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Abstract

Modern economies are increasingly based on knowledge and, more generally, on the intangible assets that favour the economic development. Knowledge-based economies are founded on increasing specialization, research, innovation and learning. The change towards a knowledge-based economy is happening on a global scale, a transformation is taking place in all advanced industrialised economies and many developing economies are also aspiring to reach this target. Knowledge-based economies require some critical requisites to become real and efficient economies. These are the four pillars: education and training, innovation, information infrastructure, the institutional regime.

This contribution will focus mainly on one of those pillars: the institutional environment. Thus, after examining the definition and the characteristics of a knowledge-based economy, it focuses on the relationship between knowledge-based economies and the role of institutions. Institutions and the institutional environment play a key role in the development of a knowledge economy, so they do matter.

The paper argues that various institutional changes must be introduced and these institutional changes that need to be made will involve the public and private sector, as it has been in the case of the Finland's economy. In addition, because of the difficulties for the institutions to build and establish itself over time, it is necessary a certain degree of flexibility in the institutional regime and, hence, the ability to respond to uncertainties.

Keywords: knowledge-based economy, institutional environment, institutions, innovation, development.

JEL Classification: O30, O32, D02, D20,

Introduction*

Modern economies are increasingly based on knowledge and, more generally, on the intangible assets that promote the economic development in the present day.

Knowledge-based economies are founded on increasing specialization, research, innovation and learning. One of the main features of knowledge-based economies is their reliance in the new information technologies, like ICT, which are general purpose technologies.

The change towards a knowledge-based economy is happening on a global scale, a transformation is taking place in all advanced industrialised economies and many developing economies are also aspiring to reach this target. It is a deep and general process which operates across all sectors of the economy: manufacturing and services, high tech and low tech, domestic and internationally traded, public and private, large corporation and small enterprise.

Knowledge-based economies require some critical requisites to become real and efficient economies. These are, according to the approach followed by the World Bank, the four pillars: education and training, innovation, information infrastructure, the institutional regime.

The transformation towards knowledge-based economies will necessarily determine a shift in the proportion of national income derived from knowledge-based industries, in the percentage of the workforce employed in knowledge-based jobs and in the ratio of firms using new technologies to innovate, but it is also very important the institutional setting.

This contribution will focus mainly on one of those pillars: the institutional environment. Thus, after examining the definition and the characteristics of a knowledge-based economy, it focuses on the relationship between knowledge-based economies and the role of institutions.

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Institutions and the institutional environment play a key role in developing a knowledge economy, so they do matter. Thus conscious efforts must be made to establish new and appropriate institutions and to change and strengthen existing institutions to support the process towards a knowledge-based economy, as it has been in the case of the Finland's economy. The paper argues that various institutional changes must be introduced and these institutional changes that need to be made will involve the public and private sectors. In addition, because of the difficulties for the institutions to build and establish itself over time, it is necessary a certain degree of flexibility in the institutional regime and, hence, the ability to respond to uncertainties.

1. Knowledge-Based Economy: definition and characteristics

The notion of knowledge-based economy (KBE) has been widely used in the literature in recent years, although its meaning is sometimes found to be vague because of the different object to which it refers and also to the difficulties of measurement.

The process towards a KBE, started in the early 1970s, has gradually spread across the economies, mainly with the evolution of high technologies and the development of information and communication service sectors. Thus a KBE has been typically characterized by a scenario of structural transformations¹. In this scenario, following a Schumpeterian view (Schilirò, 2009, 2010), knowledge becomes the central source of innovation and, hence, of growth². However, the current development of a KBE should be understood in the context of the globalization and the evolution of capitalism that has occurred since the changes in the 1990s, this is why it is so important to analyze the role of institutions and their changes to better understand the KBE. Last but not least important, KBE is driven by the demand for higher value added goods and services created by more sophisticated and better educated consumers and businesses.

