

# ECONOMICS OF KNOWLEDGE AND EMERGENT QUALITATIVE CHANGES

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“Knowledge itself is  
power”  
Bacone

## 1. Introduction

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 transforming thought and using emotions, identity (Rullani 1998).

Knowledge is a productive factor sui generis, as it generates value in ways very different from those typical of the inputs of the traditional economy, the main of which derive precisely from its unique characteristics: the ability to multiply the uses and value creation; the ability to interpret the experience as a function of subjective involvement and the ability to self-regulate the social relations between actors, with positive repercussions of mutual interdependence, sharing of knowledge and with reference to the consequences of its application may result in the competitive environment .

Such features require action to update the theory to a reality already changed, with rhythms and lines of evolution radically different from those we are used to.

The work is part of the direction to draw a clear demarcation, in disciplinary terms, between the new knowledge economy and the traditional neoclassical economics of production factors, you would not be able to receive the news related to the production of value by means of knowledge .

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

The knowledge-based economy results from the interaction of two factors: on the one hand, a secular trend of increasing the share of intangible capital in production (education, training, research) and other spectacular in the economies of the diffusion of technology 'information

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and Communication.

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

In summary, the study attempts to reconstruct a paradigmatic model to interpret the changing scenario through the detailed investigation of the hallmarks of resource knowledge and its impact on the economic situation and the characteristics of the knowledge economy that determine the dilemma between the lens social safeguard efficient use of knowledge, once produced, and the goal of providing adequate marginal returns to the production of knowledge, creating serious problems of resource allocation.

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

Knowledge as thing belongs to the positivist tradition, according to which theoretical laws can exactly predict actual behavior. With the progress of modernity, it became clear that the world of the human being is not only the result of a nature alien to him, but it was man-made (by biological, cultural, personal), so it is not longer 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 and a given 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 as a result of our ability to understand, knowing it, to turn acting.

The knowledge we see the image of a subject, who must learn to see himself in things and events in the world, who 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 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, which is continuous and is significant in all directions.

Knowledge as a process emerges in the course of the action (Davenport, Prusak, 1998), discovering possibility, 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 (Stehr 2002), 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 does not have a beginning point, and there is not an end 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.

At knowledge of fact is given 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 behavior different depending from his qualification as tacit (tacit), embodied, codified, embodied (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 that contains a series of indeterminate variants and qualitative aspects, but linking the variations between them, giving each a meaning and a utility function of the other. Knowledge is a process distributed in a network of nodes (Weick, Roberts, 1993, p. 359).

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<sup>2</sup> The positivist conception has, in the nineteenth and twentieth centuries, the supposed science as objective representation (not dependent on the subjective point of view) of a nature that the action was designed independent of the knowing subject and date, in its laws, once for all.

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 knowing and knowing subjectivity, placing unduly by the meaning and action that subjects give the building science and technology (and not only) around the world.

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

The economy deal with scarce resources and provided the knowledge necessary means to advance knowledge in fields increasingly large and demanding, requiring specialized personnel, equipment and investment in scientific experimentation. In turn, the knowledge economy has offered 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 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 say and say 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 goods albeit immaterial to consider how other goods (materials).

Knowledge can not be reduced to commodities, having properties that are not compatible with the classical conception of the 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 aluminum 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 are governed by laws that bind an original copy number (the first unit produced with the following units), in the 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 can not define a unit of product. In addition, there is a criterion to determine a price for the knowledge and motivation 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 use;
- 3) knowledge is evaluated by buying it.

Studies on knowledge reveal that the ways in which knowledge produces value convinced that it is a resource rebel with his irrepressible autonomy (Rullani, 2006, p. 16). A resource that has produced knowledge, rather than material means 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 the allocation are made in view of the calculation 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 not discriminate traders. Under these conditions, the knowledge disappears from economic: the scarce resource of classical and neoclassical theory is not a cognitive resource available. In the traditional economy is the scarcity of the resource that gives value without knowledge that you have 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.

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 the value. If Peter Sraffa in the 60s he wrote, "the production of commodities by means of commodities", now we can write to paraphrase "production of value by means of knowledge."

The work has become almost all in roles and tasks, cognitive labor, ie labor used to produce, process, transfer, or use knowledge applied to various purposes.

In the knowledge workers are increasingly being considered as cognitive resource, which goes into production (knowledge workers) to be paid not for the hard work done, but the skills you have made and the results achieved (Butera, Donati, Cesaria, 1997).

