

## ECONOMICS OF KNOWLEDGE - LEARNING AND EMERGENT QUALITATIVE CHANGES

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‘Knowledge itself is Power’

Francis Bacon

*Meditationes Sacrae* (1597)

### Summary

Knowledge economics is a rapidly emerging discipline of theoretical economics that analyses the conceptual and structural transformation of economic activities connected with processes of knowledge, learning and innovation. In this contribution it emerges that economic activities are governed by laws that differ substantially from those enforceable in work, in capital and in land. It also highlights that, compared to other factors, it is available for other uses; i.e. it can multiply, passing from one use to another. Besides, it has presented a shift in the direction of a more important role of learning for knowledge production that it is more adequate to characterize present-day reality as a learning-economy. Finally, new issues have been examined within the knowledge-learning economy involving the following emergencies: 1) a new regime of ownership of the productive resources; 2) an active role of the territories because of an increase of knowledge useful for development; 3) a different role of people, both in production and in consumption; 4) a new conception of time; 5) an imposing flow of externality, of discontinuity and asymmetries, that appear during the propagation of knowledge; 6) the emergence of complexities in the construction of the economic and social post-modern world (or second modernity).

Synthetically the objective of this research was to analyze the more and more radical changes of economic events and, in particular, the investigation on above emergencies mentioned for which the measures taken have not succeeded yet.

Key words: knowledge creation; knowledge generation; knowledge and learning; cognitive capitalism; Innovation process

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## 1. Introduction

Traditional Economic Theory is based on the static equilibrium and on the allocation of the scarce resources for alternative uses, and on linear rationality. The Economics of knowledge is founded, instead, upon a reflexive rationality, that has a long run, acts as dynamic force does not involve management within the usual trade-offs of resources.

The economics of knowledge is a discipline governed by laws that differ substantially from those applied to work, to capital and to the land and even from those that the classics consider intermediate factors (machines, investments, materials). It stands out, compared to other factors, and it can be used without consumption; it is available for other uses i.e., it multiplies from one use to another.

The economics of knowledge is a rapidly emerging sub-discipline of economics which analyzes the deep conceptual and structural transformation of our economic activities that has led to a gradual shift in knowledge-intensive activities. This transformation is the result of the collision of a long standing trend — the expansion of knowledge-based investments and activities — with a technological revolution that has radically altered the production and transmission of knowledge and information (Foray, 2006).

The economics of knowledge is, on the one hand, a new discipline of economic theory [called by Foray (2006) “the economics of knowledge”], which deals with knowledge as a *special economic good* and leads to effects both on individuals and the collective of well-being. On the other hand, it is the historical development of a particular period concerning the growth and organization of economic activities [called by Foray (2006) “knowledge-based economy”]. It represents a new historical phase characterized by permanent innovation processes requiring higher levels of training, continuous learning skills, and special skills that require adaptability, mobility, flexibility, and investment in information access systems (technology, business, law). It also involves procedures for coordinating complex activities both for research and development as well as for the design, manufacture and marketing of products: there is a massive appeal to “intangible capital”, in contrast to the first period of the industrial revolution, with an economic growth based on the accumulation of “capital equipment” such as machines.

The economics of knowledge is identified with cognitive capitalism, which, compared to industrial capitalism created by the revolution of the machines, does not generate value by transforming the material conditions of existence, but transforms thought and uses emotions and identity (Rullani, 2006; Antonelli, 1999).

Knowledge is a *sui generis* productive factor as it generates value in quite different ways from those that are typical of the inputs of traditional economy. The most important possess, and emerge, because of their unique characteristics: the ability to multiply the uses and to value creation; the ability to interpret experience as a function of subjective involvement and the ability to self-regulate the social relations between actors, which leads to positive repercussions of mutual interdependence, the allocation of knowledge, and the consequences that it may determine through application in the competitive environment.

Such features require action to update the theory to a reality that has already changed, with rhythms and courses of evolution profoundly different from those we have been used to.

This work intends to give a contribution in the direction of drawing a clear demarcation, in disciplinary terms, between the new knowledge economy and the traditional neoclassical economics of production factors, which is not able to comprehend the production of value by means of knowledge.

The knowledge-based economy suggests the idea of a cut-off point in the process of economic growth and in the ways of organizing the economy.

The knowledge-based economy results from the interaction of two factors: the first is a secular trend of increasing the share of intangible capital in production (education, training, and research) and the second, a spectacular diffusion of economies within the context of Information and Communication technology.

This interaction has a complex set of effects on the working of the economy that we will try to identify and analyze in the following pages.

In brief, the study will attempt to reconstruct a paradigmatic model to interpret the changing scenario through the detailed investigation of the hallmarks of the resource “knowledge” and its impacts on the economic situation. It will also analyze the characteristics of knowledge economy that determine the predicament between the social objectives of safeguarding an efficient use of knowledge, once produced, and the objective of providing adequate marginal returns to the production of knowledge which generate serious problems of resource allocation.

## **2. Conceptions of knowledge: object or process?**

Knowledge as an object (thing) belongs to the positivist tradition, according to which theoretical laws can predict precisely real behaviour<sup>2</sup>. With the progress of modernity, it has become clear that the world of human beings is not only the result of an alien nature to man, but it is man-made (by biological, cultural, and personal evolution), so it is no more an independent entity, which may be reflected in an objective way. Another new feature of modernity than the premises of positivism (the world and its laws are known, already made), is that the construction of the world is a never-ending process, which requires the exploration and selection of possibilities still open. The world emerges also as a result of our ability acting to understand it, knowing it, to turn it (Arrow, 1974; Nelson and Winter, 1982).

Knowledge is like on the image of a subject, who must learn to see himself in things and events in the world, who has built and can still continue to build.

Knowledge is almost always the result of a participatory and engaging work by the actors that have to produce it and / or to use it and not of a cold and independent observation.

Knowledge is a continuous learning process in which the relationship with the world is routinely tested and reworked by an exploration, that is continuous and goes in all significant directions.

Knowledge as a process emerges in the course of the action (Davenport and Prusak, 1998), discovering possibilities, which were unforeseen and that are sometimes surprising for the same discoverers and the individual becomes the engine and the recipient of the cognitive action.

Knowledge is something that people do fielding their own inclinations and abilities in a process that links knowledge, decision, action, in a work less end. It is a cognitive circuit that must have neither a beginning point, nor an ending point, even if, for methodological abstraction, one can speak of a point of origin and the end of the chain relative to a specific knowledge (Stehr, 2002)<sup>3</sup>.

Knowledge of fact has got a rather indefinite plurality of meanings.

The categories of knowledge that are taken into account from the point of view of management are numerous and meaningful. The resource knowledge has in the economic and managerial literature laws of different behaviour depending on his qualification as tacit, embodied, codified, **embrained** (registered in the cognitive faculties of the human brain), embedded (immersed in context) associated with events or procedural knowledge.

The general term "knowledge" is a process containing a series of indeterminate variants and qualitative aspects, but linking the variations between them, giving to each a meaning and a utility in function of the others. Knowledge is a process distributed in a network of nodes (Weick and Roberts, 1993, p. 359).

