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# *Space & Innovation in juxtaposition: understanding the relationship in an evolutionary public policy perspective- the case of Greece*

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'*I believe in absolute space as the substratum of force: the latter limits and forms*'
F. Nietzsche

**Abstract:** Between the geometrical apprehension of mathematicians (Lefebvre, 1974: 2) and the long-standing – open - abstract discourse of philosophical thinking, 'space' was struggling for years to emerge as a science or as a distinct subject of Science. Nowadays, space constitutes an *a priori* framework and condition for analysis on issues of development, growth, economic transformation and social reproduction at large. The following paper undertakes a detailed exploration of the relation between space, technology, regional development and public policies. Consideration is given also to specific policy cases by developing first an integrative evolutionary policy analysis framework.

## 1. Introduction

Between the geometrical apprehension of mathematicians (Lefebvre, 1974: 2) and the long-standing –open- abstract discourse of philosophical thinking, 'space' was struggling for years to emerge as a science or as a distinct subject of Science. Nowadays, space constitutes an *a priori* framework and condition for analysis on issues of development, growth, economic transformation and social reproduction at large. The following paper undertakes a detailed exploration of the relation between space, technology, regional development and public policies. Consideration is given also to specific policy cases by developing first an integrative evolutionary policy analysis framework.

More analytically, in the following pages I will address theoretical issues related to regional development by delving into classic and modern theories of innovation, growth and space. Under the critical identification and re-formulation of an 'appreciative'[1] (Nelson, 1995) theoretical background, I will explore the policy practice in the fields of innovation and regional policies as the latter are developing in distinct but interrelated and associated spatial contexts. By taking into account issues of structural or more 'surficial' transformations and changes, I will address the innovation and regional policy in the framework of European Union as well as the evolution of the latter in a national spatial context. What implicitly argued in this paper is that where each mode of production produces its own space (Lefebvre, 1974), ***each new production space and production form entails its own public policy form***. Fundamental methodological inquiries in this view shall be: a. the changing and evolving relationship between space, knowledge (innovation, technology) and policies b. the reasons behind the emergence of regions as 'incubators' of development' and c. the implications on public policy forms (policy genesis, policy rationales, policy nexus).

## 2. Theories of Innovation and Growth: how space is associated to innovation

Innovation has been identified during the last decades as a major factor and driver of economic growth and development. At the same extent innovation has been receiving differentiated definitions by several approaches, space appears as intensively incorporated to the analysis of it. On issues of regional development particularly, the relation between innovation and space has been lately transgressed to a more advanced and sophisticated level.

The term innovation has been used in the related literature for describing the setting up of a new production function, which would be a commodity, a new form of organization, a new source of supply (Schumpeter[2], 1934) or the opening up of new markets (Fagerberg, 2003: 4). Freeman's school offers a more historical, evolutionary and systemic perspective on innovation interpretation. As Fagerberg says, '*the systemic approach of innovation delineate systems on the basis of technological, industrial or sectoral characteristics, but including also other factors such as institutions (regulations, laws, rules, habits), political process, research infrastructure, financial institutions, labour force*' (Fagerberg, 2003: 9).

In a more microeconomics-based or managerial approach, Porter identifies innovation as the new way of doing things that is commercialised; alternatively, Porter incorporates in the innovation generating mechanism, the role of demand and factor

[1] The term coined by the evolutionary economist Richard Nelson mainly as an attempt to express an evolutionary composing of a theoretical landscape. As Nelson characteristically claims, '*economists also need to be understood as 'theorizing' when they are trying to explain what lies behind the particular phenomena they are describing, even when they are not advertising their account as a theory*' (Nelson, 1995: 50).

[2] Schumpeter approached innovation as the crucial force of effective competition, of economic development and the transformation of society (Freeman, 2003: 5); Schumpeter's distinctive contribution regards the 'clustering of innovation' in space and time ['*the spread of innovations is necessarily **uneven** both with respect to timing and space'* (Freeman, 1998: 8], explosive growth of new firms based on these clusters (Freeman, 2003: 6).

conditions (Galanakis, 2006: 1225), together with the role of related and supporting industries and the confluence of firm strategy and rivalry.

Innovation however is broadly defined for this paper as the creation of a new product, process or relation (i.e. services) by the use of existing or new scientific or technological knowledge. It can be argued that the relationship between knowledge [i.e. research, technology, innovation] and space [i.e. regional development] span between '*blindness*' and '*fetishism*'. Most of the classic traditions on economic growth were not very prone on incorporating 'space' in their analyses; on the contrary, some more institutional traditions tend to approach the role of 'space' as determinant and interactive in regional development. The major 'broader families' overall are the Neoclassical tradition and the Social–Institutional Tradition. The former begins with the seminal Marshall contribution[3] ['industrial atmosphere'] and continues with the developing of regional science [the incorporation of space in the analysis of regional economic phenomena], the emergence of urban theory and the emergence of new economic geography. Endogenous growth theory[4] is also a related stream which has been developed by Solow (1957), Arrow (1962), Romer (1986) and Lucas (1988).