The OECD, which have generated abundant research on this topic following the approach proposed by Machlup (1962)³, has suggested the following definition: «A knowledge-based economy is an economy where the role of knowledge as compared with natural resources, physical capital and low skill labour has taken on greater importance» (OECD, 1996). According to this view, OECD maintained that although the pace may differ, all OECD economies are moving towards a knowledge-based economy.

Historically, the development of the KBE, in which knowledge creation and easy access to knowledge generate greater efficiency, has benefited from technological and institutional conditions, like the rising relative share of GDP due to intangible capital (Abramovitz, David, 1996), the significant growth of educational institutions, the development of large research laboratories, the expansion of knowledge-intensive activities (Foray, 2004). Moreover, the ITC revolution has been crucial in this development process, as it involves technologies aimed to the production and dissemination of knowledge and information. So the production and the diffusion of ITC – general purpose technologies –, interacting with the knowledge-intensive activities, have determined important effects on the economy (Helpman, 1998, Steinmueller, 2002). The diffusion of ITC permits productivity gains in the processing, storage and exchange of information, which is an important area of the KBE. ITC favor the creation and growth of new industries (i.e., multimedia, software,

¹ Schilirò (2010).

² For Schumpeter (1942) the production and diffusion of knowledge are processes that have a strong influence on economic growth and development. Innovation and the capacity of entrepreneurs to innovate are knowledge-driven processes and thus are basic features of the KBE. In the Schumpeterian vision the effect of destruction and disorder of innovation are positive effects of the innovative activity.

³ Machlup is considered by many scholars the founder of the studies of the KBE. He identified the KBE a specialized sector consisting primarily of activities relating to communication, education, the media, computing and information-related services.

e-commerce). They constitute an incentive to adopt new and original organizational models in the distribution and dissemination of knowledge.

Globalisation has also been an important factor for the KBE. The opening up of markets and the internationalisation of trade in knowledge sectors exposed the economies to international competition. The creation of global labour markets for highly skilled workers, the provision of investment capital and access to new technology, information, ideas and knowledge flows from around the world have accelerated the transition to a knowledge-based economy. Moreover, globalisation and the liberalisation of the economy have transmitted and accelerated the forces of change into the economies. These have put pressures on the institutions and the way governments work. So institutions have to gear themselves up to respond to these changes in the market, and governments must also devise new and appropriate policies. At the same time organisational changes need to be introduced, processes have to be improved and strengthened to cope with increasing competition, while this increasing competition, in turn, call for improved co-ordination between institutions.

UNESCO (2005) has drawn a report which describes a knowledge society as one which is nurtured by its diversity and its capacities. A number of studies have been done in the area of knowledge societies and economies, in which the decisive factor to build a KBE is learning, but also the system of education and the capacity of knowledge sharing.

Powell and Snellman (2004), in their overview of the scholarly literature on the knowledge-based economy, offer another definition of KBE which focuses on the production of novel ideas that subsequently lead to new or improved goods and services. They define the knowledge economy «as production and services based on knowledge-intensive activities that contribute to an accelerated pace of technological and scientific advance as well as equally rapid obsolescence. The key components of a knowledge economy include a greater reliance on intellectual capabilities than on physical inputs or natural resources, combined with efforts to integrate improvements in every stage of the production process, from the R&D lab to the factory floor to the interface with customers. These changes are reflected in the increasing relative share of the gross domestic product that is attributable to “intangible” capital» (Powell, Snellman, 2004, p.201).

In practice, the intangible capital is made of intangible assets, which are non-material and non-physical assets, such as R&D, patents, trademarks, copyrights, brands, employee skills, discoveries of new products or processes, software programs, new ideas and new processes used in the organization⁴.

Economists like Shapiro and Varian (1999) have already noted that changes in production are part of a broader shift from tangible goods to intangible or information goods. So there is a wide recognition that knowledge and intangible capital determine economic and social change and foster growth. Unfortunately, these ‘intangibles’ are often very difficult to measure.