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2. The positivist conception has, in the nineteenth and twentieth centuries, supposed science as objective representation (not dependent on the subjective point of view) of a nature that was thought independent from action of the thinking subject and it was known, in its laws, once for all.

<sup>3</sup> Stehr (2002, p. XIV) pointed out that the vision of science and technology, as external factors have facilitated the development of an essentialist conception of knowledge, which tends to sever a relationship between knowledge and acquaintance subjectivity, putting unduly the meaning and action that subjects give to the scientific and technological building (and not only) of the world.

It is certainly not easy to give a concise definition of effective knowledge, however Lundvall and Johnson (1994) found four dimensions:

- 1) Know what: is the knowledge of the “facts” which can be transmitted with data and spread with the aid of data banks;
- 2) Know why: is the human mind and theoretical knowledge that is the basis of scientific and technological research. It allows to innovate production processes and products derived from it, and reduces the frequency of errors of procedure;
- 3) Know-how: is mainly related to operational experience and to the individual opinion of workers. It is the human capital of an enterprise and the various social networks;
- 4) Know who: allows you to find people who are involved in information about who knows what and who knows what to do and how to find solutions to new and complex problems. This requires relational skills, cooperation, communication with different subjects and with experts in various areas.

This element of knowledge allows the building of networks and feeds the formation of social capital, in the perspective of broad and intense inter-activity.

The forms of knowledge illustrated can be learned in different ways : *know what* and *know why* are acquired by reading books, attending courses, lectures, seminars, getting access to databases; *know-how* and *know who* are learned primarily with operational experience and are difficult to transfer to the other following the traditional channels of dissemination of knowledge itself.

The identification of the elements that compose knowledge show as information does not coincide with knowledge even though it is one of the components. Information is a set of formalized and structured data and becomes knowledge only after it has been processed by the mind of an individual. Knowledge is indeed capable of learning and cognitive ability. Knowledge is the ability to use information to reach economic, social, ethical or political purposes . If knowledge is an intellectual and interactive capability, it follows that the increase in knowledge includes other processes than those of information. In the case of knowledge, the development is done by practice, by learning, by intellectual and emotional involvement, while in the case of information, it's reproduction of pure duplication of an idea. Information is a set of formalized and structured data and becomes knowledge only after it has been processed by the mind of an individual.

### 3. The black box of knowledge

Exploring the black box of knowledge we can find through the electronic pipelines:

- 1) Codified knowledge
- 2) Tacit Knowledge
- 3) Information

It depends on the nature of the relationship between the senders and recipients.

#### **Codified knowledge**

Knowledge is codified when it is articulated , clarified and expressed in a particular language and recorded or better externalized by memory (Favereau, 1998). It hinges on a range of increasingly complex actions such as used and applied in industrial design techniques, creating an expert system from the formalized rules of inference underlying the sequence of stages geared to problems and so on. As such, knowledge is detached from the individual and the memory and communication capacity created is made independent of human beings (as long as the medium upon which the knowledge is stored is safeguarded and the language in which it is expressed is remembered).

Learning programmes are then produced that *partially* replace the person who holds and teaches knowledge.

Partially is the key word here because for codification amounts to the process of reducing human knowledge to information, and in the course of such transformations some things almost certainly will be altered, and, quite likely, other meanings will be lost. What is expressed and recorded, then, is not complete knowledge. It is a learning programme that helps to stabilize and reproduce knowledge. When a young technician receives a user's manual, this one does not directly give knowledge on how to run the machine. That said, the manual is helpful and will serve to reduce the costs of knowledge reproduction.

In many cases, when technicians have learned and are dealing with a more or less standard machine, knowledge reproduction becomes almost instantaneous and assumes characteristics close to those of information reproduction. In more complex cases, however, the codified knowledge, certainly useful, will only provide partial assistance.

Codification consists in translating knowledge into symbolic representations so that it can be stored on a particular medium.

This creates new cognitive potentialities that remain inconceivable so long as the knowledge is attached to individual human beings and, hence, only heard (when spoken) or seen (when put into practice) through interaction with those carriers. Inscribing (through writing, graphics, modelling, virtuality) makes it possible to examine and arrange knowledge in different ways and to isolate, classify and combine different components. This leads to the creation of new knowledge objects such as lists, tables, formulae, etc. These are fundamentally important in that they open up new cognitive possibilities that can provide a framework for the rapid production of new knowledge.

Codification thus plays a central role in the knowledge economy because it serves to further memorization, communication and learning, and forms a sound basis for the creation of new knowledge objects.

### ***On tacit knowledge***

There is currently a deep debate among economists about the role of tacit knowledge.

It has been assumed that the more knowledge is tacit, the more difficult it is to share it between people, firms and regions.

Tacit knowledge is knowledge that has not been documented and made explicit by the one who uses and controls it. The fact that a piece of knowledge is tacit does not rule out the possibility of making it explicit if incentives to do it are strong enough. It is useful to distinguish between tacit knowledge that can be made explicit (tacit for lack of incentives) and knowledge that cannot be made explicit (tacit by nature) (Cowan et al., 2000).

*Know-what* can be inserted into databases and *know-why* can be made explicit in theorems. Skills embodied in persons and competencies embodied in organizations can only be documented to a much more limited degree.

There are "natural" limits to make "know-how" possible and explicit; approximations are only possible. This is because of outstanding experts whose activities are based on their unique know-how and firms whose activities are based on unique competencies and permanent innovation may gain extra profits for long periods.

Knowledge written in a code can be accessed only by those with access to that code. Two parties can share the knowledge or one party can sell the knowledge to another.

Codified knowledge is potentially shared knowledge, while non-codified (tacit) knowledge remains individual, at least, until it can be learnt in direct interaction with the possessor. The sectors in which knowledge is dominated by non-codified, but potentially codifiable knowledge, likely suffer more difficult practices of systematic progress.

The debate on codification has been complicated owing to the fact that two different kinds of codes have been alluded to. Some are explicit and available in the form of textbooks, manuals, formulas and organizational diagrams.

The issue of the extent to which such implicit codes can be transformed into explicit ones is an important one. It is well-known that organizational diagrams and management information systems lose some of the complexity and richness that characterize social systems. If these codes could be made explicit, they could be made available to external parties, and mediation of knowledge would become less difficult. Another reason for making implicit codes explicit might be the fact that, in some instances, this would make it easier to formulate and realize strategies of change<sup>4</sup>.

Some science-based sectors build their activities mainly on codified knowledge, while others operate and compete mainly on the basis of unstructured and experience-based implicit knowledge. Thus is not a pure case. Even in the most strongly science-based sectors tacit knowledge will be a key element in their competitive position and conversely it is difficult to find firms that can avoid completely the need to codify.

- Knowledge and information

A basic distinction should be drawn between knowledge and information.

Knowledge, in whatever field, empowers its possessors with the capacity for intellectual or physical action. So what we mean by knowledge is fundamentally a matter of cognitive capability. Information, on the other hand, takes the shape of structured and formatted data that remain passive and inert until used by those with the knowledge needed to interpret and process them. The full meaning of this distinction becomes clear when one looks into the conditions governing the reproduction of knowledge and information. While the cost of replicating information amounts to no more than the price of making copies reproducing knowledge is a far more expensive process because some, indeed many, cognitive capabilities are not easy to articulate explicitly or to transfer to others. There are elements that therefore remain "tacit": we know more than we can say.