The latter [institutional tradition] on the other hand, includes institutional economics, evolutionary economics and critical economic geography. Major differences from the classic interpretations are both the conceptions for the market embeddedness in non-market social relationships, institutional parameters, business organization processes (tacit knowledge), untraded interdependencies but also the role of context [space specifities, productive specializations, institutional framework] on actors' performance.

In the following paper a theoretical preference has been developed towards evolutionary economics[5] (Nelson, Winter, Morgan, Cooke) and critical economic geography (Massey, Morgan, Cooke); the former is approaching innovation as an interactive, non-linear process. The latter apprehends space not as a self-existent entity but as a social construction, a nexus of relations and social interdependencies.

[3] Alfred Marshall underlined the importance of 'industrial clusters' through the developing of concepts such as 'labour pooling' (available and proximate and well-trained labour force), the 'supplier specialisation' (proximate presence of specific suppliers for industries) and the knowledge spillovers (the exchange and flow of information, tacit and explicit knowledge, and know-how between the constituents of the 'district').

[4] Endogenous growth theory draws its argument from the assumption that not only the accumulation of capital promoted sustainable growth but also the development and accumulation of knowledge and technological change. Thus, knowledge and technological transformation are the main 'drivers' of development as long as those are endogenously produced, re-produced and spilled-over throughout the economy. The specific theory is relaxing the assumption of diminishing returns to capital and by rendering technological progress endogenous to the growth model.

[5] The most influential evolutionary economist ever is Schumpeter; the latter has developed a theoretical perspective focusing on the *co-evolution of technology, organisations and institutions*. Based on classical, Marxian mostly, principles (technological competition), he extended the prism by imcorporating micro-based approaches and historical analysis. Overall, he developed a theory of innovation and growth, explaining the former as a social phenomenon which determines economic evolution (Fagerberg, 2002: 15).

'*there are not spatial processes without social content...spatial does not exist as a separate field, and space is primarily a social construction*' (Massey, 1984).

In the debate of the relation between knowledge (or innovation apparently) and space, one could find three different specialised schools of thought. The one interested in institutions, the one interested in industrial organization and that paying attention on technological change and learning.

The first one can traced back to mid-70s Italian scholars and it is centered on the concept of 'marshallian industrial districts'[6] and its economic characteristics as long as its socio-cultural supports to inter-firm interaction within an industrial district (Storper, 1997: 5). The 'California school' on the other hand constitutes a theorization of the relationship between the division of labor, the transaction cost and the agglomeration. Scott characteristically claims that agglomeration is an outcome of the minimization of transaction costs [external economies] (Storper, 1997: 9). Last but not least, a seminal insight is coming from the so called evolutionary economics; for them, technologies are developing along pathways and trajectories, unpredictabilities, path-dependencies and 'collectivities' [interactivities]. For this non-orthodox school technological change is an endogenous force of economic system as long as development evolves through technological and knowledge spill-overs, untraded interdependencies and dynamic processes[7] (Nelson, 1995, 2002). This approach is widely acknowledged as wedded to neo-Schumpeterian economists and the imperative that ***technical and institutional changes*** are the key variables to study in the explanation of economic growth (Freeman, 1998: 27). By predisposing the interpreting value of evolutionary school for regional development, this paper underlines for instance that 'path dependency' concept could explain the 'technological transition difficulties' some regions face (i.e. peripheral regions), at the same extent 'institutional thinness' and 'sufficient conditions' [institutions, spillovers, interaction] could demonstrate the reasons behind the 'social technologies'[8] scleroses.

### 2.1. Flows, Interaction and Distance as Constituents

What primarily connect innovation to space are the terms of '**flow', 'interaction'** and **'distance**'. These three concepts, although appeared separately, constitute a part of the same process. Namely, the flow of knowledge is a mechanism facilitates the interaction between the different actors of the innovation system; similarly, the distance between actors determines the type and the degree of interaction between them.

[6] According to Marshall, external economies resulted from many firms in the same industry located in the same industrial district (Freeman, 1998: 9).

[7] 'Evolutionarists' approach technological competition as driving force of capitalist development, incorporating the concept of 'bounded rationality' as well as including dynamic and evolutionary elements from biology.

[8] Nelson draws a distinction between physical (labor division) and social technologies (institutions), as the driving forces behind economic growth; by the term social technologies, Nelson defines new institutions and as 'social capacity' the ability to make institutional changes essential for the economic growth (Nelson, 2002). Similarly, as 'social technologies scleroses' I define the inability to pursue with institutional changes in social-regional context.

