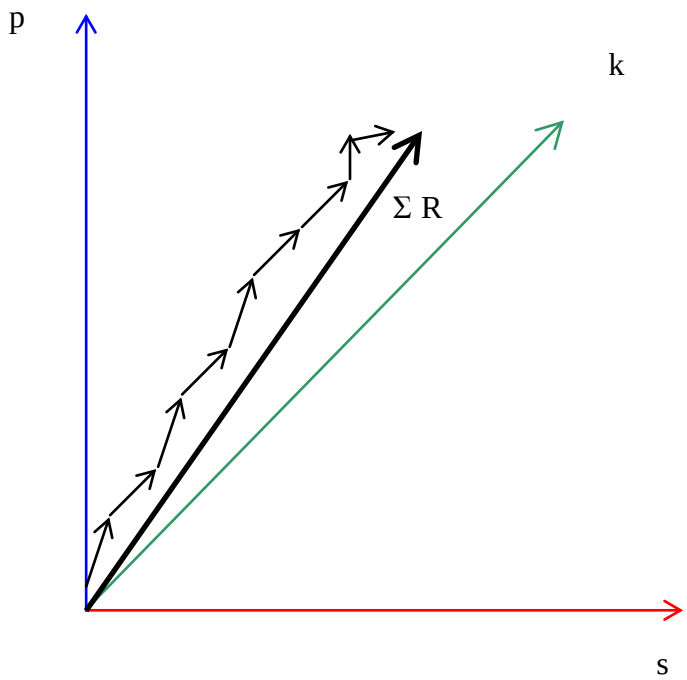
accumulated values of these three factors k, p and s. These, as aggregates, are being assigned an explanatory power at the macroeconomic level.

5.3 The Macroeconomic Aspects: The development of the Nation-States and International Trade

5.3.1 The units of analysis

There are two approaches that can be used to analyze macroeconomic aspects and these lead to two different kinds of units of analysis.

As Hicks pointed out, the formation of the world market was arrested by the emergence of the Nation-States. It is clear, then, that from a conceptual viewpoint the unit of analysis that should be used to analyze problems of economic development is the nation state operating within a world economic system. This is also reasonable from a practical viewpoint.(18) For this reason the possibility of being able to deal simultaneously and explicitly with the more than two hundred units of analysis presently existing within a world system that is by definition a closed one, is considered to be very favorable within the proposed conceptual framework.(19) With the proposed three-dimensional scheme world "wealth" is by definition ΣR_i where sub index i corresponds to each of the elements of the group of nation-states.



GRAPH Nº19: World wealth is a vector that adds up the wealth vectors of each and every country.

Consequently, for another kind of analysis, such as that of International Trade and also of the International Monetary System, the world as a whole can be used as a superior unit of analysis for which the entire economic process shall be a "zero sum game" (in which the players shall be precisely the nation-states).

This is the approach which should be strictly used to address these problems, for we have witnessed the inadequacy of the analytical procedure used thus far of taking an economic unit as a close universe and then bringing it into contact with reality by relaxing its bounds to permit some exchanges. It is proposed that the ideal unit of analysis for these problems is the world as a whole, within which the nation-states, as sub-units of analysis would interact, but with the perspective that one should eventually arrive at values that comply with the condition of adding up to zero for the world as a whole (zero sum game).

5.3.2 A three-dimensional picture of the process of historical accumulation

Economic activity at the macro level is generally construed as a highly complex social process whereby material resources are continuously produced and consumed, accumulated and dispersed (and distributed among social groups). But at the same time human resources, both productive and creative-enterprising, are also being produced and consumed, accumulated and dispersed.

If one considers each of the three dimensions of these kinds of resources or factors one will have an initial quantity that has grown in absolute values and also, assuredly, in per capita values over the centuries.

It is obvious that there may be an increase in the component elements of "k", material capital (which includes natural and energy resources, fixed capital, productive goods, financial resources and also informational material resources not in the minds of persons as knowledge but incorporated in processes or registered as formulas in material means); this can occur as a result of the discovery of natural resources or of new sources of energy and above all as the result of the firms' very process or production, innovation, capitalization and accumulation.

The important thing here is that similar reasoning can and should be applied to "p" and to "s", that is to say, to Productivity and to Steering. Productivity may be enhanced over a certain period by the incorporation of a new group of persons with a particular education, the educational level of already productive persons may be raised through further education and training, etc. Investments in material resources, improvements in "s" and other means can be used, as well, to better the average production capacity over that given period.

On the other hand, a group of workers with a given educational level may withdraw, workers may migrate in masses or a significant percentage of the population may die, perhaps in a war, and this will significantly reduce the value of p (or of s). Furthermore, strictly speaking, each of the workers will have worn himself out somewhat over the period but the influence of this element on the whole is likely to be negligible in the face of training administered, learning and the incorporation of new workers.

The same phenomenon shall occur in the case of s but it shall also increase if the

work of heretofore unproductive, creative and enterprising persons were to be added or if managers or entrepreneurs were to return to or to enter economic activity (persons who, for example, might have withdrawn or retired for reasons that could be economic and also, more likely, political, ideological, social and even racial).

Any theory that is devised should also, of course, seek explanations for social, political, economic, or any other conditioning which regulates or restricts the employment of these three causal factors. The installation of a manufacturing system to replace a handicraft industry would, for example, of itself augment productivity, as Georgescu-Roegen explains. (20) The growing technological capacity existing today for information handling or processing is sharply increasing the productivity of the professional and administrative echelons. Furthermore, a social environment that is conducive to the use of "p" over more hours of the day would enhance the value of this factor, while an organization or social environment conducive to a short working day or to frequent stoppages or strikes would decrease it.