Knowledge reproduction has therefore long hinged on the master apprentice system (from a new capacity) is modelled by watching, listening and imitating or on interpersonal transactions among members of the same profession or community of practice.

These means of reproducing knowledge may remain at the heart of many professions and traditions, but they can easily fail to operate when social ties unravel, when contact is broken between older and younger generations and when professional communities lose their capacity to act in stabilizing, preserving and transmitting knowledge. In such cases, reproduction grinds to a halt and the knowledge in question is in imminent danger of being lost and forgotten.

#### **4. The link between economy and knowledge**

The economy deals with scarce resources and provides for knowledge of the necessary means to advance knowledge in fields that are increasingly large and engaging, requiring specialized personnel, equipment and investment in scientific experimentation. In turn, knowledge has offered to the economy ideas, solutions, languages to innovate the processes of production and consumption, changing the competitive advantages of firms, regions and countries. However, for many decades, the link between the economy and knowledge has been neglected by economic theory. For the dominant theory, knowledge has remained a size exogenous dependent on technology and other external factors and the relationship between economy and knowledge appeared to be delivered to the slow evolution of things. For some time, however, the situation is changing, revealing a close link between economy and knowledge. On the one hand we can state that the economy has become a "knowledge based economy" and, on the other, knowledge is drawn by the economic logic of value: knowledge is expensive!

Now the question is whether knowledge is a good, albeit immaterial, quality to consider how other goods (materials)?

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<sup>4</sup> See Cowan, David and Foray (2000) on two different perspectives on the limits and the utility of codification.

Knowledge cannot be reduced to commodities, having properties that are not compatible with the classical conception of goods.

Knowledge compared to traditional capital goods has no fixed capacity in terms of producing additional units of goods. There is a formula similar to that which binds the input for example of aluminium with the growth of the production of aircraft. Basically there is no function of production that can also determine in an approximate way the effects of a unit of knowledge on the economy.

The measurement of stocks, already difficult in the case of physical capital, becomes an impossible task in the case of knowledge.

In the economy of tangible additional units that are governed by laws that bind an original copy number (the first unit produced with the following units), in knowledge there is no original, thus the concept of additional units is not relevant.

A measurement of the stock of knowledge is impossible, because we cannot define a unit of a product. In addition, there is a criterion to determine the price for the knowledge and motivations that are interesting:

- 1) knowledge is acquired outright, but the sale does not involve a loss for the seller;
- 2) the buyer acquires the knowledge once though repeatedly in use;
- 3) knowledge is evaluated by buying it.

The prices, for the same reasons, cannot play the role of reliable indicators. In addition, a significant portion of knowledge is not exchanged, being accumulated within companies and organizations, and therefore is not evaluated in monetary terms.

Studies on knowledge reveal that the ways in which knowledge produces value, convinces that it is a resource "rebel" with his irrepressible autonomy (Rullani, 2006, p. 16). Knowledge is a resource that, rather than to produce material means, it generates value in ways very different from those typical of the factors considered outside the mainstream (roads, ships, airports).

The role of knowledge, within an economy in which the engine of the system was the production of goods and services, was to maximize productivity with the use of better techniques. Knowledge used in this allocation is made in view of the calculation of convenience identified by the excellent statement of each operator and the market (depository of pricing equilibrium between alternative destinations of resources). These elements are considered as exogenous or calculable and if they are public information, they do not discriminate traders. Under these conditions, knowledge disappears from the economic sectors: the scarce resource of classical and neoclassical theory is an available resource, but not that one that is cognitive. In the traditional economy it is the scarcity of the resource that gives value, without attributing to knowledge a valuable role. But it is now known to live in a world built on the knowledge for the generation of economic value and competitive advantage.

In the era of knowledge, economic growth and competitive position depend on the amount and quality of learning processes carried out, the possibility of access to knowledge distributed in large networks and reliable outside specialists and strategic partners and finally the ability to propagate in basins of use increasingly broad knowledge possessed, extracting, in the end, the maximum possible value.

Knowledge produces economic value through the following channels (drivers):

- a) with the multiplication of the uses and the useful value obtained with the knowledge of departure;
- b) giving a meaning to the "endogenous" subjective experiences, making them more valuable in terms of identity operators in action;
- c) with the self-regulation of social relationships between the actors, building effective rules governing the mutual dependence is put in terms of sharing knowledge and its economic consequences.

The classical concept (and neoclassical) production of capital referred to as physical transformation of the starting material is not useful in finished products (profits).

Knowledge is a factor that has a particular way of general value. It must be organized, encouraged, empowered to increase value. If Peter Sraffa in the 60s wrote: "production of commodities by means of commodities" (Sraffa, 1960), now we can paraphrase "production of value by means of knowledge".

The work has become almost totally in roles and tasks, cognitive labour, i.e labour used to produce,

process, transfer, or use knowledge applied to various purposes.

With knowledge, workers are increasingly being considered as a cognitive resource, which goes into production (knowledge workers) to be paid not for the hard work done, but the skills we have made and the results achieved (Butera et al., 1997; Nonaka and Takeuchi, 1995; World Bank, 1998).

Today, not only work is cognitive, but also capital consisting both of material goods (machinery, inventory, etc.) than assets of an invisible intangible nature (Itami, 1987). The intangible asset is fundamentally relational capital (the network) and social capital (Coleman 1990; Putnam, 1993).

Knowledge is a resource closely linked to networks in which it circulates, in which it propagates and it is renewed and in relation to the flow of new experiences it is realized. Among others Golfetto (2002) underlines the fact that to produce value there must be put into effect an efficient mode of complex cognitive circuits, requiring specific skills and knowledge management in the economic exploitation of knowledge possessed. He goes on saying that the player who uses, creatively his knowledge in an intellectual, relational, social territory, is the winner.

The knowledge economy is one in which the economic weight of the sectors related to knowledge has become dominant (determinant) and in which the share of intangible capital in the total capital stock has become greater than physical capital, doubling between 1929 and 1990 (Kendrick, 1994).

The analysis of the process of growth of the U.S. economy carried out by Abramovitz and David (1996) reveals the following. During the mid-nineteenth century, the growth of physical capital per hour worked has contributed to two-thirds of the increase in labour productivity, the contribution in the twentieth century has fallen to a fifth of productivity growth. These elements show that the new technical progress gives a relative increase in the marginal productivity of capital and consists of education and training, improvement of the organizational structure (management structure, systems contract).

In the past, knowledge-based economies have emerged through an increase in resources devoted to the production and transmission of knowledge (education, training, research and development, economic coordination) and technological innovation (new technologies of information and communication), acting as a factor for the structural changes.

The term "license-based economy on knowledge" captures a new quality in the organization and management of modern economic life in the fact that the determinants of the success of businesses and national economies are increasingly dependent on the ability to produce and use knowledge, which is more and more to "knowledge-intensive"

## **5. Knowledge as a productive force<sup>5</sup>**

Knowledge has always been an essential resource for human life and therefore of its economy. Even the production of homo sapiens was considered an "expert activity" because it was different from all other production activities, natural or animals, as employed in the work of the intellectual capacity of the human brain, but its management occurred in an unconscious way and without taking into account the importance of the relationship between knowledge and value for several centuries.