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

Knowledge is a resource closely linked to networks in which circulates, which propagates and it is renewed in relation to the flow of new experiences is realized. Among other Golfetto (1980) points out that in order to produce value should be triggered efficiently circuits cognitive complex, requiring specific skills and knowledge mangament economic exploitation of knowledge possessed. He goes on saying that the player who uses his knowledge creatively intellectual, relational, social.

The knowledge economy is one in which the economic sectors related to information 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 labor 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 consists of education and training, improvement of the organizational structure (management structure, systems contract).

#### **4. Knowledge as a productive force**

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 can not establish from the outset as adequate framework to represent the industrial capitalism because the two polarities of its object (the economy on the one hand and the knowledge of the other) on the ground contradict methodology and has been hidden in the attic for a very long time. It is 'the crisis of Fordism that highlighted a rapid and continuous increase in the complexity and indeterminacy, in which the economy must respond. The big machines, the procedures and the algorithms and programming 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, must resort heavily to the one resource that is able to manage, the complexity: is the knowledge (Antonelli 1999, Foray 2006, Rullani 2006, Rullani 2004).

In particular it should be noted that the knowledge you 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. In fact, between codified knowledge and experiential knowledge (or fluid), 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).

For March (1991) the link between codified knowledge, which serves for the "exploitation" (to produce revenues from what we know) and experimental knowledge, which serves for the "exploration" of the new, it is that we should have not exploration revenues generated with exploitation, and it would not be possible to go on for a lot with the exploitation if someone does not invest on the exploration of the new. So in the knowledge society need both knowledge.

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

The 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. Paul 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 low cost or null of reproduction. To reproduce millions of copies of a 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 you 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 not drop 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 is less incentive to produce new knowledge (the value of the product to be appropriate by the (research center, company, etc. ) otherwise 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, its sensitivity to certain issues, and, consequently, her deepest identity.

## **5. The typical production system of the knowledge economy**

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

1) Effectiveness. The knowledge must create utility for the end user, ie an additional value added, 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 was designed from 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 efficiency technique (engineering) and is based on functional performance that are 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 effectiveness objective which is linked to the performance functional object useful. The subjective appreciation is realized both in consumption and in the production and propagation Knowledge is a reflective process, in which an important part of the utility produced by knowledge is not in the consumer, but in the production and dissemination.

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

The second step for which the knowledge produces value is its propagation which 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 the 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 resource feature 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 multiplication of reproductive knowledge generates benefits for the users, however, rarely protects manufacturers who invest and risk to provide new knowledge or develop new applications.

3) An owner who makes sustainable adjustment 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, ie it should give rise to an economic value, b) of uses multiplication that should enhance the value delivered 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 product, sufficient to keep it active and involved to function performed.

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 problems of complementarity between man and computer, and the other regard to the skills that individuals should have to deal with (master) the permanent change that requires learning skills that go far beyond the familiar with the technology (Hatchuel-Weil, 1992). It should be noted that knowledge is not an absolute concept but is defined based on the context in which it is immersed (Von Hippel Tyre, 1995).

## **6. Ownership 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 quality fundamental which

consists of being used, without being consumed and therefore to be available again for other uses, multiplying. This property of the resource knowledge generates two innovations that do not 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 recover from knowledge produced is potentially infinite.

When playing 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 does not go through the same stages. The reproduction of knowledge that can be done by copying, imitation, learning side compared to what he did the first manufacturer take a different route from that taken by the original production.

The second novelty of the knowledge in economy concern the way how 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) contains a potentially infinite stock of useful value. The process of its spread in time and space increases the overall value. The multiplier can grow the value of knowledge generated by the diffusion even at levels incommensurable with the manufacturing costs incurred initially.

As a result of two new (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 their use to artificially support 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 matching of revenues and costs is very imperfect both in time and in space, giving rise to externalities;
- c) it can not be excluded: the non-excludability of the resource (resource not excludable) knowledge creates advantages to the owner but also advantages to third parties without paying the fee.
- d) it is not instrumental: knowledge is a reflexive resource acting on both ends that the identity of those involved, so it can not be a means to satisfy given ends and unchangeable.

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

## **7. 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 characterizes the propagation of knowledge;
- f) the complexity of the economic and social world of the post-modern (or second modernity).

### **7.1 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 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 has not arrived to find a balance between the propagation of knowledge and defense 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 the 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 who would like to gain access to knowledge for the sake of experimentation, curiosity. Any use of lost 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, Foray, 2003).

Need 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).