Thus far we have thought only of two indicators which, as regulating coefficients or variables, could upon the formulation of a long-term theory of economic development affect the intrinsic effectiveness of factor (p). This, of course, putting aside those which are in nature of causal factors, namely Steering, the stock of capital (and the increase in it) consisting of directly productive capital goods (excluding those in the nature of economic or social infrastructure) -or in other words, the direct per-job investment which would assuredly affect productivity.

A first indicator should be an element that gives an approximate idea of the educational level of the labor force. Possibilities could be a combination of average years of schooling, percentage of literacy and percentage of university education.

A second indicator would be the average number of hours effectively worked, in fact and not according to regulations.

These coefficients should be conceptually applied to what would be the measurable value of p, in other words, the portion of the remunerations connected with directly productive tasks, so that comparisons may be made between the "effective work" effort of "labor" in different countries; this would be construed in a broad sense to encompass engineers, experts and other top level professionals dedicated to produce. But for the initial measurement of p that we propose they would not be relevant. Total remunerations (w) less those constituting s -corresponding to creative-enterprising human resources-to be defined later and which we will call w, shall be equal to the present net value (NPV) of w_1. Thus we have $w_1 = w – w_2$.

It will be much harder to find factors that regulate "s". Cultural aspects, degree of infrastructural development, degree of social inequality, degree of political instability, society's favorable or unfavorable attitude toward the role of the entrepreneur and of the manager, the environment of freedom and other factors shall most likely influence its effectiveness.

There must be many ways of reflecting this complexity. For the moment, and only to illustrate the kind of possible indicators that could be used to reflect this group of regulatory phenomena when devising a theory, as indicators of the effectiveness

with which this Steering may effectively direct the economy, we shall mention only two:

The first would be an indicator of per capita capital stock that constitutes infrastructure and other assets (k_2) expressed as a ratio with a certain reference value (OECD average, for example). The idea is that a country with a larger investment in infrastructure will doubtlessly be easier to handle than one without such an investment.

A second indicator would be one which would reflect in economic terms the degree of social and political stability, attitude toward entrepreneurial work and other factors of this kind. We suggest that a good indicator of this would be the extent of income inequality, and we propose that the Gini Coefficient in particular be used.

These regulatory factors would be conceptually applied as in the case of production to the absolute amount represented by the measurement of s, the net present value of the remunerations of a country's creative-enterprising human resources, to formulate a specific theory of economic development, to find the intrinsic value of the effort. This could be done later but for now it is more than enough in aggregate terms, as in the case of p, to use the market value of s without entering into further detail. In the following point in speaking of measurement we shall try to make this concept operational, although very tentatively.

The dynamic influence of the various regulatory factors is outlined tentatively in table 2.

TABLE 2

POSSIBLE FACTORS AFFECTING K. P, S, DYNAMICALLY

For purposes of the following table the capital stock (k) shall be broken down into directly productive capital (k,), such as factories, machinery, etc., and infrastructure (k_2) encompassing buildings, communications, cultural heritage and so forth.

MATERIAL RESOURCES	⟹	Capital Stock (k)
Causal Factors	Productivity	P
	Steering	s
PRODUCTIVITY HUMAN RESOURCES	⟹	Productivity (p)
Causal Factors	Steering	s
	Capital Stock	k
	Change in the directly productive capital stock	Δk_1
Regulating factors	Educational level (degree of literacy, years of schooling, percentage of population with higher education).	
	Effective hours of work	
CREATIVE-ENTERPRISING HUMAN RESOURCES	⟹	Steering (s)
Causal factors:	Change in the capital stock	Δ k
Regulating factors:	Relative per capita level of infrastructure	K2/k2 reference
	Inequality of income (Gini coefficient)	

It would perhaps be interesting in analyzing problems of economic development, international trade and also assuredly the International Monetary System, to use a perspective of the causality of the phenomena similar to that developed in point 5.2, combining the division of labor raised now to the level of a country's series of enterprises, with its association in a nation-state in which political, strategic and military phenomena are also involved. This nation-state, in turn, is operating in a competitive world market in which each state is, of course, far from being equal and in which the most powerful employs economic, political, or military power of any kind to obtain economic benefits. The so-called international economic order has always been the set of playing rules of those who have the power to impose them on the rest of the nation-states. And the same happens in some cases inside the nation-states where certain groups profit from the state by imposing it their rules. And it isn't our intention to be critical in making this statement, for the lack of order of any kind tends to be worse than even the most unjust order.

Although it has already been said, we would like to insist, lastly, that the effects of wars, migrations, genocides, starvation and other phenomena which are usually not explicitly considered in economic analysis can and should be taken into account, for they not only affect productivity, steering and material resources, but will also modify -perhaps even significantly" the number of inhabitants which, as a denominator, may be reflected appreciably in the per capita values (we would like to insist again that per capita amounts, and not the total amounts of resources, that is to say k, p, and s) are explanatory of economic development.*

5.4 The valuation or measurement of the proposed factors.

As a starting point, we maintain that the variables proposed as causal factors are clearly observable empirically and are certainly precise enough given their observed effects (which show extremely marked differences). We shall go further into the process of measurement of these factors.

First I shall try to outline a system which can apparently coherently envisage, with a single criterion and for any kind of productive economic unit, the measurement procedure for these three basic concepts.