The explanation for this delay is the fact that economic science is born with a deterministic scientific program, which is still in the following. Knowledge, however, is inherently complex, non-deterministic. The knowledge economy cannot establish from the outset as an adequate framework to represent industrial capitalism, because two polarities of its object (the economy on the one hand and the knowledge of the other) on the ground that it contradicts methodology and it has been hidden for a very long time. It is the crisis of Fordism that highlighted a rapid and continuous increase in the complexity and indeterminacy, in

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<sup>5</sup> Marshall in the Principles of Economics attributed to knowledge a founding character of the capitalism of the nineteenth century, is saying that: "Capitalism consists largely of knowledge and organization. Knowledge is the most powerful productive force ... the organization acts supporting knowledge", p. 115, 1965.



which the economy must respond. The big machines, the procedures and the algorithms and programming, in which Fordism had built the principles of optimization of business decisions, are too rigid to cope with economic events that are not anticipated. To adapt in an intelligent way to the complexity, it must resort heavily to the one resource that is able to manage the complexity: is knowledge (Antonelli 1999; Foray 2006; Rullani 2006; 2004).

In particular it should be noted that the knowledge we need to deal with the complexity that is not encrypted, but the experimental one that arises from the events and the reflection on the events, or that is in the minds of men, and in the knowledge of organizations capable of learning: you can call knowledge in action (Malerba and Orsenigo 2000). In fact, between codified knowledge and experiential knowledge (or fluid knowledge), which operate in different contexts and unpredictable action, there is a subtle connection, which is established as a result of modernity (Cowan, David, Foray, 2000).

By March (1991) the link between codified knowledge, which serves for "exploitation" (to produce revenues from what we know) and experimental knowledge, which serves for "exploration" of the new, it is that there would be no exploration without revenues generated with exploitation, and it would be not possible to go on for long with the exploitation if someone does not invest in the exploration of the new. So in the knowledge society both knowledge are needed.

David and Foray (2003) argue that labour and capital transformed into knowledge produce value, changing everything, because knowledge is a resource absolutely *sui generis*, that does not behave at all like the old "inputs" discussed in the manuals.

Knowledge, in the first place, is a resource that, in contrast to the traditional "immovable" and "inputs" is not consumed with use. Indeed the use renews and deepens, making it a non-rival resource when you are using it. David (2001) notes that knowledge is not as fodder which ends with the consumer, you are not likely to make a crop too. On the contrary, it is likely that it will be enriched and made more accurate if the number of scientists, engineers and craftsmen are allowed to compete with it.

Secondly, knowledge has high production costs (for the first use), but a low cost or a nullification of reproduction. To reproduce millions of copies of new knowledge costs little or nothing, for each additional copy. This means that knowledge has a special regime of scarcity when it is lacking at all (before discovery, invention or solution to a problem), but once we get the first unit, it becomes redundant because it can be replicated for any further use, without restrictions on quantity. This has the great advantage of making the resource available to a very large number of potential users, but has the disadvantage of dropping to zero, or nearly so, the price, if knowledge is offered on the open market.

These elements lead to a contradiction: a) on the one hand, the value of knowledge to be best "for society" must propagate on a dock to use as large as possible at a marginal cost of zero; b) on the other side part of this value should go to those who have product knowledge, to remunerate the original resource used, otherwise it has less incentive to produce new knowledge. The value of the product to be appropriate by the research centre, company, etc. other-wise if the institution fails to appropriate the profits generated by the new knowledge, it will not invest in R & D and technological progress will suffer slowdowns. So, we must build a system of artificial monopolistic restriction of supply (by secrecy, patent, copyright or other "protections" of contracts). Or, we must develop a cooperative regime (chain customers and suppliers, consortia, networks), community (sharing, peer-to-peer exchanges) or district (mutual imitation) in which knowledge is exchanged (Lanza, 2000) or copied for free or almost with tacit or express agreement of the manufacturer.

Thirdly, knowledge is different from all other goods: it is not normally a means to an end because, as the experience of knowing often involves the person who makes it, changing his view of the world, his sensitivity to certain issues, and, consequently, his deepest identity. The knowledge has the special ability to create value by acting on the ends of the subjects as, create meanings, lifestyles, backgrounds of experience, desires, etc..

## 6. The typical production system of the knowledge economy

The knowledge economy creates value through three types of cognitive processing:

1) Effectiveness. The knowledge economy must create utility for the final user, i.e. an additional added value, the effectiveness of which must be maintained over the entire circuit of propagation, not only for the first uses. It must be creatively adapted to the characteristics of the different contexts of use. The re-use of knowledge is never a mechanical replication process of the original, but a continuous regeneration of knowledge from which you started. It is necessary to set in motion a process of transfer, adaptation, creative reworking of knowledge when it comes to extending the pool of propagation (Grandinetti, 2002). The effectiveness of knowledge manifests itself in two very different ways:

a) through an objective improvement in process performance (cost reduction, with the same results or products, new features).

b) through a subjective experiential knowledge, in terms of meanings and emotions that it yields.

In the first case, the effectiveness of knowledge is linked to technique efficiency (engineering) and it is based on functional performance that is measurable, albeit without determinism.

In the second case, the effectiveness depends mainly on the intense practical experience of the user. It is something fundamentally different from objective effectiveness which is linked to the functional performance of a useful object. The subjective appreciation of knowledge is realized both in its consumption and in its production and propagation. Knowledge is a reflective process, in which an important part of the utility produced by knowledge is not in its consumption, but in its production and dissemination.

2) A multiplicative propagation that occurs by using knowledge in other applications;

The second step for which knowledge produces value is its propagation that makes it possible to multiply the value by users, by widening the basin of the reuse in time and space.

The value of knowledge generated by propagation increases as the number of re-uses.

Ways to increase the value of reuse are several:

- increasing the value of the products;
- increasing the geographical basin or the period of time in which the same knowledge, with the adaptations, is used in the solution of problems;
- developing new applications to problems and areas not initially considered in which knowledge is found useful.

Today, what makes knowledge a feature resource is the special nature of its reproducibility, which takes place in a path of decreasing costs. The cost is concentrated in the first unit (or the first application of knowledge) to produce it we embark on a long and uncertain process of learning. Once we have found the solution, subsequent units of the same knowledge will be obtained at costs far lower than the first. In some cases, we can reproduce the initial knowledge at almost zero cost or none at all.

The reproductive multiplication of knowledge generates benefits for the users, however, rarely protects manufacturers who invest and risk to provide new knowledge or develop new applications.

3) A rule owner who makes sustainable a process in presence of a weak protection proprietary or none at all. Knowledge to create economic value and competitive advantages must enjoy: a) of use effectiveness, i.e. it should give rise to an economic value, b) of multiplication of uses that should enhance the value produced by hand to the hand knowledge propagates giving rise to an increasing number of re-uses; c) of propagation of the fruits obtained with the use of knowledge according to a process that assigns to each subject in the chain part of the value produced, sufficient to keep him active and involved to the function performed.