A developed line of research focused on patent-based measures to quantify both R&D activity and stocks of knowledge (Powell, Snellman, 2004), since the term ‘knowledge-based economy’ has been used to refer to economic shifts in industrialized nations from industrial manufacturing to production that relies primarily on intellectual property⁵. In this picture, knowledge is a commodity to be traded in private markets. Obviously, this approach is not shared by economists like Dasgupta and

⁴ The role of intangible capital and intangible investments for the growth in the U.S. economy has been highlighted by Abramovitz and David (1996).

⁵ Since the main motivation of R&D activity is the production of knowledge and although knowledge is considered a commodity traded in private markets, R&D is subjected to different kinds of economic constraint as those characterizing the production of goods and services. The uncertainty embodied in the research activities creates a protected world for R&D, which become less dependent on cost-effectiveness and timely delivery outputs than are other economic activities. (Foray, 2004).

David (1994), who, in their seminal paper on the economic analysis of open knowledge, maintained that knowledge is a public good, even if it is a peculiar good⁶.

Powell and Snellman (2004) argued that the upsurge in overall patenting activity in the U.S. and Europe has been driven by the emergence of new industries (i.e. biotechnology industry and semiconductor industry), which were highly fertile in terms of generation of novel ideas and new products. In turn, this upsurge of new industries was associated with a decline of traditional sectors. In particular, Finland's economy, a small European country, was largely based on forestry and paper production, but since the mid of 1990s it became a global producer of mobiles and wireless communication goods through its big corporation Nokia. Thus, telecommunications patents replaced paper patents as the leading patenting sector. Although Powell and Snellman have recognised the role of the legal and regulatory environment in pushing up process of patenting, they did not give too much weight to the institutional environment, preferring instead to emphasize the role of technology.

The literature, however, has showed that it is important to follow a strategy regarding the institutional framework of intellectual property, by altering the legal conditions and terms of property rights, and then changing the institutional setting. The results obtained are effective for producers as regards, for example, the policy incentives. The U.S. patent policy, in particular, has been strengthened in terms of protection since the early 1980s by a more appropriate institutional regime.

Another important point regarding the KBE is that is essentially a learning economy (Lundvall, 2004), where learning processes enhancing competence are fundamental for the economic performance of organisations and the whole economy. A knowledge-driven economy demands a larger proportion of the workforce with a university education and with access to lifelong learning opportunities. This has inevitably determined a major impact on participation rates in tertiary education not only in all OECD countries, but also in the developing ones (TLRP, 2008). China has already more students in tertiary education than the United States. This is leading to a massive increase in the global supply of highly educated workers, able to compete on price as well as knowledge. Thus, knowledge has become a vital commodity to countries, businesses and individuals in the 21st century, which can be considered the age of the knowledge-based economies (Kefala, 2010).

Since a country's most important resource is its human capital, another indicator of the development of the KBE is the growth in human capital. This growth can be captured, according to OECD (2009), by university graduates that furnish an indicator of a country's potential for assimilating, developing and diffusing advanced knowledge and supplying the labour market with highly skilled workers. In 2006, more than one young person in three graduated at the first-stage university level in the OECD area. This represents 7.1 million degrees awarded. Iceland, Australia and New Zealand had the highest graduation rates. Japan with 39 per cent ranks slightly above the OECD average (37 per cent), the United States with 36 per cent rank just below. In Europe almost twice as many degrees per age cohort were awarded in the Nordic countries, Poland, the Netherlands, Belgium, Germany and Austria (OECD, 2009, 5.1). Doctoral graduates are also important for the diffusion of knowledge in the society. They are key players in research and innovation. In 2006, OECD universities awarded 200.000 doctorates to 1.3 per cent of the population at the typical age of graduation. In many OECD countries doctoral degrees have multiplied faster than other university degrees. Since 2000 the number of OECD-area doctorates has increased by 5 per cent a year and the number of first-stage university degrees has grown by 4.6 per cent. Doctoral programmes have also progressed in emerging countries. In 2006, Brazil, the Russian Federation, India and China combined trained half as many doctoral graduates as OECD countries, taken together. Most doctorates are in science and engineering (S&E), followed by the social sciences. 40 per cent of OECD doctoral students graduate in scientific fields. There are proportionally twice as many S&E graduates at

⁶ According to Foray (2004, p.5) knowledge is a particular good different from conventional tangible goods, and it is an "ambiguous good".

doctoral level than at the first-stage university level. The S&E orientation of doctoral programmes is even more pronounced in emerging countries. (OECD, 2009, 5.2).