The course to be followed is suggested in Hick's observation: (21)

> "... since Adam Smith the method of economics has consisted in the fitting of the whole economy into a framework which is derived from the accounts of a single business. Businesses grow by accumulating capital; it is convenient for economists to look upon the development of a nation in the same terms. This attitude of thought, though it is far older than the national income accounting of our day, has been enhanced in authority by the success of the statisticians in transmuting it into figures. What began as a technique of economics communicated itself, as a state of mind, to administrators and politicians.

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* This will allow to use Hamiltonians for a more detailed mathematical analysis in a future stage in order to operationalize this work which at the present moment remains at a conceptual level.

> Certainly, up to a point, there is no harm in this bias, since there are many other kinds of improvement which can be described, more or less accurately, in terms of capital investment. Improvements in the fertility of land are largely due to capital investment; many improvements in skill are derived from a kind of investment -- 'investment' in education, in training, and so on. Yet the reduction of all improvements to the investment of capital is a bias; and it can lead one far astray..."

5.4.1 The firm.-

If we want to discard this bias we must, accordingly, propose a broader means of keeping a firm's accounts with a long-term approach. An analysis of the attitude of the person responsible for committing a firm's long-term resources - such as, for example, a banker or an investor - could suggest the course to be followed. In our experience this person places as much weight in his analysis on the human resources -especially the managerial resources- as on the balance sheets and the fixed assets. In fact, during crises he tends to call as much or more for changes in these human resources or their commitment to greater involvement than for contributions of funds.

Our intention, then, is to increase the complexity of the normal accounting system slightly by adapting it to the proposed conceptual framework. While the balance sheet does give a fairly reasonable idea of the assets and liabilities and enables one to get a clear idea of the material aspect, it does not explicitly reflect the value of the human resources, behind the firm's structure.

Usually in its initial pages the firm's annual report tends to highlight its main creative-enterprising resources, but it does this in the form of a list, rather than quantitatively. Its directly productive resources are even less evident.

To get a true picture of a firm's wealth as it is today -in other words, that of an institution whose social structure provides for a normally long-term association with its workers- the presence of these two resources should also be reflected in its "balance sheet". To do this one must resort again to a three-dimensional representation, abstract from the normal balance sheet the value of k (Material resources) reflecting the material assets, and add the values of p (Work as redefined or overall Productivity) and s, Steering, or Management and Research in their broad sense.

How are these last two resources, p and s, to be valued? The logical way would appear to be by calculating the present value of the income anticipated throughout the firm's useful life for both human groups. In most of the countries where the state more than the firm takes on the task of protecting the individual after his work relationship ceases the existing social system will make it unnecessary to deduct liabilities from these values, with the exception of the obligation, if such exists, to pay retirement pensions to workers who are no longer productive.

If firm's assets, k, consist of so many million dollars, then the potential value of its

personnel, p, shall be its annual non-directive payroll for the probable average period that said personnel will continue working for the firm, discounted at present value, which will most likely result in an amount similar to k. Then, s, shall be calculated similarly, using the payroll of enterprising-directive staff and including, of course, all remunerations, whether visible or not. So, s, shall take in the value of the remunerations of the top management level (for which some kind of rule shall have to be established, depending on the size of the firm; in a small firm, it may be only the owner, while in a transnational corporation the first three or four managerial levels may be involved, adding up to some several dozen persons), but should include all persons working on research and development tasks, among them market research.

In a normal firm, s will most likely be considerably smaller than the other two factors, but in a high technology firm this will not be the case because Steering as a concept encompasses those who invent, innovate, plan for the future, train human resources, open new markets, and so forth.

It is apparently more difficult to measure the value of Steering within a firm than in a country, as we shall see. It will have to be estimated on the basis of the present value of the total remuneration of a few executives, inventors and innovators who shall be easily identified because of the fundamental role they play (this is more easily seen during periods of shortage when because of salaries below the market value or for other reasons this resource is lost or, more often, has a relative loss of motivation). If the remuneration is large enough, however, to fulfill the normal needs of a highly qualified person (which is certainly not the usual case in many state owned companies in the underdeveloped countries) or if, even if that requisite isn't fulfilled, there is still a broad area for other internal motivations which will probably exert a tremendous influence in many cases; however, I can see no easy means of quantifying these because the elements involved are intangible and therefore will have to be left aside in making the measurement.

A firm's wealth shall be then, as stated above,

$$\mathbf{R}(e) = k\{e)\,\mathbf{i} + p(e)\mathbf{j} + s(e)\mathbf{k}$$

If one accepts this idea of a firm's wealth as a better conceptual model of it for the long term, instead of the more simplified model currently in use (and I feel that that which we are proposing is quite consistent with the true view of owners, managers, labor unions and workers, on the one hand, and bankers and external analysts, on the other) then it would not be difficult, following the course proposed by Hicks, to extend this model to the realm of national accounts.

5.4.2. The macroeconomic level

Extending the foregoing to national accounts will obviously require a good deal of further conceptual work to harmonize it with the currently existing system and far more work on the part of statisticians to arrive at precise definitions; but even if it were to be used for the time being only as a conceptual framework whose variables would be provisionally handled through approximate values, I think it would still help to clarify many of the questions raised in the comparative analysis of different

countries' economic development. In fact, it could help to clear up the most common entrepreneurial problems in developing countries as is the case with the problems of economic development itself occurring because of the lack of essential resources and not merely because they are not activated, motivated or exploited in the best possible way. (22)

As Galbraith points out the resource in shortest supply in the world, and hence that most difficult to accumulate, is Steering (which, it is true, I have defined more broadly than Galbraith). This is even truer in the case of the developing countries.