If you don't safeguard the ability of appropriation of knowledge, the return on investment in new knowledge tends to zero and also the manufacturer fair is displaced on the market from who doesn't pay for the rights to the legitimate producer of knowledge used. On the other hand, a knowledge of special protection can determine high prices for its use by the monopolist (producer of knowledge), excluding use to many potential users, resulting in the reduction of social value produced by knowledge itself.

In addition, the knowledge economy must rely on human expertise, which are of two types: one is related to the use of information and communication technologies, which create complementary problems between man and computer; the other regards the skills that individuals should have to deal with (master) the permanent change that requires learning skills that go far beyond the technology of information (Hatchuel and Weil, 1992). In this context, learning is the ability to design, implement strategies in response to change and the unexpected: the skills to be acquired are interactive and cognitive skills. The skills include knowledge of a particular discipline and the ability to apply that knowledge to the solution of technical problems (Anselmi, 2009).

More generally, knowledge-based economy is the acquisition of "know how to learn" and has as its key objective: education and training. The exclusive role of the school is important, but too limited (Bresnahan, 1999), as education and training should also involve persons temporarily or definitively deprived of employment.

In the knowledge-based economy, the educational opportunities for all ages is guaranteed by the public sector, having a central role in the exploitation of these opportunities to acquire the skills and knowledge required.

It should be noted that knowledge is not an absolute concept but is defined based on the context in which it is immersed (Tyre and Von Hippel, 1997; OCDE, 1996).

## **7. Property of knowledge**

The new knowledge is in part produced by the man with inventions and in part with findings. The latter consist in trying something that exists, but that it was hidden. Invention is the result of a new idea, of a new production process, a new product, a new organization of production.

Knowledge is characterized with respect to other factors, for its fundamental quality which consists of being used, without being consumed and therefore to be available again for other uses, there by multiplying. This property of resource knowledge generates two innovations that don't arise in the traditional notion of goods:

- 1) the production of knowledge is an irreversible process that leads to a rupture between past and future;
- 2) the value of utility that recovers from knowledge produced is potentially infinite.

When we reproduce a good material there is a process that covers all operations for the production of the first unit, therefore, cost of production and reproduction are the same thing. In the case of knowledge, however, in the reproduction process it does not go through the same stages. The reproduction of knowledge, that can be done by copying, imitation, and learning side compared to what the first manufacturer produced, takes a different route from that taken by the original production.

The second novelty of the knowledge in economy concerns the way to generate the utility value from the use of knowledge as a productive resource.

Knowledge is a renewable resource to infinity (at almost zero cost); it contains a potentially infinite stock of useful value. The process of its spread in time and space increases the overall value. The multiplier can increase the value of knowledge generated by the diffusion even at levels incommensurable with the manufacturing costs initially supported.

As a result of two novelties (irreversibility, utility value theoretically infinite), knowledge becomes a resource with the following features:

- a) it is not a scarce resource: its uses are not competitors (rivals) with each other and lead to zero "the opportunity cost" of each. Knowledge once produced, by lower costs of reproduction can expand the offer to society as a whole, but not for the original producer of knowledge that would have the convenience to restrict its use to support artificially the price;
- b) it is not divisible, in the sense that its cost is minimally attributed to a single use. In the context of knowledge, the match between revenues and costs is very imperfect both in time and in space, giving rise to externalities;
- c) it cannot be excluded: the non-excludability of the resource (resource not excludable) knowledge creates advantages to the owner but also to third parties without paying the fee.

d) it is not instrumental: knowledge is a reflexive resource acting both on ends than the identity of subjects involved, so it cannot be a means to satisfy given ends and changeless.

Therefore, the construction of the economics of knowledge must be governed by laws that differ substantially from those applicable to labour, capital, land.

## **8. Towards a learning economy**

During the last decade of the twentieth century a close relationship was created between knowledge and learning in economy called "learning economy" (Lundvall and Johnson, 1994; Gregghersen, 2001; Lundvall, 2003).

The knowledge economy can be classified according to two fundamental factors: a steady upward trend in the share of intangible capital in production (e.g. education, training, etc..) and a pervasive spread of communications, technology and information.

The combination of these two phenomena generates increased investment in activities aimed at production of knowledge and at a simultaneous acceleration in the processes of reproduction and transmission of knowledge. In a knowledge-based economy competition of enterprises is determined by the quality of processes, by reducing the timing of decisions, reduction of delivery times for new products, adoption of technical innovation and organizational processes of production on farms and external institution. It is important to develop the professional skills of the workforce in the various levels of the system considered (corporate, etc.). They are essential knowledge, distinctive skills and know-how. Hence the concept of economy of which is the evolution of the knowledge economy, as it seeks more about know-how to do than only on knowledge.

Lundvall and Johnson (1994) argued that it was more appropriate to speak of learning than knowledge, as in the large and rapid changes a short life of knowledge was observed, instead of, the ability of learning and of adaptation to new conditions were critical factors, that determined the performance of individual, regions and Countries.

In the neoclassical approach learning is to an individual scale, it is a learning experience or "learning by doing". It is an automated process and without costs.

In modern evolutionary theory, learning is a multidimensional and cumulative phenomenon with local character and a strong dimension in a cognitive chain model of Kline, Rosenberg (Kline, Rosenberg, 1986). In the chain model of Kline and Rosenberg, learning is a process that has a variety and multidimensionality of contents, trajectory and mechanisms that are linked to different sources of knowledge. It involves relations with other actors as clients and partners (learning by using, learning by interaction).

In evolutionary models, learning also plays a key role: It is not simple acquisition of information or Bayesian learning, but it is especially construction of new representations of environment and development of new knowledge and skills that allow companies to exploit the opportunities that will be presented to them.

In a learning-economy innovation is perceived as a learning process that is interactive and depending on the cultural and social institutions. Learning is a direct activity of solving specific problems.

Learning is not a simple acquisition of knowledge, but it is a construction of new representations of environment and development of new knowledge and skills to realize the opportunities that present themselves to businesses.

Different types of learning have been identified: learning by doing (Arrow, 1962), learning by using (Rosenberg, 1982), learning by searching (Nelson, Winter, 1982), learning by interacting (Lundvall,

1988), learning by monitoring (Rosenberg, 1990). Learning and skills are strongly linked: learning skills and nurtures the amendment, greatly influencing the process, speed and the direction of learning. Even the imitation often requires by the imitator skills and learning advanced applications on similar domains (Nelson, Winter, 1982).

Moreover, learning is local and contextual and different sources, the modalities and objectives of learning and it is closely linked to increase and generate new knowledge.

Another key factor of innovation is on the R & D and to non-formalised learning.

Learning not formalised, it is an activity non-focused to solve specific problems in technology, production or market and it can be a learning experience, use and interaction (Malerba, 2003).

The other report concerns the research and innovation as a process that is interactive and collective. The new knowledge can be considered as a process "chain", which puts emphasis on the complementary aspects of the innovation processes, interdependencies and retro-actions and in addition, the role of actors from various innovative in generating innovation with significant implications for innovation conceived as a system and the development of concepts such as national and local systems of innovation.