The differentiated flows of knowledge within, between and across spatial contexts form the latter differently (flow quality and direction). In other words, where knowledge introduces novelty into the economic sphere, innovation is approached as crucial for long-run economic growth for national, regional or local level (Fagerberg, 2003: 12). Simultaneously, transformations upon the knowledge production and diffusion processes retain different repercussions upon social and spatial formations (interactive evolutionary relations). As Fagerberg claims, '*knowledge has always been important for economic development but the way it operates today is new compared to situation a century ago'* (Fagerberg, 2006: 20), while it is usually now pre-supposed that higher innovativeness produces higher productivity, thus higher income.

Similarly, distance (or proximity apparently) plays historically a crucial role on the analysis of space and innovation under an 'inclusive' and common framework. It is a almost a common place that innovation tends to cluster in industries, sectors or space whereas is leading to structural changes in production and demand as long as to organizational and institutional change. Tracing back to Marshall (Marshall, 1919), knowledge appears producing more 'value' wherever found in 'proximity loci'.

Main hypothesis of this paper is that evolution of technology (productive systems, techno-economic paradigms) is interconnected to the physical, social and institutional environment as long as development process is interrelated to these co-evolving relations. In other words, ***each new production space and production form entails its own public policy form***. In this perspective, space is incorporated not only as an element but as intrinsic condition, an '***active interval'***. Based on the ideas that proximity[9] is important for research and productive activities and technological change is crucial for development, I will explore ***the co-evolution of technology and institutions together with the importance of institutional assimilation to technological advances.*** Relatedly, a general assumption concerns the relation between place and space; the assumption is that as long as the importance of space (in some, debatable, extent) is decreasing, the significance of 'place' follows an increasing trend as a locus of economic, policy and institutional activity. The exploration of fundamental methodological inquiries such as a. the changing and evolving relationship between space, knowledge (innovation, technology) and policies, b. the reasons behind the emergence of regions as 'incubators' of development', and c. the implications on public policy forms (policy genesis, policy rationales, policy nexus), will assist the investigation of the major hypothesis.

## 3. Why 'regions' and 'knowledge' are becoming so important?

As Storper notes, in the early 1980's region rediscovered both as a field of scientific analysis but also as a fundamental unit of social life in contemporary capitalism (Storper, 1997: 3). Even if regions are a constituent of the dynamism of new

[9] By the tern 'proximity' is meant not only (and not necessarily) the mere geographical proximity but the 'relational proximity' (Morgan, 2001) at large. The positive effects from the geographical proximity (co-location of actors) has been in depth analysed by various theorists; as Morgan claims though, geographical proximity by itself, is not always beneficial (spatial fetishism). On the other hand, much of the positive spill-overs of 'proximity' derive from the relations among actors. In this sense, proximity is likely to be found in cases of more fluid geographical concentration (virtual clustering). Proximity is approached for this paper as including the dimension of 'relational proximity' too.

production systems or simply an expression of major shifts in the capital accumulation process *per se*, the 'region' now emerges as an important 'incubator' of innovation and development. The explanation of putting together the theoretical exploration of regions' re-invention and the investigation of knowledge role in the economic development processes lies on the common factors affecting these forces and their interrelation.

At this point is useful to underline the importance of understanding the innovation process in relation to spatial dimensions, since the way in which innovations occur in different contexts (regions in specific) is essential for the developing of the appropriate regional innovation, technology and research policy (Isaksen, 1998: v). In a more empirical level one can observes some more reasons linking knowledge (as research or innovation) to space and regions.

The relation of the dominant mode of production is more than all associated to spatial forms and knowledge. The specific trajectory brings changes forward; for example, the ways firms are organized (knowledge-intensive processes, outsourcing production, integration and disintegration of productive activities, business networks) is shifting towards an 'economy of networks', flexible and technology-intensive production. As long as the incorporation of functions was a particularity of Fordism, *post-Fordism* retains the characteristic of 'contracting out. The 'externalisation' of functions makes production more flexible to change since it provides the opportunity for new corporate strategies. Hence, the relation of production to space is changing as long as the role of regions is changing towards a suitable sometimes frame for 'incubating'.

At the same time technological restructuring transforms the *role of knowledge* upon the economic and production process. The increased adaptation rate of supply to demand [just in time, kan-ban], the short production chains [batch production], the emphasis on quality and the development of horizontal and vertical networks increase the significance of 'intangible resources' (knowledge, information) (Skayannis, 2003: 4). Production, more than ever, has sustained on scientific and technological knowledge (Geuna, 2003: 3), with the importance of R&D departments (in-house) to increase as long as the significance of innovation and research-technology policy. In parallel, companies' immaterial and intangible resources [patents, property rights, royalties, technological knowledge] have been tremendously increased as a proportion of total large companies' assets.