I would dare say that whenever rapid economic development has been attained this lacking factor has been retained and put to work in a variety of ways, over lengthy periods of time. This is borne out in the experience of many countries.

Japan is a case in point as, more recently, is Korea. Another similar case is that of the USSR following the Russian revolution when rapid economic development was achieved by purely coercive measures (which, to our way of thinking, are unacceptable) very different from those taken in most of the developing countries. I feel that the case of renaissance Holland is significant, and also that of early industrial revolution England as a result of its ability to accept ethnic minorities or those persecuted for their religious beliefs, to promote free individual initiative and to develop a social ethic openly favorable to the social group represented by the Steering factor. Indeed, the best possible illustration of this assertion is to compare what was happening in Spain over that same period, when the governmental system and the social ethic did not give the least encouragement to individual research or initiative to produce.

Although the U.S. case may be explained satisfactorily, as may the similar cases of Canada, Australia, New Zealand, Argentina and part of Brazil in the past century, through the use of traditional models based on surplus resources, of the kind presented by Richard Caves in his excellent article "Vent for Surplus: Models of Trade and Growth", (23) it is also apparently a case in which the more or less selective opening to European, Jewish, Asian and Latin American immigration enabled it to add fairly considerably to its own already large stock of Steering and most likely to its per capita productivity. (24)

A logical and obvious consequence of this process is its positive feedback (which is in line with the historical experiences with accelerated economic development) for when a country begins to have successful economic development it is able to retain its talent and, almost unavoidably, attracts more capable and enterprising elements from other regions.

In the developing countries with slower or disjointed progress, the accumulation of "s" is even more difficult and complicated.

Not only do they experience large migrations, a brain drain, but these are compounded by the attraction of multinational enterprises and externally encouraged corruption. (25)

In fact those belonging to the Steering or High-productivity group who for different reasons decide not to emigrate (although this possibility is open to them because of their qualifications) despite the economic stagnation, tend to be increasingly mistreated and obstructed or hindered from producing for their own country's

benefit. The reason for this is the existence of egalitarian or distributive criteria, generally of a socialistic nature which even the most capitalistic and liberal countries support for humanitarian reasons because it is a question of developing countries in which the inequalities are truly notable and notorious or, worse, because they lack material opportunities and the means (libraries, laboratories, etc.) for furthering their work or developing their talent. (This fact will be reflected in the measurement that we are proposing). (26)

Now that we have described the regulatory factors we envisage and have given a rapid historical overview of the s accumulation process, all that basically remains is to define how to conventionally draw the line dividing the directly productive resources from the creative-enterprising resources in other words, determining which portion of the remunerations are attributable to p and which to s. This shall obviously be a conventional rule.

Provisionally, we can propose the following:

1) The value of s shall consist of that portion of the remunerations defined below plus the profit, expressed in per capita terms and converted to present value.

2) The value of the remunerations would be the sum of the following flows:
   a. The sum of the various "s" of all of the country's firms, as defined above; in other words, encompassing the remunerations of the top management levels and of research and development personnel.
   b. The remuneration of university professors and researchers of all kinds;
   c. The top management levels of essential government services in the areas of education, health and so forth;
   d. The top management levels of government activity including the directors of security (police) and defense (armed forces) and all of the remunerations of intelligence personnel.
   e. Although rather insignificant, the income should be included from artistic and creative activities performed outside the purview of the firms, academia and the government when they have a clearly perceptive economic effect (we are thinking of the economic effects in their respective countries at a given moment, of, for example, The Beatles, The ABBA group and, even more so, Wait Disney.)
   The summary of this proposal for the measurement of causal factors as aggregates is shown in Table 3.

We have cited all of the above with the intention of showing that a measurement may be made and not to suggest that our proposal is necessarily the most adequate way of making it. What we do maintain is that the proposed causal variables are observable and that, grosso modo, they may be measured perfectly. For the moment these general measurements are more than enough.

For greater precision in the case of the countries, adjustments and additions would have to be made to the national accounts. It should be recalled, however, that this national accounting is nothing other than the implementation by statisticians, as the last quotation from Hicks points out, of a relatively recent theorizing which, as we are aware today, has not been proven scientifically.

If the proposed theory is "better" then it would be well worth the statisticians' efforts

to bring about the standardization that would allow it to be more precisely corroborated, even if this were to take several years.

Original Resources	**Material Resources**	**Productive Human Resources**	**Creative – enterprising Human Resources**
Aggregates	**Stock of Material capital**	**Productivity**	**Steering**
Flow	$K^{\cdot}$	$p^{\cdot}=w,=w - w_1,$ where w = total remunerations w_1 = remunerations of directly productive	$s^{\cdot} = w, + u$ where u = net profits w,= remunerations: -- High level managernent of all firms (1) --University proffesors and researchers --Research Management State Development and Services --High level governmental management --Creative, artistic or other activities
Per capita Flow	$K^{\cdot}_{pc} = K_i$	$p^{\cdot}_{pc} = w_{1pc} = P_i$	$s^{\cdot}_{pc} = w_{2pc +} U_{PC}$
Causal Factors	Present value of Stock of Material	Present value of Productivity per capita	Present Value of Steering per capita
	$VPN_{ki} = \sum_{i=1}^{i=T1} Ki$	$VPN_{pi} = \sum_{i=1}^{i=T2} pi$	$VPN_{si} = \sum_{i=1}^{i=T3} Si' + \sum_{i=1}^{1=T4} Si''$
(Symbol)	k	p	s

(1) Average Remuneration $Pc = \sum_{j=1}^{j=n} S(e)j$

where n= number of firms

Perhaps it will not be easy to arrive at the precision with which economic variables are measured today, but for the moment it is not a problem in the development of a theory in which absolute preciseness is not essential. It does not have much relevance for the problems to be corroborated. In its application to the comparison of differences in level of economic development, for example, these are so large that it will probably be enough to employ a Spearman correlation, that is, of an ordering to prove a theory. When Denison's estimates impute some 50% of the variation in the level of American economic growth to the residual then, what does absolute accuracy matter? At issue initially is whether the theory is explanatory and whether it may be sufficiently corroborated.