An important aspect of the expansion of the knowledge-based workforce is the development of occupational communities that consist of individuals, often working for different, sometimes rival organizations, who are in the forefront of producing and distributing novel ideas. R&D collaborations among competing organizations have grown in such fields as IT, nanotechnology, biotechnology where knowledge is developing rapidly and the sources of knowledge are widely dispersed (Mowery, 1999). Therefore, in the knowledge-based economies there are knowledge communities, which are networks of individuals involved in the production, reproduction and circulation of knowledge through an intensive use of ITCs that strongly reduce cost of transmitting and sharing knowledge (David, Foray, 2003). These networks also bring about spillovers and feedback mechanisms. A positive virtue that comes from them is that learning productivity is increased by the fact that an individual can «learn to learn» through reproducing the knowledge of others. So these knowledge communities become agents of economic change and of innovation, because they cut across the boundaries of firms and other non-firm organizations and exchange knowledge within a framework of a network operating by the rules of disclosure and reciprocity⁷.

If we want to sum up the defining characteristics of a knowledge-based economy (Steinmueller, 2002, Smith, 2002, Foray, 2004, Powell and Snellman, 2004, Lundvall, 2004, Leydesdorff, 2006, Schilirò, 2005, 2009) we can include: i) A fundamental shift in investment towards the creation and exploitation of knowledge and other intangible assets such as R&D, software, design, development, human and organisational capital as the basis of competitive advantage. ii) The presence of cheap, powerful and pervasive general purpose information and communication technologies. iii) The establishment of knowledge-based industries and knowledge related occupations. iv) The key role of innovation, that comes from both the successful exploitation of R&D undertaken and from wider forms of innovation as design and development, marketing and organisational change. v) A KBE is a learning economy, where interactive learning is a key to economic performance of firms, regions and nations. vi) The need to align public investments more closely with the demands of a knowledge-based economy, especially in support of R&D, science and technology, higher education, business and enterprise policies. vii) Universities and the higher education sector have an extremely important role as economic actors in attracting and retaining R&D and as agents of diffusion and regeneration of knowledge, so in the KBE it is more important than ever the role of knowledge institutions and the higher education sector as providers of human capital and drivers of innovation.

In conclusion, to understand and describe a KBE is not question of labels or of defining the knowledge work, rather the KBE describes a change in economic structures, and the way in which firms and people operate across all sectors potentially affecting a very wide range of occupations. But it is also important to analyze the institutional regime within which the KBE operates.

2. The role of institutions

The knowledge-based economy is an economy that favors the development of those sectors where the technological knowledge spreads more quickly and effectively, this necessarily leads to the unfolding of processes of structural change. In this context the role of institutions is important, because it is by the interactions between actors and institutions and, therefore, through the relationships that exist between the production system, public authorities, universities and the education sector as a whole – addressed to developing scientific knowledge and technology –, which is affected the innovation performance of firms, organizations and economies (OECD, 1996; Mokyr, 2002). So technological and institutional aspects are intertwined in the knowledge-based economy.

⁷ David and Foray (2003, p.8).

However, the problems that concern the institutional determinants (which must be distinguished from technological ones) are not easy to solve. At the same, technologies and institutions usually tend to adapt to one another, following a coevolutionary process (Powell and Snellman, 2004).

Douglas North (1995) pointed out that competition forces organizations to continually invest in skills and knowledge to survive. Hence, the stock of knowledge the individuals in a society possess is the deep underlying determinant of the performance of economies and societies. Changes in that stock of knowledge are the key to the evolution of economies. Whether it is learning by doing on-the-job or the acquisition of formal knowledge, the most important thing to survive is improving the efficiency of the organization relative to the of rivals. The key point, according to North, is that learning by individuals and organizations is the major influence on the evolution of institutions.