Research will be based on knowledge and skills that exist and we can say that among them there is a dynamic relationship. The research increases the skills that would improve the absorption of knowledge and a more advanced research (Cohen, Levinthal, 1989).

In conclusion, learning is a process of acquisition and accumulation of knowledge by companies that take place with research, learning, skills and productive activity.

## **9 . Qualitative changes of the emerging knowledge**

The analysis of the theory of knowledge highlighted in the previous pages require updating processes of growth and organization of the economy and they pose a series of large qualitative changes on which to argue. They are:

- a) a new system of ownership of productive activities;
- b) an active role in the territories;
- c) a different role of people in both production and consumption;
- d) a different conception of time;
- e) a massive flow of externalities, discontinuities and asymmetries characterizing the propagation of knowledge;
- f) the complexity of the economic and social world of the post-modern (or second modernity).

### *9.1 A new system of ownership of productive activities*

In the classical tradition, the concept of property was grounded, to material objects (buildings, equipment, consumer goods, etc..) and work as the resource owner of free workers, which "swap" with the land and material objects of the holders. The property indicates the ability to exclude others to the enjoyment of a material object, but with modernity the primary productive force is no longer the land and work becomes progressively cognitive and the knowledge by it produced. The new features are constructed by the productive power of knowledge that is: 1) a social resource, in the sense that its value depends on the circuit socially shared, which spreads and regenerates the content. It is a circuit that is not appropriable by a single owner. Institutions that protect intellectual property rights are weaker than those that protect the ownership of material goods. The property "knowledge" has a much lower power of exclusion, and it may be exercised on individual phases or functions of the circuit and not the whole of knowing and knowledge, 2) a personal resource, tied to no salable capacity of the mind of the worker. Knowledge can be sold, but not totally moved. The knowledge, skills, abilities are in part related to the person who owns them.

The production force that the work moved to the knowledge is not fully appropriable by those who have

financial resources and organization of the means for the production.

The knowledge employed in the economy is a knowledge that is open, freely accessible, which, however, gives rise to a contradiction, enhances the resource knowledge produced largely out of the market, being the public and freely accessible to the low costs of reproduction.

Under the system of regulation of proprietary knowledge, it has not arrived to find a balance between the propagation of knowledge and defence of private convenience to invest. Extent necessary to protect the sustainable intellectual property rights. In the absence of these rights, there would be advantageous to produce (exchange) knowledge, in other words, this would not be produced, or manufactured for the car would be consumed in small circuits, keeping as much as possible secret.

In the absence of legal protection of intellectual property, the producer (fair) is displaced in the market by the "unfair" for not paying the legitimate owner of the rights to use, however. protection of intellectual property also has its drawbacks.

The most serious drawback is the expensive access to certain fields of knowledge that can inhibit creativity, as it excludes all those that would like to gain access to knowledge for the sake of experimentation and curiosity. Any use of loss leads to a reduction of the value produced by social knowledge itself.

The area of knowledge in the public domain thanks to the role of science has led to such innovations, which in the future may shrink making it less popular for creative work and capital investment in innovations (David and Foray, 2003; Hatchuel et al., 2002).

It needs to find a compromise between the interests involved, beginning to create processes and rules for sharing between the parties involved.

In the knowledge society, institutions and their ability to mediate in a shared manner between differing interests become the focal point.

Intellectual property has two basic functions: to end the exclusivity and the objects on which there is such exclusivity, allow the actors to enforce their rights. These features reduce the uncertainty.

The intellectual property rights defines the set of rights granted to the one who invented a new beginning, a new idea. It is an object of property the realization of the idea, the principle, but not the ideas that are recognized as being part of a common fund of human knowledge.

It follows that the objective is not to "protect the property," but that – it is much more relative - providing the foundation for the dynamic propagation of knowledge (making it convenient to invest in the production of new knowledge), then the right of exclusion must be limited to what is needed to achieve this goal, excluding all cases in which the exclusion would have a counterproductive effect (limiting the propagation static and dynamic rather than to stimulate it).

Especially, we have counterproductive effects and often unjustified in all cases in which the protection is not offered to the additional knowledge that are the result of a work of original invention, but is required to make exclusive use of structures that already exist in nature (certain biological diversity, for example), or the evolution of a sector (some software programs initially in the public domain or amortized over time) and cultural history (some marks, or become part of the collective identity). If the author merely reproduce what already exists in nature or in history, he should not be preventing others from doing the same, if you do not want to reduce the static and dynamic propagation capabilities of existing knowledge.

However, the work on standards and their pragmatic use is only a part of things to do. In addition to this, it is to carry out a work that aims to create relationships based on shared awareness and dialogue of knowledge, language, rules, projects. This work is invaluable if you want to get out of the logic of scarcity and embrace the multiplication organized (Rullani, 2006).

## *9.2 The active function of the territories*

Territories emerge as points of a system of division of labour, local / global. Today we see that a growing part of knowledge is localized. Economics rediscovers the territory because it rediscovers the cognitive role (Becattini and Rullani, 1993).

A major change is the economic role of the territory increasingly linked not so much to the classical knowledge localization (distance, location, equipment, fertility, etc..) as the cognitive circuit that settled in places making them different from each other. The firm of the XXI century, or of the knowledge economy, is not the task of producing what is being asked, but to propose oneself to govern the knowledge of networking, of putting to work the knowledge of a network to variable geometry (suppliers, customers, professionals, etc..).

## *9.3 A different role of people in the knowledge economy*

In the knowledge economy people cease to be isolated individuals, as the orthodox economics continues to represent them. In the economics of knowledge people are individuals who develop projects, take initiatives and assume risks interacting with each other.

People involved in the production and consumption of knowledge are building a social network of relationships parallel to those of the market, it is the interpersonal network, in which they exchange performance gains and property rights, in which they exchange mutual recognition, cooperation, social ties. People connect these two networks to make them work without getting in each other. It is a personal capitalism that uses the resources and personal networks as means for supporting the division of cognitive labour.

Knowledge is produced by people who live in dense interpersonal networks of shared meanings (exceeding the only instrumental reason (Habermas, 2001; Micelli, 2000)).

The first modernity was developed through forms of knowledge that have dispossessed workers and consumers of their intelligence and closed widespread access to private knowledge, exchanged on the market.

The knowledge used in the first modernity has been incorporated or in machines or in organizational circuits, capable of excluding the social knowledge and intelligence personnel, however, when the complexity of knowledge used in the production is output from the places where it had been confined, social knowledge and personal knowledge emerge at the forefront of the resources to be mobilized. This is a profound reason for which industrial capitalism (or machine capitalism) has become personal capitalism, which focuses on people and their capacity for initiative.

In the knowledge economy the meaning of work is not only to work to earn a wage. It has become something more complex and changeable to be built within the community of men working. The risk-taking, willingness to cooperate are results that cannot be obtained simply by paying, but requiring the mobilization of personal deep energies, unreachable if we merely encourage opportunistic conveniences. The firm is cooperative activity, which contributes to its operation to generate meaning for people most directly involved in the activity. Different networks and personal feelings can make a big difference in terms of production and use of knowledge. In the knowledge economy people become important in the consumption also. The consumption returns to play a creative role. It was an anomaly of the first modernity to concentrate all power on the offer, reducing the demand for a passive component, which delegates to others the interpretation of its needs and the creation of its desires (Micelli, 1998).