In the case of business why aspire to absolute preciseness when none of the microeconomic theories of the firm fully explains the phenomena involved at the present time? I would venture to say that any theory based on this conceptual framework, despite the limitations in making exact measurements of s or p, would have far better empirical results than any other economic theory of the firm available. In fact, I would make this same claim in regard to economic development. A future second part of this study shall be devoted to this topic, with a further explanation in the Notes for a Theory of Production, the outlining of at least a framework for a Theory of Economic Development along the lines set out in this chapter, the proposal of a strict program for putting this theory to the test by bringing it to bear on the major processes of economic development of the last centuries and, finally, its illustration by means of a case (that of Peru in recent centuries).

NOTES

1) The decision not to consider cases such as that of slavery was made to avoid complications in the analysis and not to deny the possibility of its existence or that it played an important part in the economic process of the past. In other words, to simplify the analysis a minimum of freedom is admitted in the behavior of the human resource as an economic agent, at least as concerns its discretionary capacity for realizing its potential effort and the extent involved. This, despite the degree of restriction of its discretionary power to determine the distribution of the portion of the benefits from that process which it may use to cover its own needs.

2) Luigi Pasinetti has the following to say in this connection: "Like Quesnay, Ricardo postulates a strict identification of the social classes with specific roles in economic activity", going on to point out that these three social classes are the landholders, the workers and the capitalists. L Pasinetti, op. cit., same page.

3) Joan Robinson. Aspects of Development and Underdevelopment. Cambridge University Press, 1979 page. 10.

4) It is worth discussing these interpretations by means of several examples. According to J.P. Platteau in Les Economistes Classiques et les sous development. 1978, in Adam Smith's time "... the essential element of the capital used for production was the circulating capital which took the form of an "advance for the work". Platteau goes on to say that Ricardo and his disciples, attributing far more importance to the concept of machinery, considered "fixed capital as accumulated or stored labor". H. Johnson in his 1968 Wicksell Conference describes the concept of capital, from these classical notions in a basic work, such as that of Irving Fisher, as cited below in the text.

   In "The Nature of Capital and Income". Irving Fisher, however, has the following to say (which gives one the impression that the idea of capital was not clear before its definition): "Previous definitions of capital and income, it is true, are not accepted by all. Many authors seek to define capital not as wealth in a particular aspect with reference to time, but as wealth limited to a particular purpose in short, as a specific part of wealth, rather than the whole."

   As a result, we are obliged to stop a moment to consider these options; in this chapter we shall concern ourselves only with the concept of capital.

   What Senior wrote seventy years ago is still true today; "Capital was defined in so many different ways that it is doubtful whether it has a generally accepted meaning. Almost every year there is a new attempt to resolve the matter but unfortunately no authorized result has yet followed from those efforts. On the contrary, many of them have only served to bring further contenders into the field and to add food for discussion. Many authors are dissatisfied with their own treatment of capital and even go so far as to rework it in subsequent editions." Fisher then cites different definitions put forward by some 15 authors. Reedition of The Classical Economists, A.M. Kelley, New York, 1965, p. 53 - 57.

5) Harry G. Johnson "Comparative Cost and Comercial Policy Theory", Wicksell Lectures, 1968, p. 17

6) T. Schultz states in this connection: "The understanding of agriculture as a source of economic development is complicated, to a considerable extent, by ideas of land that have been handed down.

   Arable land has two component elements, natural structure and capital structure. The latter is the outcome of investments made in the past. Theoreticians implicitly refer to land only as the natural structure, but this is usually an empty concept because differences in productivity are due in most instances to man..." Theodore W. Schultz, Transforming Traditional Agriculture, Yale University Press, 1964.

7) In which he points out the following: "It is now clear what gives power to a production factor or to those who control it. The power lies in that factor which is most difficult to secure or hardest to replace. To be more precise, power resides in the factor whose supply is most inelastic as to margin.

This inelasticity may be the result of a natural shortage or of effective control over the supply by a human agent or a combination of the two. Technological and planning requirements have greatly increased the need for specialized talents and their organization in industrial firms. The industrial system must rely, primarily, on external sources to obtain those talents. Unlike capital, they are not something the firm may administer to itself. To be effective, those talents must be coordinated. They must interact within an organization..." Judging by past experiences one must expect to find a new shift in power within the industrial firm, this time from capital to organized intelligence (and one would expect this shift to be reflected in the distribution of power in society in general)."

"This has actually happened. It is a shift of power among the production factors similar to that which has been occurring from Land to Capital in the advanced countries over the last 200 years. It is a fact of the past 50 years and is still underway..." "This power shift has been concealed because, as was the case with Land at some time in the past, Capital occupies a privileged position which it considers to be unshakable... It has also been unnoticed because power has not gone to another or the established factors of production consecrated in traditional economic teaching. It has not passed to Labor."

"Actually, the power has passed to what anyone in search of an innovative approach would be justified in calling a new production factor. This is the association of individuals with varying technical knowledge, experience and other talents needed by modern technology and industrial planning." J.K. Galbraith, The New Industrial State. H. Hamilton, 1967, p. 46 - 59.