Moreover, it must be accepted the idea that the whole process of knowledge creation and diffusion in a knowledge-based economy heavily depends on appropriate government policies that are usually the outcome of economic incentives and institutional regimes. Thus governments play a crucial role, because knowledge creation and diffusion cannot simply depend on market mechanisms alone. An appropriate framework of economic incentives and institutional regimes is necessary for facilitating the interaction among different sectors in a knowledge-based economy (Schilirò, 2010).

Empirical evidence has sufficiently demonstrated that the institutions help to generate and use new technologies. The institutions that facilitate this task were especially those designed to protect and promote the competition within an industry, the existence of agencies that coordinate set the standards and the evolution of new techniques, the existence of military orders that reduce the uncertainty of demand for a new product or a new technique, the communication between the industries and organizations that specialize in generating new technological knowledge, such as the Universities and research institutes, the intellectual property (Mokyr, 2002, Schilirò, 2010).

To promote a knowledge-based economy not only is required the existence of institutions, but it is equally necessary that these institutions must be strong and credible and that give stability⁸. The creation of credible institutions becomes a precondition, since the development of a knowledge-based community is particularly based on the institutional framework and human capital resources (David, Foray, 2003). Knowledge and institutions are strongly interconnected with each other and their relation is very complex. Institutions typically offer a framework of reference, they constitute “the environment”, an autonomous reality that exists independently from the consideration of individuals. They nevertheless reduce uncertainty and create stability for organizations and individuals, and also guide the behavior and the process of knowledge creation.

North (1990) argued, in this regard, that institutions form a rescue anchor for individuals, they can greatly simplify the choice between the options, narrowing the number of possible alternatives. Institutions also offer a stable equilibrium and the knowledge of routine within which the problem of the choices appears regular, repetitive and evident. A basic role of institutions in a society and an economy is, therefore, to reduce uncertainty by establishing a stable structure of human interaction, although not necessarily efficient.

To better understand the importance of the institutional environment and the role of institutions in the affirmation of the knowledge-based economy we take into consideration the case of Finland and, then, as a specific local case the city-region of Tampere in Finland.

The Finnish experience in the 1990s is an example of how knowledge can become the driving force in economic transformation and growth. Although in the 1970s Finland was relying mainly on resource-intensive industries – it was in fact an economy largely based on forestry and paper production –, the country has become later the most ICT specialized economy in the world, with a narrow set of leading industries producing new products strictly connected with telecommunications (Powell, Snellman, 2004, Dahlman et al., 2006). The evolution of Finland’s economy was marked by the development of Nokia, a successful enterprise, which have become the global leading company of

⁸ Kostiaainen, Sotarauta (2003, p. 431).

mobiles and wireless communications. Although there were also other firms in the country operating in the engineering and telecommunications, Nokia has been the industrial engine for developments in the ICT industries in Finland. Nokia, thereby to a significant extent, influenced the rapid industrial restructuring in the 1990s toward electronics and electrical engineering⁹. At the same time a large number of smaller high technology firms also have been established, and many of them have become world leaders in their niche markets.

Noteworthy is the focus of industrial policies in the 1990s of Finnish government toward microeconomic policies that “provide conditions”. These microeconomic policies put R&D and innovation at the center stage. Since 1980, research and development (R&D) investments by the government have more than doubled to reach levels equivalent to 3.5 percent of GDP in 2004, which was above the EU average. The Finnish innovation system also has been successful in converting its R&D investments and educational capacity into industrial and export strengths in the high - technology sectors. This change is demonstrated by the fact that Finland is among top performers in patenting (Dahlman et al., 2006). In addition, the governance of the economy in Finland was characterized by a strong focus on coordination of policies among key government agencies and between them and the productive sector, which created a cohesive environment.