It is hardly surprising therefore that a major change at the OECD regional economies is the gradual replacement of manufacturing by service industries as their cornerstone. Although 75% of OECD regions[10] have net employment growth, less than one third (29%) recorded an increase in manufacturing employment (OECD, 2007a: 17). As long as the share of manufacturing in regional output and employment is declining, the importance of the service sector has increased ('*tertiarization*'). As major reasons behind this shift are detected technological progress (applications of new

[10] A typical average regional economy created a positive balance of 61.000 jobs over the period 1998-2003 and lost an average of 20.000 manufacturing jobs (OECD, 2007a: 17). Main reasons for this shift have been identified the technological progress, the productivity growth and the low demand. As the OECD report noted, '*since much of the manufacturing sector has been characterised by relatively high productivity growth, prices of manufacturing products have tended to increase little over time and for certain products have fallen significantly*' (OECD, 2007a: 18).

technologies, elevation of knowledge as a productive force), low profitability of manufacturing sectors and the growth of demand for services and the liberalization/deregulation of markets, as the latter '*have opened up new possibilities for business and financial services to expand'* (OECD, 2007: 19).

A more important parameter though appears the emergence and evolution of new *spearhead technologies* such as ICT (Information & Communication Technologies), bio-informatics, biotechnology, robotics. Their applications transform the productive processes making the knowledge requirements and standards higher and the landscape of competition and cooperation different. As Schumpeter claimed, and as European Union data reveals, knowledge (research, innovation) tends to cluster and ineluctably, different demands (high) for knowledge requires different institutional and geographical forms of organisation.

Furthermore, through the seminal contributions of Perez the main principles of these pages are reinforced; as she claims, '*the diffusion of new technologies is strongly affected or inhibited by the institutional framework surrouding older, now mature and obsolescent technologies*' (Perez, 1983 in Freeman, 1994: 87). Perez -as the present paper does- associates technological dynamics to institutional forms and she suggests that each dominant technological style ('techno-economic paradigm') transforms almost all branches of the economy. Consequently, spatial entities (regions, nations) making institutional innovations (or policy innovations, as it is suggested hereinafter) which match any emerging techno-economic paradigm '*are likely to prove the most successful in growing fast or catching up*' (ibid: 88).

Overall, a general interest can be identified focusing on how knowledge (technology, innovation) influences economic growth, how geography influences knowledge activities, and how policy forms can be affected by and affect such processes. As Fagerberg claims, *'knowledge'* has always been important for economic development but '*the way it operates today is new compared to situation a century ago*' (Fagerberg, 2006: 20). The main reasons for the 'elevation' of knowledge as a 'social and economic process' hides on the a. rise of innovation as an organized activity within firms[11], b. the rise of supportive R&D infrastructure[12], c. the massification of tertiary education, which had been started from United States after World War II, and last but not least, d. the ICT[13] revolution (Fagerberg, 2006).

It is within this framework the shift in *economic policy mix* affected the relations between institutions, economy and policies. The increasing significance of monetarist policy upon the fiscal policy the last 20 years (monetarism) and the 're-engineering' of state intervention encouraged the searching of methods in public policy, others than funding. Synergies, public-private consortiums and industry-university relations justified and fortified on the base of monetarism, notwithstanding the possibly positive and efficient effects they generally retain. Under the same prism regions are emerging as identical arenas not only for productive and research activities but also for the new forms of '*governmentality*' (Foucault, 1966). Regions level seems to be

[11] According to Fagerberg, a century ago the devoting of resources to R&D was very rare; R&D investments started in Germany one century ago (chemical industry) and had been more progressed in United States after the World War II (military, space, ICT).
[12] From in-house R&D to innovation systems (regional, national).
[13] Information & Communication Technologies.

more operant for policy negotiation, policy initiation, policy action, policy implementation, policy diffusion, policy 'devolution'.

In a great extent, this change is affecting the development of policies in organizational terms at least (more interactive and inclusive). Much relatedly, shifts have been occurred at the field of micro and macro-economic priorities. The realisation that macro-economic policy is not enough to sustain growth shifted strategies to more micro-interventions. New policy forms such as the encouragement of technological partnerships-consortiums, SMEs networking, clustering and the establishment of scientific parks, incubators, industrial parks and innovation poles are ought to an emergent rationale concerned with micro and targeted interventions. Furthermore, the recent dominance of theories about the importance of 'endogeneity' of growth have given a push to policy instruments more concerned to bottom-up integrated strategies. After all, it seems that 'knowledge' (as a process, asset) and regions (as a frame) are becoming more and more important for the sustaining of constant growth. Most importantly, the emergence of a new mode of production and more specifically, the establishment of a '*new techno-economic paradigm*'[14] (Perez, 2001: 117) entail new competences and new contexts. Knowledge has been always a productive force, although now appears as mush more important both in it's merely 'productive function'; but also in its 'social investment'[15] dimension.