8) Georgescu-Roegen, Dynamic Models and Economic Growth. Note No.8 on page 238 points out that the suggestion to use the functional in economic dynamics was first made by Paul Samuelson.

9) A vectorial field is generically defined as

$$\overline{r}(k,p,s,t) = \overline{r}_1(k,p,s,t)i + \overline{r}_2(k,p,s,t)j + \overline{r}_3(k,p,s,t)k$$

10) List, Op. cit, page 135.

11) The substantive pan of the model developed by Professor Juan Antonio Perez Lopez is the concept of Transcendent Motivation which comes from the satisfaction of knowing what one's work means to others, to society or to a given group and which may become so powerful that it explains extreme cases of denial or heroism. Juan Antonio Pérez López, "Las Motivaciones Humanas", Research Division of the IESE of Barcelona, March, 1985.

12) Except, perhaps, those which are most advanced in the world in which this distinction may once again be becoming nebulous to a certain degree, but, unlike two centuries ago, because Steering is predominant instead of insignificant in relative terms.

13) 1) A definition of new concepts is being advanced on the basis of a "better" classification of entities. 2) The requirements of neorealist philosophy are being respected as regards a) having causal variables with clearly defined generative mechanisms which explain that causality and b) having a favorable field for the use of paramorphic models on having introduced the idea of economic space, of causal factors as component vectors and of Wealth as resultant vector. 3) Historical time is being explicitly and permanently introduced as the independent variable. It is evident, as well, that a third dimension has been definitively introduced into economic analysis.

14) See the distinction which Professor Pérez López makes between institution, organization and technical system in his article "La Empresa como Realidad Humana". IESE, Barcelona, 1985.

15) This can lead to the firm's taking "advantage" of society, rather than it's rendering a service to that society.

16) Theoretically, an institution which generates a negative value such as pornography or drug trafficking would not constitute a firm, strictly speaking; but, for economic purposes, who would judge that? Obviously, these distinctions are not worth to be taken into account in measuring aggregate values.

17) Leonardo Polo, Conferences on Dynamic Anthropology at the Universidad de Piura, PAD program, Lima, July 1984. He elaborates on an Aristotelian perspective applied to the modern world.

18) I believe that from a conceptual viewpoint John Hick's excellent study "A Theory of Economic History" (OUP, 1969) leaves no doubt as to the historical process of recent centuries: "The creation of a world market was clearly stopped by the historical phenomenon of the emergence of the nation-state." From a practical viewpoint, as Kuznets points out, it is determined in part by the organization of statistical and historical data, and even more so, by the fact that the quest for economic development constitutes one of the most important aims of all states in modern history.

19) It shall not be very hard to bring down this number considerably, without losing strictness, by grouping together some of the small countries with similar characteristics.

20) Georgescu-Roegen, Op. cit., chapter 1, Note 3.

21) The description presented by Hernando de Soto in "El Otro Sendero" of the peruvian state and other descriptions of it are excellent "illustrations of this phenomena".

22) J. Hicks, Op. cit.

23) In some cases in the developing countries, unlike the developed countries where the problem is to make the best possible use of existing resources heretofore untouched at a given moment, there is another problem of far more basic importance: there are not enough of the resources needed for production. In other words, it is not merely a question of regulation, for the problem is, above all, causal. To make a very rough comparison, the vehicle cannot climb the hill merely because it is poorly regulated; even if its engine were to be well-tuned, it would still not have enough power to climb it.

24) Richard Caves, "Vent for Surplus: Models of Trade and Growth" in R.E. Baldwin (ed), Trade. Growth and the Balance of Payments.

25) Furthermore, I believe that recent phenomena and perhaps temporary ones such as the relative development of England between the '60's and '70's are in keeping with the number of English people who were working, inventing and teaching in the rest of the European Community, in the U.S. and in the rest of the world as a result of the social environment existing at that time in the United Kingdom.

26) An important group of persons, frequently the country's most outstanding professionals, may be working for transnational corporations whose aims are not necessarily strictly in line with the objectives of the country insofar as the accumulation of material capital, productivity or internal steering are concerned. Usually top management and the most qualified personnel are oriented more toward, and aspire to, being promoted to the head office or to another office in a more important country (although in most cases then the effective migration does not take place).

This group will logically continue to cooperate and to contribute to the country and it is preferable by far that they remain in it and continue to be active rather than inactive and migratory. But even so, their contribution, their value to the country would have to be measured to reflect a coefficient that is inferior to the unit, and which may differ little or greatly from this value depending on the particular firm and person involved.

Another group may exist which would have to be multiplied by a negative coefficient (in some cases a very high one); this would consist of persons who in most cases would not strictly be in the employ of these foreign firms but who, from their position in the government, in other national firms, or as agents or representatives of foreign firms would participate actively, often resorting to corruption to attain their ends, in implementing production decisions and, above all, in influencing projects that are obviously contrary to the country's interests.

As these phenomena are being measured in per capita terms one must trust that this negative component will not be significant in size (even if arms purchases are considered within it). But, this is to be doubted in certain cases when one considers the course taken by certain developing countries, especially in the last decade in which the developed countries have been strongly pressed from inside to export and certain firms and even the governments of these countries have demonstrated an overt aggressiveness in selling their products, arms and projects.

These two elements cannot be measured for the time being with the procedure we are proposing so we shall leave them out.