The experience of Finland shows that it is possible to make significant structural changes in a relatively short time. It also shows that long-term decisions that shape research and education are possible and must be implemented by suitable institutions (Sahlberg, 2007). Finland in 2007 was the top OECD county for the number of researchers employed (per 1000 employees) and also the top for researches employed in business enterprises: 10 per 1000 employees against an OECD average of 6 per 1000 employees (OECD, 2009, 1.10).

So the specialization in high-tech and R&D intensive production needed to be preceded by important changes in economic and social structures. These decisions are indeed necessary, since they provide guidelines for longer-run growth and help create a sustainable competitive edge. Institutions, in fact, form the reference framework for the action of individuals, and in the present case have played an important role. First of all the transformation of the Finland’s economy has been influenced by various favorable changes in the regulatory framework and in market structures. So there has been changes in the institutional regime. The major changes relate to market liberalization and internationalization of business; these changes are interlinked and mutually supportive. The internationalization and the aim of competing in a context of global markets in the 1990s have given a decisive push towards a structural renewal of the economy (Dahlman et al., 2006).

This deep transformation of the economy of Finland has also affected its local economies as is the case of Tampere city-region. In Tampere, there has been a virtuous combination of integration, based on networks, between tangible and intangible resources, local institutions and actors, where the major characteristics of the knowledge-based economy are strongly tied to those of globalization. In addition, a key element has been the presence of a strong and dynamic central government that promotes national systems of innovation and that interacts with the endogenous factors of the development which are oriented at the local level. It was created, therefore, a dynamic relationship among the various levels of government: local, national and global, where learning, seen primarily as a means to renew and increase the resources, has been the basis for success¹⁰.

Regarding the institutional environment in Tampere, Kostiainen and Sotarauta (2003) point out that the creation of knowledge-based economy was largely made possible by the increasing role of knowledge institutions. First, the establishment of University of Tampere in the early 1960s, after the important institution of Polytechnic in the 1970s, thirdly the creation of the Science and Technology Park and Agency for Technology Transfer in the 1980s. In fact, the close ties between universities

⁹ Nokia is by far the largest company in Finland, and it has a considerable impact on the small economy. In 2003 Nokia accounted for 3.7 percent of GDP, one-fifth of exports, 1 percent of total employment, and 35 percent of total national R&D expenditure. Dahlman et al., (2006).

¹⁰ On the relevance of learning in the knowledge-based economy see Lundvall (2004), Schilirò (2009).

and industry and the major role of Polytechnic in transferring knowledge and technological expertise to the system production and, more generally, to provide a set of services to firms, were certainly crucial for the economic development of Tampere. Moreover, the regulatory framework in terms of laws and statutes has induced the Polytechnic to invest in product development, contributing favorably to the university-industry relationship, through the Agency for Technology Transfer, and, at the same time, the renewal of the legislation on the Research Technology Center of Finland has allowed the transfer of a number of research laboratories in strategic areas in Tampere. Nokia, the large company which has become global leader in manufacturing mobile phones, also had a considerable impact on the economy of Tampere, in particular through the growth of activities related to information technology. So in the span of 40 years, Tampere has transformed into one of the foremost Finnish cities of the knowledge economy.