## **7.2 The active function of the territories**

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

A major change is the economic role of the territory increasingly linked not so much to the knowledge classical 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 networking, putting to work the knowledge of a network to variable geometry (suppliers, customers, professionals, etc..).

## **7.3 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.

The people involved in the production and consumption of knowledge 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 labor.

Knowledge is produced by people who live in dense interpersonal networks of shared meanings (exceeding the only instrumental reason (Habermas, 1999; Micelli, 2002).

The first modernity was developed through forms of knowledge that have dispossessed workers and consumers of their intelligence and closed widespread access to The knowledge used in the first modernity have 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 had been confined, social knowledge and personal knowledge emerge at the forefront of the resources to be mobilized. This is a profound reason why industrial capitalism (or machine) 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 can not be obtained simply by paying, but requiring the mobilization of personal energies deep, unreachable if we merely encourages 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 .returns to play a creative role. It was an anomaly of the first modernity concentrate all power in the offer, reducing the demand for passive component, which delegates to others the interpretation of its needs and the creation of his desires (Micelli, 1998).

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

In the knowledge the order is experienced at any time 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. The knowledge, on the one hand, creates a 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 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 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 those held lapse. Supporting the fixed cost of the first unit you change the costs of all subsequent units, resulting in an irreversible change. The more rapid the possibility of losing control owner of knowledge must be much more rapid propagation for the compensation. As a result, the amplifier multiplier space has to be counteracted by de-multiplier time.

#### **7.5 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 the value generated by the latter. When the latent knowledge lack and when there are no more than the difficulties encountered, the multiplicative mechanism stops. The propagation is not a continuous process, 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.

### **7.6 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 that potential 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 center of gravity on the balance and static allocation of scarce resources to alternative uses.

The knowledge economy can not 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..

The individualism of early modernity has a meaning liberating: 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 the 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 the knowledge to create value, neither production nor consumption can be done on an individual basis. 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 endless.

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

The knowledge economy within conventional models of neoclassical and Marxist origin remained only with efficiency, that is, as a factor of simply reducing transaction costs. Such a system that is modified by the innovations of the saving factors, in particular job, it 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 the amount (cost reduction) whose immediate result it is the emergence of unemployment that likely remains so if there are obstacles to the simultaneous increase in the quantities consumed and asked. We imagine the consumption of goods and services in the context of data needs with a path of decreasing utility..This economy promises to enrich the world, but it ends up impoverishing permanently detaching the production work.

The new knowledge economy has tendencies not to leave the unemployed without job, but it constantly needs of intelligence, professionalism, creativity. There is a need to explore the possible and to use the results to a new cognitive work that must be continually added to the previous job. A job that can not be delegated to machines and automatic, 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 labor intensive.

The knowledge-based economy use 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.

Schumpeter's theory of innovation picks up the idea of the classic cognitive aspects of the process of division of labor (Smith) and the role of general knowledge and science in the development of 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 can not be calculated in advance, but they born from the intuition and the assumption of risk of 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 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), spaceless, 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 degrees of freedom that knowledge requires are removed from simplified models with devastating consequences for relations systems of knowledge-based economies. The new potential knowledge to become economic innovation has to through conditions much more complex. Among others, Dosi (1982, 1984) states that knowledge need time to be aggregated, integrated, become consistent with the context following trajectories that can not 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). The master plan of economic growth must go towards the exploration of the new, that through exploitation on a larger scale of knowledge dates.

## **9. Concluding remarks**

Fordism had spread the use of large machines, formal procedures and algorithms and programming to deal with the events, but his 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 the only resource that is knowledge that can make tractable complexity

The knowledge you need to deal with the complexity is not that codified, but the experimental

one that arises from the events and the reflection on the events or who is in the know of organizations capable of learning, called: knowledge into action.

Economics of knowledge investigates on productive resources governed by laws that differ substantially from those enforceable to the work, to capital and to the land and even from those of classics consider intermediate factors (machines, investments, materials). It stands out compared to other factors can be used without consumption, to be available for other uses that is to multiply from one use to another.

In this contribution major qualitative changes have been put in relief that the knowledge economy brings with it requiring an update of growth processes and modalities for the economic Organization. The major changes involve a new qualitative property of the productive activities ; an active function of territories, increase of knowledge useful for development; a different role of people both in production and in consumption; another concept of time; a massive flow of externalities, discontinuity and asymmetries that characterize the process of propagation of knowledge; the emergence of the complexity of the economic and social world of post-modern (or second modernity).

In conclusion, the fundamental characteristic of knowledge is the ability to remain active in the circuit in which knowledge 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 things other than those initially found.

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