At the same time, and while a key feature of regional economies has always been the level of concentration and specialization they exhibit (OECD, 2007a: 23), regions are re-emerging as an important institutional and relational frame of action. As OECD notes, '*even if traditional reasons for clustering might have diminished in importance with 'globalisation', new motivations for proximity to customers and competitors have grown in importance in an increasingly complex, knowledge based economy'* (OECD, 2007a: 1). The 'economic shrinking' of space appears to reinforce the importance of place as a 'locus' for regional innovation and development.

Regions and knowledge are becoming *key concepts* for technological development. Alternatively, spatial forms are co-evolving with the productive force of knowledge, as long as both are influenced by the shift in the mode of production. Science and technology resources tend also to cluster in spatial terms[16]. Of much importance though for the understanding of regions as 'incubators' of knowledge development and technological change, is the so-called 'intangible resources'. As Morgan says, it seems that in the new 'knowledge economy', intangible resources '*merit as much attention as tangible resources*' (Morgan, 2001: 3). Trust, voice and reciprocity constitute major relational assets for the success of social networks; at the same level, key issues for regional innovation are knowledge spillovers (tacit knowledge and stickiness), proximity as trust, proximity as externalities, and last but not least, untraded interdependencies (i.e. strategic alliances) and social capital (Kourliouros,

[14] Technological paradigm is used mostly to express the establishment and the wider use of new technologies and their effects on the production processes per se, but also on the social institutions and relations. Freeman for instance, identifies historically five different technological regimes with last one that of ICT revolution.

[15] I use this concept in O'Connor's terms; knowledge as social provision by the state for reasons of improving the total level of education (socialisation of public expenses).

[16] In 1996, Commission found out that the 50% of all research and technological development funds were concentrated in '12 islands of innovation', such as Ile de France, Ruhr, Grenoble.

2003) *at large*. It should be mentioned also that proximity might not be enough condition *ex hypothesi*, since it can be counterbalanced by coordination problems or competition; although 'intangible resources' are definitely part of the 'new regional economies'' assets, as the latter provoked by a progressive 'spatial restructuring' and 'knowledge renaissance'.

## 4. Policy Practice: repercussions on public policy

Lefebvre claims that since each mode of productions has its own particular space, the shift from one mode to another must entail the production of a new space (Lefebvre, 1991: 46). Similarly, each mode of production, and its subvariants, entail different public policy forms (new regulation forms) as long as differentiated relations among these forms.

It is widely acknowledged that the crisis of the post-war accumulation regime and the emergence of the so called 'post-fordist' pattern of production [flexible production] have '*changed the hierarchy of cities and regions in Europe*' (Komninos, 1998: 37). As Komninos demonstrates, where traditional centers face decline threats, new dynamic areas have arisen.

> '*It seems that a new macro-economic cycle has opened, redefining 'core' and 'peripheral' regions, in which critical factors are innovation, technology transfer, industrial clustering, and the internationalisation of local productive systems*' (Komninos, 1998: 38).

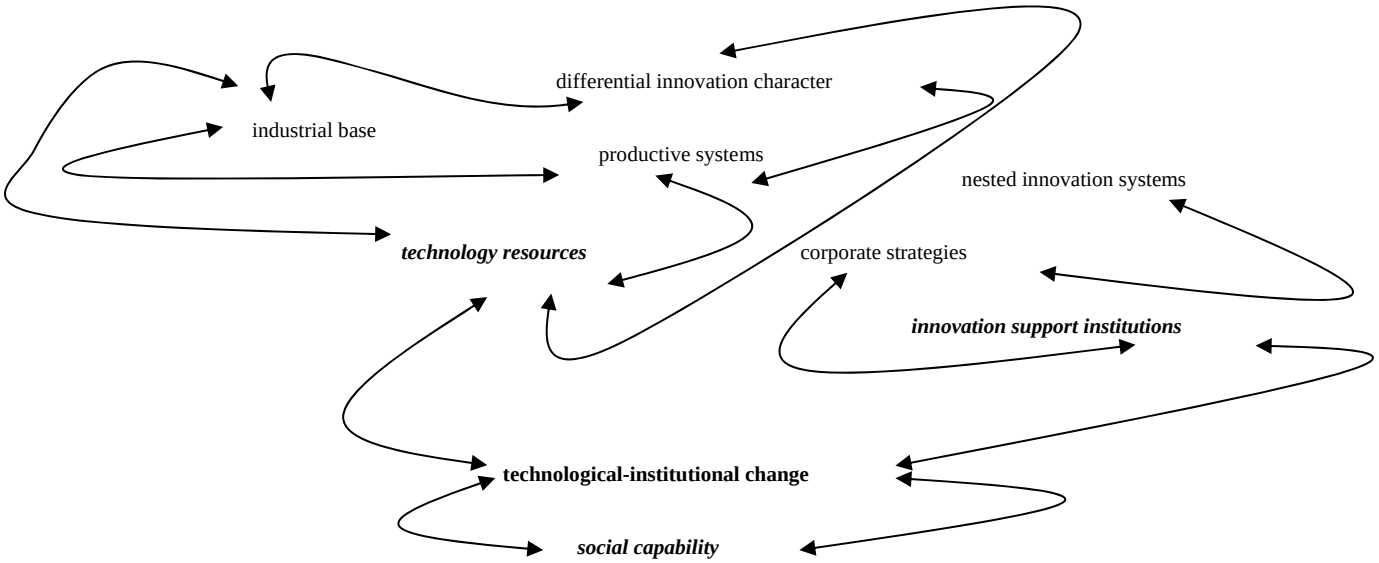
Similarly, it appears that 'European space' is changing through the constituents of the differential innovation character[17] [IC], industrial base [IB] and productive systems [PS] (i.e. production organisation, production specialization, clustering), nested innovation systems (Universities, research institutions, public and private R&D financing, innovation financing[18], associations, agencies, technology transfer, technology information system[19], innovation-science policy and state role) [IS] and corporate strategies [CS][20]. These constituents form two main pre-conditions for