In the relationship between institutions, knowledge-based economy and development, the path dependence plays an important role, since it represents an element of persistence of structure over historical time (David, 1994). The central point of the question is whether this path dependence blocks the economic system in the previous path, or is able, through mechanisms of feedback and adjustment processes, to change and evolve towards more advanced scientific and technological knowledge and thereby implement economic development of the territory and its economy. The path dependence could, in effect, lock the system in the previous path, so it may occur two alternatives: or is a structural change that occurs through a deep crisis of the previous system, or the local production system remains locked in an increasingly slow vicious circle. In the case of Tampere the first of the two alternatives has occurred, because from an economic reality already industrialized, but declining, it arose a new knowledge-based economy, through a self-reinforcing evolutionary process (Kostiainen and Sotarauta, 2003). Tampere is a paradigmatic example of the Finnish model, based on the application of a system's view of industrial policy. This model based on system's view could be described as an acknowledgement of the importance of interdependencies among the knowledge institutions (research organizations and universities), firms and industries due to the increasing importance of knowledge as a competitive asset. This institutional regime enables the improvement of the general framework conditions for firms and industries, especially in knowledge development and diffusion, innovation, and clustering of industrial activities. Tampere has characterized by an high percentage of educated population, 64,5 per cent of adult population has a secondary level degree, and by an high R&D intensity, equal to 14 per cent of R&D national spending. Therefore, if we look at the factors that have determined the success Tampere we find basically three constants: first, the close ties between universities and firms, secondly, the creation of institutions of research, and thirdly, the creation of Scientific Parks or incubators. There are so new organizations created specifically, which are to operate in an innovative institutional framework, to be the protagonists of the development of the knowledge-based economy. Naturally, there are other factors that have almost always had a positive effect, particularly research policy, direct government support and even the historical and economic context.

In conclusion, for economic success certain institutional innovations are as important as the technological ones. Because of the difficulties for the institutions to build and establish itself over time, the pressure of competition due to the effect of globalization and the evolution of technology, it is necessary a certain degree of flexibility in the institutional regime and, hence, the ability of the institutional environment to respond to uncertainties. Tampere was a case in point.

Conclusions

The present contribution has analyzed the important role of the institutional environment in a knowledge-based economy. Knowledge-based economies are economies founded on increasing specialization, research, innovation and learning and on their reliance in the new information technologies. This work outlined a knowledge-based economy and its features, so it discussed the problems regarding its definition and the proposed solutions in the literature to measure this peculiar economy in which knowledge is the main driver. Since knowledge-based economies require some critical requisites to become real and efficient economies – that is the four pillars: education and training, innovation, information infrastructure, the institutional regime, – this work has focused on the relationship between a knowledge-based economy and the institutional environment, highlighting the role of the institutions.

The work argues that various institutional changes must be introduced to achieve a knowledge-based economy in a world characterized by processes of globalization, of harsh competition and continuous innovation. The institutional changes that need to be made will involve the government with its economic policies and the private sector, as it has been in the case of the Finland's economy. To deepen the relation between knowledge-based economy and the institutional environment for the development, not only the Finnish experience has been examined briefly, but also the peculiar case of its city-region of Tampere in order to show the important role of the institutions, and, in particular, of the knowledge institutions (university, polytechnic, institute of research, Scientific Parks), since learning, the transmission of knowledge and the communities of researchers are crucial factors for a knowledge-based economy. In addition, since the institutions need time to build and establish itself and the globalization and the innovation are changing the competitive scenario rapidly and continuously, it is necessary a certain degree of flexibility in the institutional regime and, hence, a capability to respond to uncertainties.