A consumption re-customized and re-socialized becomes a concentration of desire, which brings new elements of value creation.

#### *9.4 Knowledge economy: another view of time*

In the knowledge economy the order is experienced at any time and is not the result of the stability of the physical universe and its laws, but an evolution that takes place over time, which is creative, because it can change weak fluctuations or contingent events to make them durable structures.

Knowledge, on the one hand, creates an irreversibility: every knowledge subsequently produced will no longer be produced at the same cost of the first and second, to maintain the validity of the knowledge in the course of time, but it is necessary to continually update it, adapt it, re-invent, supporting costs (which steal resources from other activities). Knowledge is not distributed over time, in any order, but it is organized in paths made of steps in trajectories that are recognizable (Dosi, 1982). In its evolution, knowledge is developed for subsequent explorations that allow you to track the learning processes that occur at different times.

New knowledge must continually be intercepted and absorbed, while that one held lapses. Supporting the fixed cost of the first unit you change the costs of all subsequent units, resulting in an irreversible change. The more rapid is the possibility of losing control of the owner of knowledge the more rapid must be propagation for the compensation. As a result, the amplifier multiplier space has to be counteracted by de-multiplier time.

In an increasingly knowledge-based society susceptible to frequent changes of equilibrium of the system, propagation becomes much more accelerated in time by becoming unprofitable knowledge after a very limited time (a few months), whereas in the past it happened after years of slow and calculated diffusion. The lifecycle of the products expressed by new knowledge has been greatly reduced, resulting in a continuous flow in all fields of application of knowledge.

#### *9.5 Externalities discontinuities and asymmetries*

The propagation of knowledge voluntary or involuntary generates ideas that cross the boundaries set to protect the confidentiality and proprietary control. At all levels of the value chain are generated externalities, which occur when the investments made by the producers of new knowledge produce benefits also for others (users, imitators) who did not support the costs and risks of producers.

Externalities produce asymmetries between different subjects, and distorting competition. The presence of knowledge multipliable at no cost (or very low cost) determines important discontinuities in the value generation.

The existence of latent knowledge makes difficult the application of knowledge received from outside to grow rapidly to a few orders of the value generated by the latter. When the latent knowledge lacks and when there are no more than the difficulties encountered, the multiplicative mechanism stops. The propagation is not a continuous process, it goes on for stop-and-go dependent on the context of time and by the case, in a cycle that is quite unpredictable a priori.

#### *9.6 The complexity in the world of knowledge*

The production of knowledge in the world of complexity (characterized by variety, variability, uncertainty or nonlinearity of dynamics of the phenomena and courses of action), assumes potentiality that can be realized only gradually and by successive adaptations to the situation that will be created. Knowledge has a value for the customer if the producer is at the service of those who must use it creating relationships that are not of inter-dependence, as is typical of networks. The bond lasts, behaving in a certain extent paths that are not easily predictable.

Traditional economic theory still has its centre of gravity on the static balance and on the allocation of scarce resources to alternative uses.

The knowledge economy cannot be based on these elements: it acts as a dynamic force that is not



manageable in the usual trade-off allocations.

In the knowledge economy the plot of subjectivities that are compared through markets and institutions become less impersonal and less individualistic.

People less reliant on the automation of machinery or organization (hierarchy) and rediscover the need to be involved in choices with their intelligence and ability to exploit paths that are not fixed in advance. At the heart of the economy returning people not individuals. They are persons who have networks of relationships, meanings that make them interact socially with others.

The individualism of early modernity has a liberating meaning: the abstract nature of the markets and the rules dissolved the single from the social bond that had kept him a prisoner of prejudice to the social bond. There is illusion that markets can effectively replace, in all fields, the social link between people. The magic of markets turns vices into public virtues. But the knowledge economy that has remained in the background of early modernity, emerged with full force. When we use knowledge to create value, neither production nor consumption can be done on an individual basis. The production of knowledge generates meanings that have value only if others make them their own.

The social bond of community networks with its complexity of interactions and personal meanings replaces the mechanism of the market. Individuals and markets remain active but they do not operate more in an abstract space with no other features, also. the properties of non-excludability, non-rivalry and cumulativeness of knowledge allow to operate in conditions of increasing returns almost endlessly.

## **10. Economics of knowledge and innovation theory: past and future**

The economics of knowledge within conventional models of neoclassical and Marxist origin remained only as efficiency (that is, as a factor of simply reducing of transaction costs). Such a system that is modified by the changes of the saving factors, in a particular job, runs into the trap of quantitative growth and threatens to create social and political instability. The knowledge economy, in this perspective, becomes an economy of quantity (cost reduction) whose immediate result is the emergence of unemployment that likely remains so if there are obstacles to the simultaneous increase in the quantities consumed and asked for. We imagine the consumption of goods and services in the context of needs given with a path of decreasing utility. This economy promises to enrich the world, but finishes to impoverish it permanently detaching the production from work.

The new knowledge economy has tendencies to remove the unemployed job, but it constantly needs intelligence, professionalism, creativity. There is a need to explore the possible and to use the results with a new cognitive work that must be continually added to the previous job. A job that cannot be delegated to machines and automatic processes, but requires the involvement of human intelligence that uses psychological energy, attention and participation of men (workers, consumers, citizens). The knowledge-based economy turns out to be intensive labour.

The knowledge-based economy in direction towards the learning-economy uses time because it has to use intelligent work to explore spaces of possibility that the machines could not take as its field of action. The work-time is spent in paid work (of employees and independent contractors), sharing, communication, and partly in active imagination, creative leisure ((De Masi, 2001). Finally, a part will affect the consumption started to become more and more complex and exploratory. In fact, the knowledge can be used to cover costs and risks with limited fields of new possibilities, increasing the complexity, the economic value of our experiences of production and consumption.

In the knowledge economy there grow possibilities of action and appreciation both at work and in consumption: the new knowledge help people to manage more complex tasks (more open to surprises and innovations), to experiment with production capacity they previously did not know.

Schumpeter's theory of innovation picks up the idea of the classic cognitive aspects of the process of division of labour (Smith) and the role of general knowledge and science in the development of the long-term (Marx)

in the theory of the excellent allocation of resources and long-term accumulation.

Innovation is a form of knowledge that experiences possibilities that cannot be calculated in advance, but they are born from the intuition and the assumption of the risk of the entrepreneur innovator. Innovation constitutes the connection between the economic sphere and the technological-cognitive ones.

In the Schumpeterian view innovation is a phenomenon "exogenous". Over time there is a need to build models that can incorporate knowledge as a productive resource that has its own dynamic and its own productivity. With the endogenous growth models (Lucas, 1988; Romer, 1990) of neoclassical theory, knowledge becomes a productive resource that is embedded in "human capital" (education, training, competence) or in physical capital (machines, products, etc..). It becomes a part of the economic model and it is no longer assigned to exogenous dynamics. However, the simplifications assumed of knowledge in the endogenous growth model (a kind of technological coefficient), space-less, make it little responsive to its characteristic properties in the real economy, destroying complexity and novelty.