[17] 'Embedded knowledge' or innovation linked to machinery, fixed capital and labour vs endogenously produced, research-driven or knowledge-intensive innovation.
[18] Venture Capital for instance.
[19] i.e. patents, standards, quality.
[20] I suppose that the aforementioned parameters compound the two main conditions towards '*regional economic restructuring*', and which are the technology resources [$R_t = F(IC_t, IB_t, PS_t)$] and the innovation support institutions (Komninos, 1998: 39) [$I_t = F(IS_t, CS_t)$]. The former is mostly connected to the critical economic geography interpretations about the relationship between space and capital; the latter is connected to evolutionary economics understanding regarding the crucial role of institutions, organizations and technology to development (being that regional or local). The connecting concept between these two parallel and occasionally interfacing theoretical streams is that of technological change; where technological resources resemble the differential innovation character and the industrial base and productive systems, and where the nested innovation systems and corporate strategies represent innovation supporting institutions, technological change is arising as the *sine qua non* of economic progress and development. After all it seems that 'proximity effects' preserve an important, sufficient but facilitating role on the processes of development; what appears as determinant in the processes of economic progress, having a more differentiated substantialness is the successful and coordinated evolution of technological resources and supporting institutions, or in other words the technological and institutional change: $Y_t = F(R_t, I_t, SC_t)$, where $Y_t$ represents technological and institutional change, $R_t$ represents technology resources, $I_t$, the innovation support institutions and $SC_t$, the 'social capability'. The specific correlations resemble abstract relations among the components of

economic growth which are technology resources and the innovation support institutions; in congruence with these, technological and institutional change is arisen as a subcutaneous requirement for evolution as long as the latter depends on 'social capability'[21].

Hence, and as long as European industrial landscape is being metamorphosed, European Union policies denoting an explicit recognition of the renewed relationship of knowledge (research, technology, innovation) and space. Moreover, the vibrant admission of the heavy and increasing 'geographical concentration' (which is accompanying the 'geographical re-formation') of innovation is provoking an 'innovation-turn' on policies rationale.

**Figure 1**




More specifically, the implication this realization has on public policy forms can be detected on three levels: first, there is a clear and explicit '**innovation turn**' for EU's regional policy. The current Framework Programme of EU invests more on 'intangible structures' [research, knowledge] and in specific, on innovation, which is

innovative development; the volume of these relations though determines very different types of change. As Morgan describes, differences on the relation between the industrial inheritance (path dependence) and the institutional context of a region can lead to the emergence of completely differentiated development paths. The predominance of 'industrial districts' as corporatist social contracts in Emilia Romagna, the large multinational companies-driven growth in Wales (Cooke & Morgan, 2001) as long as the emergence of R&D and high-tech industry centres in Cambridge and Grenoble constitute examples of differentiated combinations among the considered parameters. Komninos for instance speaks for three different development path: the 'neo-Taylorist', the 'sunrise' and the 'corporatist' (Komninos, 1998: 38).

[21] What is recently defined as 'regional competitiveness' is determined by the capability of 'successfully' pursuing this dual change (technological-institutional) in any given context; that is partly of what Freeman defines as 'social capability' (Freeman, 1998) [SC] or in other words, the capacity to make institutional changes essential for economic growth. Social capability is widely acknowledged, especially from neo-Schumpeterianists, an interfering (as accelerating) variable to economic growth.

now perceived as a major driver for growth. Although is considered that 2/3 of the expenses for research are conducted in only three European countries (France, Germany, UK), the 'new innovation-friendly regional policy' of EU is aiming at the increase and improvement of investments for research and innovation, as long as on the encouragement of synergies to other contiguous policies (Commission, 2006: 1).