27) With the measurement procedure suggested this fact would already be borne in mind, for the relatively low income of these groups, by international standards, would not only be reflecting their intrinsic value, but also the value assigned to them by society and the respect which they deserve. (This would, as well, be an indicator of their influence and true power within society).

CHAPTER 6

SUMMARY AND CONCLUSIONS

1. In this monograph a new conceptual framework has been proposed, which we consider different from those previously used in economic analysis, and which is oriented toward dealing with very long term problems, specifically of production, of economic development and of international trade. This new conceptual framework consists of the following:

   a. The proposal of three sole causal factors of wealth, empirically observable and measurable, consisting of strictly Material Resources, Natural Resources and capital goods, DIRECTLY PRODUCTIVE HUMAN RESOURCES or LABOR, and CREATIVE-ENTERPRISING HUMAN RESOURCES or TALENT which, historically accumulated and expressed in per capita values, constitute the CAPITAL or accumulated material resource per capita, the historical per capita PRODUCTIVITY and the accumulated per capita STEERING. These three factors are treated as vectors and not as scalar elements.

   b. The proposal of a different definition of WEALTH, considered to be the vectorial sum of values of the three factors cited, in a three-dimensional space in which each dimension corresponds precisely to one of these three factors. Economic development is defined precisely as the increase in wealth as we have defined it.

2. We have analyzed in a certain degree of detail the ways in which this conceptual framework differs from those used previously, from two different viewpoints: the economic and the methodological.

3. From the economic viewpoint far greater emphasis is placed on the human factor than on the material; moreover, the economic process to be analyzed and explained incorporates technological progress, considered with reason to be the most important activity of this economic process.

4. Also from an economic viewpoint, the conception of this conceptual framework has been compared with different positions of economic theory in an effort to discern similarities and differences. In brief, the following may be said to this connection:

   a. That it is a return to the theory of wealth of the classical theoreticians, which places greater emphasis on production than on distribution and trade (which, in the terms once used by Hicks may be described as New Plutology).

   b. That is a step forward in the definition of the concept of human capital, going significantly beyond anything proposed thus far in that regard.

   c. That, on the contrary, this is not a proposal that is in keeping with the neoclassical theory of economic growth of the third quarter of the century but, rather, at most a parallel course which differs substantially as to its

methodological proposals.

d. That this approach used exclusively for analytical purposes seeks to isolate the economic facet from a highly complex social process and thus differs from the approaches of Peroux, Furtado, UNESCO and others which seek an understanding of the economic process by considering the entire social process in its entire complexity.

e. That the proposal differs from the methodology of Marxist economic theory for its essence involves the proposal of causal factors independent of the social order in which the historical process takes place, or of the stage of evolution of this social order and it is able to express or explain the production process in any kind of social system not considering at all the system of ownership of the means of production as causal variable, and independently of the process of class struggle.

f. That, lastly, the proposal appears to have much in common with the proposals, though it differs as to content, of those who have given thought to the approach to the economy of the future (for example, in St. Gallen).

5. The proposal is analyzed from a second viewpoint, that of methodology, in regard to four aspects:

a. The analysis of long-term economic phenomena is considered to be appropriately viewed from a scientific perspective which is coincidental with that of the initial stages of any science and which consists basically of a better definition of concepts through the classification of entities. A very explicit idea of Nagel's with regard to the social sciences is used to back up this position.

b. The criteria of a nonrealistic philosophy of science developed in recent years are used to question the positivist approach behind all proposals connected with social sciences, and specifically of economics, made in the last two hundred years, to analyze the variables being used as causal factors in the first place and to analyze the models used in economic analysis in the second. This approach is borne out especially by the work of Professor Harre of Oxford University.

The conclusion with regard to the first aspect is that only causal variables whose generative mechanisms may be clearly explained should be used. The three variables chosen as causal factors fulfill this requisite, unlike the variables used formerly.

As for the second aspect, the conclusion reached was that the mathematical models used in general by economists are of a so-called homoeomorphic type, which have more of a representational value as simplifications of reality to make it more manageable. We propose that models of another kind exist, which were heretofore used in economics, at least insofar as basic aspects are concerned: these are called paramorphic and have a greater explanatory value in all sciences because, unlike the homoeomorphism models, the subject or phenomenon which they are to explain differs from their "source".

The latter is taken from another well-known process to apply it by analogy to the new phenomenon (in this case the economic) that is to be explained.

The model employed in all of our proposals in this study is clearly paramorphic, with the source being the description of trajectories of particles (units of analysis) in "economic space"; in this effort we have adopted the vector concept and some very elementary notions of vector analysis.

c. The third methodological aspect taken up is that of the explicit inclusion of the time variable, understood as real historical time, in all analysis of problems of economic development and international trade which interest us. A maximum period of the last five centuries is proposed as being sufficient.

d. The fourth methodological aspect discussed is the apparent coincidence between the process used in formulating the proposed conceptual framework and that shown in the early stages of other sciences unearthed in recent investigations of the real history of science made by scientific philosophers (more than by scientists seeking to find evidence to support their theories). The first matter of interest is the important change which took place early in the history of chemistry when it abandoned the Phlogiston theory to replace it with that of Oxygen, based on empirical evidence. A second aspect of interest is the progress made by physics early in the modern age with the replacement of the Ptolemaic model of the universe by that of Copernicus. The analysis of these philosophers clearly shows that conceptually speaking this signified a progression from a two-dimensional view of the universe to a three-dimensional picture.

Einstein's analysis subsequently ushered in an outlook in four dimensions and recent theories are making use of eleven. What this would appear to show is that the transition to three dimensions which has obligatorily been made in this conceptual framework, to abandon the two-djmensional approach heretofore used in economic analysis, has yielded positive results in other sciences, and might help in economics as well.