According to Foray (2006) knowledge is a complex product and the degrees of freedom that requires the removal of from simplified models with devastating consequences for relations systems of knowledge-based economies. The new potential knowledge to become economic innovation has to become through conditions much more complex. Among others, Dosi (1982, 1984, 2003) states that knowledge needs time to be aggregated, integrated, become consistent with the context following trajectories that cannot be compressed in mechanical algorithms that can govern them in advance. Furthermore, in this context, the subjects (people, companies, territories), and the contexts in which they operate (culture, institutions, paradigms and national systems of innovation) have a key role (Lundvall 1992, 2002; OECD 2009).

The master plan of economic growth must go towards the exploration of the new, that through exploitation on a larger scale of knowledge determined. Therefore it is very important to engage in the activity of exploratory consumers and workers as persons, encouraging the search for the most complex and immersive experiences that are the condition in order that the reserves, in productivity that are latent, contained in cognitive work can continue in the future to generate value and economic growth. Capitalism becomes cognitive not only because it uses so widespread and intense the knowledge accumulated in the past, but also because it needs a growing stream of cognitive work to explore new possibilities. In the presence of complexity and excess non-adjustable, work capitalized in the old knowledge can co-exist with the new for the exploration of the new and the possible.

Knowledge is linked to understanding, development and assimilation of information and therefore has a cognitive dimension. In addition, the diffusion of knowledge -- as it is known -- is not automatic and does not take place freely. Indeed, companies have different absorption capacity and use of external expertise. Moreover, the various characteristics of knowledge determine its transferability: more knowledge is tacit or not codified, not teachable, not observable in complex or on part of a system, the more difficult it is to share it between companies, people and regions (Winter, 1987). In particular, tacit knowledge plays -- as it is already known -- a significant role in the innovation process and it confers benefits to companies not being transmitted through formal channels and publications. It develops with the experience and personal interactions.

Finally, innovation is production of new knowledge that has economic value because it is used in production processes. An innovative process then incorporates different forms of knowledge and learning that increase the productivity of production factors, fueling economic growth and laying the conditions for achieving economic development.

## 11. Concluding remarks

Fordism had spread the use of large machines, formal procedures and algorithms and programming to deal with the events, but its crisis has highlighted how these turned out to be too rigid to allow the economy to cope with events and varieties which have not estimated (determined) or which are more generally complex. To cope with the complexity, we must resort to massive doses to the only resource that is knowledge, that can make tractable complexity.

The knowledge we need to deal with the complexity is not that which is codified, but the experimental one that arises from the events and that from reflection on the events or that is in the know-how of organizations capable of learning, called: knowledge into action (working knowledge).

Codified knowledge and experimental knowledge (or fluid knowledge) are not opposed, but linked as follows: experimental knowledge serves for the exploration of the new, that codified for the exploitation of what is known. In the knowledge economy both have needs: there would be not exploration without revenues generated by exploitation, but we could not go on further by exploitation without investing in new exploration. They are two sides of the coin.

Modern economics is more than ever aware of the importance of knowledge and learning. New growth theory and new trade theory assume a strong link between the increase in the knowledge base and the rate of productivity growth. The last decades have witnessed an explosive growth in institutional economics and the economics of innovation. In these new fields, knowledge and learning play a pivotal role in economic development.

New theories of the firm focus on building capabilities and competencies. Management literature has formulated the term of “learning organizations” fundamental for theoretical developments and especially for practitioners but, in almost all of these contributions, the understanding of knowledge and learning remains narrow.

The knowledge factory never stops working to the rhythm of creation and depreciation of knowledge that speeds through, besides some processes are not well functioning, others have been monopolized and accessible for a fee and others are not collectivized.

It should be noted also that the transformations generated by the knowledge generated organizational and institutional innovations that need to be solved (to deal with) many challenges to be by the increasing use of intellectual property and the extension of new forms of public properties, which are forces between them in opposition. In fact there are strong disparities between countries for investment in knowledge (different levels of public spending in education and training, different levels of private investment in research and development, and advertising) and then several possible balance between public and private spheres and severe disparities attention paid to the collective production of knowledge, which suggest that the knowledge-based economies can be on different trajectories. In this there is the fear of unbridled privatization of knowledge and a growing gap between the privileged groups and the rest of the population (Steinmueller, 2002).

In a knowledge-based economy in which there are benefits for everyone, the way that the country must take is the path of knowledge open and public research in a production system of intellectual property rights to be implemented, ie you need to have protection of institutions that are capable of supporting efficient production and allocation of knowledge of all kinds.

In conclusion, the fundamental characteristic of knowledge and learning is the ability to remain active in the circuit in which knowledge and learning and its use is as a stimulus and an opportunity to generate additional knowledge that is both effective and efficient. Citing Merton and Barber (1992), the production of knowledge should be propagated not only to repay to the value generated by using the cost of production, but also for major advances in know how *serendipity*, which expresses the ability to discover a lot of other things than those initially found.

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## **ABSTRACT**

### **Economics of Knowledge – Learning and Emergent Qualitative Changes**

The traditional economics has its barycentre on the static equilibrium and on the allocation of the scarce resources for alternative uses, on the linear rationality. The economics of knowledge founds instead, upon a reflexive rationality, that has a long run, that acts as dynamic force does not management inside the usual trade-off of resources.

The economics of knowledge and the real economy are changing deeply, the subjectivities that are compared through the market and in institutions they become less impersonal and less deterministic. Persons are entrusted less to the automatism of machines or organizational and they discover the requirement of being directly involved in the choices with their intelligence and their capabilities to plan, to discover, to assume risks and to enhance ways that are not predetermined.

The conveniences, calculated by people and compared by market, can notably develop, if there is a joined benefit at personal and social level. Persons replace individuals and they don't operate in an abstract space anymore; contrarily their job is lent in personal nets and in social connection.

The economics of knowledge considers economy a system that does not produce deterministic surplus, but to varying geometry, in relationship to the initiatives, that are not prefixed. of employment of available knowledge and those that is possible to conceive, to create through the experience of people.

The factors that allow to turn knowledge into value are fundamentally three: 1) the effectiveness; 2) the numerousness of the uses; 3) the appropriability of the results of the cognitive job. They notice, within the knowledge economy, six great qualitative changes in comparison to the economy of the energy (what has dominated the industrial economy), that constitute some emergencies, that are: 1) a new regime of ownership of the productive resources; 2) an active role of the territories, in the increase of the useful knowledge on development; 3) a different role of people, both in production and in consumption; 4) a new conception of the time; 5) an imposing flow of externality, of discontinuity and asymmetries, that appear during the propagation of knowledge; 6) the emerge some complexity in the construction of the economic and social world of post-modern (or the second modernity).

The objective of this research is to investigate on such emergencies on which it is not succeeded in taking well the measures yet. There are problems, concerning intellectual property rights and the privatization of knowledge; problems of control and fragmentation of knowledge.

Key words: Knowledge; Types of Knowledge; Emergent Changes