During the period 2000-2006 European Structural Funds have spent 10.5 billion on research, technological development and innovation. The improving of knowledge and innovation for growth is one of the strategic aims of EU implemented through specific priorities such as: **a.** strengthening of cooperation among business and between business and research institutes through the creation of regional/transregional clusters of excellence, **b.** supporting research and innovation activities in SMEs, **c.** supporting regional and trans-regional research collaboration and **d.** strengthening R&D[22] capacity building (ibid:4). More than the half of these expenses is committed to research and innovation infrastructures (incubators, technology transfer offices, innovation centres, technology parks) as to the creation networks and consortiums between business and institutes[23].

Secondly, an emergent trend in EU policies for *micro-economic* interventions has been identified. Industrial and economic policy, appears moving to more targeted and micro-oriented actions such as the development of research infrastructures and the encouragement of linkages with development zones, centres of excellence, technology parks and 'clusters'[24]. Space is rather significant parameter in this new conception. The support and development of the so-called *'clusters'*, which are groupings of research and innovation operators (governmental or non-governmental, business or research-academic actors), resembles both the recognition of geographical proximity as a precondition for research, innovative and commercial relations, but also the admission of the importance of regions '*as the spatial basis for the successful and integrated evolvement of such groupings*' (Commission, 2006: 2).

Thirdly, the **inclusive, bottom-up, changing character** of policy instruments appears through changes in three major public policies: regional policy, science and technology policy and industrial policy. Regional policy is shifting from the 'old approach' of redistribution from leading to lagging regions, to a new approach of ***building competitive regions*** by bringing local actors and assets together and by enhancing national and regional innovation systems (OECD, 2007b). Science and technology policy is passing from the financing of individual single sector projects in basic research to the financing of ***collaborative research***, involving networks with industry and links with commercialisation (OECD, 2007b). Shifts on the field of industrial and enterprise policy have been observed too; the 'old approach' was oriented to the subsiding of firms and national champions. The 'new paradigm' is more oriented to the support of common ***needs of firm groups*** (SMEs mostly) and technology absorption. Based on Commission sources, it seems that at the end of

[22] Research & Development.

[23] In parallel with the support through Structural Funds, the Framework Programme for Research and the Innovation Framework Programme aiming at the strengthening of knowledge infrastructures and relations.

[24] As cluster is conceived the formation under which differentiated actors such as research institutes, business, financial institutions, Universities develop a consortium, aiming at specific scientific, technological and economic targets.

1990's industrial and regional policy increasingly concentrated on stimulating clusters and clustering processes (Commission, 2002: 41). The genealogy of this change can be traced back to the **Article 10**[25] of the European Regional Development Fund which was a first attempt for EU to establish innovative regional pilot studies and to work directly with regional actors (Morgan, 2001: 8). The main rationale included the promotion of innovative dimension of regional policy, the development of policies through partnerships and public-private sector synergies and the implementation of projects through the inclusion of local-regional actors (bottom-up approach). Further developments of Article 10 were projects such as STRIDE[26], RTP[27], RIS[28], RITTS[29].

The main guiding principles of this shift entail a. a focus from individual firms to local/regional systems of firms, b. less reliance on large firms and more interest in local agglomeration of SMEs, c. emphasis on indigenous growth rather than efforts to attract inward investments, d. encouraging of social (and systemic) processes (trust based interaction). Overall, the new embryonic cluster policy '*is about stimulating the links to the local business environment through public-private dialogues, defining joint research needs, co-development between contractors and suppliers and so on*' (Commission, 2002: 42).

### 4.1. Clusters as comprising framework of knowledge and spatial forces

An industry cluster is a group of firms and related economic actors and institutions (Brookings, 2006: iv). Clustering constitutes a popular economic development and 'social technology' approach for Universities, research institutions, technological actors, small businesses or regions. By the term 'cluster' nowadays is meant a network or agglomeration between public and private institutions, businesses, research institutes etc. The wide spread of clusters as policy, economic and organisation method makes difficult a concrete definition of 'cluster' or even a categorisation; cluster forms vary from technology field to technology field as from innovation system to innovation system.

In an evolutionary perspective, clusters represent an institutional framework (a 'social technology') which provides some additional pre-conditions for technological and economic change. These include creation of multiplier effects through supporting institutions (i.e. law firms, intellectual property rights policies, technology transfer agencies), knowledge spillovers (tacit knowledge) and flows, interaction and synergies (Nelson, 1995), 'untraded interdependencies'[30] as external economies of scope and last but not least, 'social geography'[31] effects *per se*.