References

- Abramovitz M., David P., 1996. Technological change, intangible investments and growth in the knowledge-based economy: the U.S. historical experience, in Foray D., Lundvall B.A. (ed.), *Employment and growth in the knowledge-based economy*, pp.35 – 60, Paris, OECD.
- Cowan R., David P., Foray D., 2000. The Explicit Economics of Knowledge Codification and Tacitness, *Industrial and Corporate Change*, (9) 2, pp. 211 – 253.
- Dahlman C. J., Routti J., Ylä-An P. (eds.), 2006. *Finland as a Knowledge Economy. Elements of Success and Lessons Learned*, Washington, DC, The International Bank for Reconstruction and Development / The World Bank.
- Dasgupta P., David P.A., 1994. Towards a New Economics of Science, *Research Policy* 23, pp. 487 – 521.
- David P., 1994. Why Are Institutions the ‘Carriers of History’?: Path Dependence and the Evolution of Conventions, Organizations and Institutions, *Structural Change and Economic Dynamics*, (5) 2, pp. 205 – 220.
- David P., Foray D., 2003. Economic fundamentals of the knowledge society, *Policy Futures in Education-An e-Journal*, n. 1, pp. 1 – 22.
- Foray D., 2004. *The Economics of Knowledge*, Cambridge (MA): The MIT Press.
- Helpman E., 1998. *General Purpose Technologies and Economic Growth*, Cambridge (MA), The MIT Press.
- Kefela G.T., 2010. Knowledge-based economy and society has become a vital commodity to countries, *International NGO Journal*, 5 (7), pp.160-166.
- Kostiainen J., Sotarauta M., 2003. Great Leap or Long March to Knowledge Economy: Institutions, Actors and Resources in the Development of Tampere, Finland, *European Planning Studies*, (11) 4, pp. 415 – 438.
- Leydesdorff, L., 2006. *The Knowledge-based Economy: Modeled, Measured, Simulated*, Boca Raton, FL: Universal Publishers.
- Lundvall B.A., 2004. The economics of knowledge and learning, in Christensen J.L., Lundvall B.A., (ed.) *Product Innovation, Interactive Learning and Economic Performance (Research on Technological Innovation, Management and Policy, Volume 8)*, Bingley, Emerald Group Publishing Ltd., pp.21 – 42.
- Machlup F., 1962. *The production and distribution of knowledge in the United States*, Princeton, Princeton University Press.
- Mokyr J., 2002. *The Gifts of Athena. Historical Origins of the Knowledge Economy*, Princeton, Princeton University Press.
- Mowery D.C., (ed.), 1999. *U.S. Industry in 2000: Studies in Competitive Performance*, Washington, DC, National Academy Press.

North D. C., 1990. *Institutions, Institutional Change and Economic Performance*, Cambridge, Cambridge University Press.

North D. C., 1995. Five Propositions About Institutional Change, in Knight J. and Sened I. (eds.), *Explaining Social Institutions*, Ann Arbor, The University of Michigan Press, pp. 15 – 26.

OECD , 1996. The Knowledge-based Economy, *OECD/GD* (96) 102, pp. 1– 46.

OECD, 2009. *Science, Technology and Industry Scoreboard*, Paris.

Powell W., Snellman K., 2004. The knowledge economy, *Annual Review of Sociology*, 30, pp. 199 – 220.

Sahlberg P., 2007. Education policies for raising student learning: the Finnish approach, *Journal of Education Policy*, (22) 2, pp.147 – 171.

Schilirò D., 2003. Dibattito sulla globalizzazione. Un commento, *MPRA Paper* n. 34943, University Library of Munich.

Schilirò D., 2005. Economia della conoscenza, istituzioni e sviluppo economico, *MPRA Paper* n. 31492, University Library of Munich.

Schilirò D., 2009. Knowledge, learning, networks and performance of firms in knowledge-based economies, in *New Technologies, Networks and Governance Structures*, edited by A. Prinz, A. E. Steenge, N. Isegrei,, *Wirtschaft: Forschung und Wissenschaft* Bd. 24, Berlin, LIT-Verlag, pp. 5-30.

Schilirò D., 2010. Investing in Knowledge: Knowledge, Human Capital and Institutions for the Long Run Growth, in *Governance of Innovation*, edited by M.J. Arentsen, W. van Rossum, A.E. Steenge, Cheltenham, Edward Elgar, pp. 33 – 50.

Shapiro C., Varian H.R., 1999. *Information Rules: A Strategic Guide to the Network Economy*, Boston, Harvard Business School Press.

Schumpeter J. A., 1942. *Capitalism, Socialism and Democracy*, New York, Harper.

Smith K., 2002. What is the Knowledge Economy? Knowledge Intensity and Distributed Knowledge Bases, *United Nations University, Discussion Paper* 2002-6, pp. 1 – 28.

Steinmueller W.E., 2002. Knowledge-Based Economies and Information and Communication Technologies, *International Social Science Journal*, 54, pp.141 – 153.

TLRP, 2008. *Education, globalisation and the knowledge economy*, London, TLRP Institute of Education.

UNESCO, 2005. *Towards knowledge societies*, UNESCO world report, Paris.