6. After having analyzed these two viewpoints, the economic and the methodological or epistemological, in support of the conceptual framework the study delved more deeply into two basic aspects of the latter: the selection of the causal factors chosen and their measurement.

A difference in nature between the human and the material resources which must be respected at all times was first pointed out. This has not been so in economic theory, at least in the most recent economic theory, as shown in the table on page ... Capital has generally been construed to encompass not only material resources, but also human capital, technology and, in general, a residual, in order to be able to explain the empirical economic results.

Here we very clearly postulate that the three causal factors chosen should explain the entire economic process, but it is essential that they be truly understood as causal factors and not, as has apparently been the case in economic theory from the time of Quesnay and certainly since Ricardo, as something different; according to Joan Robinson these causal factors have been confused with the sources of income of the different social groups. We feel that we have clarified this confusion

here.

7. After having clearly established the identification between wealth and the vectorial sum of these three causal factors, an analysis is made, to comply with the methodological norm which we have set for ourselves, showing the generative mechanisms behind the three causal factors cited. The generative mechanism of the material resources is easily explained, inasmuch as they are scarce goods capable of satisfying economic needs or of producing this kind of goods or services. The generative mechanism of the two other causal factors is the same, as their human nature is identical and the difference between the two is a deliberately made analytical division of human resources conceptually considered to differ as a result of their larger or smaller contribution to one or the other kind of economic activity: the directly productive or the creative-enterprising. It should be clear that the difference is one of degree and that the border between the two is necessarily arbitrary.

   The main aspects in which the difference may be noted between the creative-enterprising and the productive resources are the following: the former is more willing to accept personal risk and also has much more intense motivations of personal achievement, recognition and benefit, and devotes more effort to this undertaking than the latter. The creative-enterprising resource has a greater personal capacity for decision-making and leadership, as well as for adopting a long-term outlook on problems and lastly, as its name would indicate, has a tendency to be imaginative or creative.

   Following the thinking of List, we propose that the generative mechanism of human resources is not only the division of labor which is behind modern production, but also the association of the specializations which this division of labor brings about, as oriented toward the task of producing. And behind these are the total motivations of the human being when aimed at economic activity.

   To explain these motivations we have used the typology developed by Professor José Antonio Pérez López, which breaks down motivation into three components: the extrinsic (benefit), the intrinsic (satisfaction with what has been done), and the transcendent (interest in what is done for the benefit of others).

   It is obvious that this entire generative mechanism is embodied in the firm and some of the essential features of this basic institution are analyzed: its need to generate an added value for society, its nature of a risk activity, and the importance it has assumed in the world today as a mechanism for satisfying individual aspirations for wealth, power, success, and so forth.

   These are only some of the points which, worked out in greater detail, could constitute the notes for a Theory of Production.

8. The effects of the selection of factors made is then analyzed at the macroeconomic level, but viewed as aggregate values which are always measured in per capita terms and which in this way once again constitute the causal factors of economic development. The advantage of being able to consider all nation-states as units in the analysis of economic development is shown, as is the possibility and advantage of being able to consider the world a closed system and a superior unit of analysis for dealing with problems of international trade and eventually, those of the

international monetary system.

The importance was pointed out of considering for both productivity and Steering the process of accumulation throughout the centuries, in which new contingents of persons are constantly being added and the old replaced, with a growing amount of training in both cases which undoubtedly increases both factors to a greater degree than the natural wearing down of the persons.

Attention was also drawn to the importance of taking into consideration phenomena capable of drastically altering those factors, such as wars, mass migrations, etc., by not only varying the numerator of those factors but also, when a variation in the number of inhabitants changes considerably the denominator. Any theory that is devised to explain this economic development ¡s supposed to incorporate a series of factors regulating those causal factors, but the latter are definitively limited to the three cited. These and only these, together with all of the regulating factors one might wish to incorporate, should be able to fully explain the empirical results of all of the development processes over history with a relative degree of accuracy. The measurement of those causal factors was then taken up.

9. The three causal factors proposed are observable and empirically probable and it is easy to measure them grosso modo, which is all that is needed, given the enormous differences in economic development among countries today after having made the necessary adjustments in the existing measurement procedures. But it is not necessary to await this adjustment, which may take years, to corroborate the theory as there is enough statistical evidence in the existing information to, in sufficiently approximate values, estimate the values of these variables (construct the data) which would make it possible to prove or disprove a given theory devised using these three as causal variables.

   Thus we have seen that the factors chosen are observable and may be measured, both at firm level and the macroeconomic level of nation-states, using the same criteria and applying a measurement model that may be the same for the microeconomic and macroeconomic levels.

10. The effect of using this proposed conceptual framework to analyze the problems of international trade is only introduced by means of an example, leaving a more strictly defined proposal of this subject for a more explicit formulation of a theory of economic development that would be the subject of a second study (such to involve a continuation of the research conducted). All that shall be stated here is that the world as a whole shall be taken as a unit of analysis and that it is no longer enough to continue considering the countries as closed universes which are open to explain phenomena such as international trade, but an integral presentation of its effects must be made. The proposed conceptual framework seems to be especially suitable for this kind of analysis.

11. In the author's judgment the proposed conceptual framework has, therefore, been shown to be useful for more profound analysis which calls for the formulation of the respective theories, of problems of production, economic development and international trade.

    The author has only insinuated in a very tentatively way, the content of these possible theories in his discussion of the selection and measurement of this kind of

factors.

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