[25] 1% of the ERDF's 70 billion for the period 1994-1999 (Morgan, 2001: 8).
[26] Science & Technology for Regional Innovation in Europe.
[27] Regional Technology Plan.
[28] Regional Innovation Strategies.
[29] Regional Innovation & Technology Transfer Strategies.
[30] By 'untraded interdependencies' is meant, locally bounded resources [tangible or intangible] which are available to all parts of the regional or cluster system.
[31] As 'social geography' is meant the purely geographical distance (proximity) but also the technological distance (similarity among the technologies applied), the skills distance (the similarity of the workers employed), the market distance (similarities among the clients and the target groups) and the social distance (kinds of interactions) (Brookings, 2006: 4).

In a more classic perspective, Marshall was the first who analysed and interpreted the spatial dimensions of economic organisation in relation to knowledge (Marshall, 1919). Broadly speaking, clusters appear to resemble a method of economic organisation which combines external economies of scale, economies of scope, minimisation of transaction costs but furthermore, labor market pooling, supplier specialization, knowledge spillovers[32], entrepreneurship, path dependence and lock in, culture, local demand (Brookings, 2006: 18).

Marshall paid attention on the role of a proximate labor market, the presence of specialised supplier and the knowledge spillovers. In his view Marshall observed that a concentration of firms could facilitate the development of specialised skills and attract workers who they could minimize their economic risk (Marshall, 1920). At the same time, the same concentration could offer opportunities to the specialised supplier for refining and expertise as long as the 'tacit' (as it is later defined) knowledge and the flows of information and know-how between the participants, increase productivity by creating 'external economies'[33].

In a later interpretation, concentration had been connected to 'localisation' and 'urbanisation' economies[34] whilst some following traditional economists detects as drivers of 'clustering' scale economies[35] and transaction costs[36]. A seminal contribution on the theorising of clusters is Porter's; Porter defines clusters as geographic concentrations of interconnected companies and institutions in a particular field (Porter, 1990: 78). More specifically, he describes as cluster foundations the so called factor conditions [infrastructure, labour], demand conditions [demanding local customers], related and supporting industries [suppliers], firm strategy, structure and rivalry.

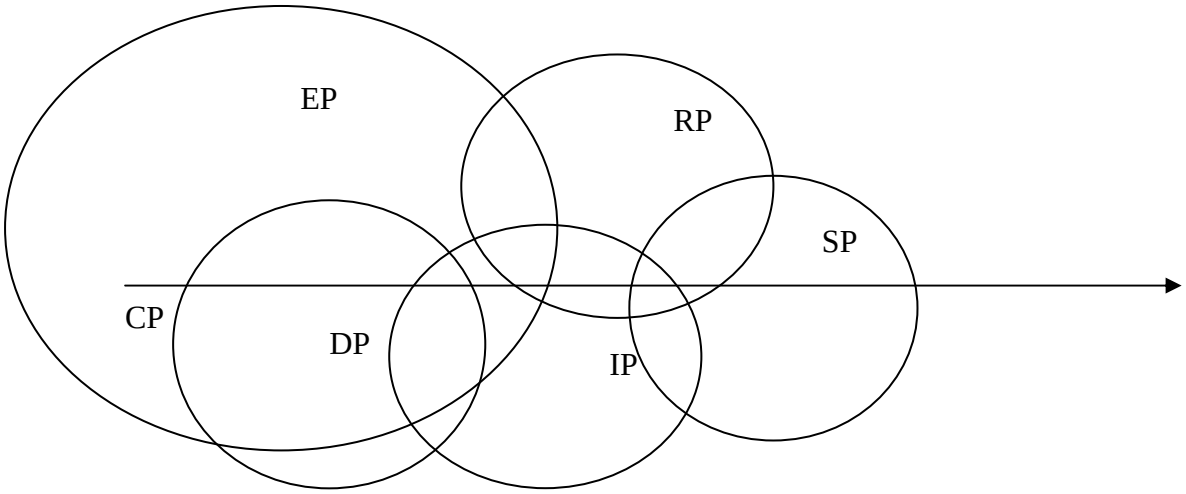
The 'rationale' of clustering combines foundations from all over the theoretical landscape. Overall, clusters represent, nowadays, an emerging but dominant 'policy technology' for regional development. As clusters comprise geographical and knowledge aspects, they constitute a popular platform both for the traditional regional policy but also for innovation policy and research-technology policy.

Although cluster policy constitutes an almost new public policy field, its positive impacts are not *ex definitione* determinable. Clusters are not profitable *ipso facto*, since their impact depends both on the performance of the participants but also on the completeness of the componential frame [i.e. innovation system, industrial base]. At the moment, ***cluster policy*** [CP] has not the characteristics of a distinguished policy stream, while it resembles a 'nexus' of three different public policies: regional policy

[32] Labor market pooling, supplier specialization and knowledge spillovers constitute the major factors for businesses (industrial districts) located near one another than separately.
[33] By the term 'external economies' is meant the association between the scale and specialisation.
[34] By the term 'localisation economies' is meant the gains from proximity to similar firms while as 'urbanisation economies' is broadly defined the gains from proximity to different firms (Brookings, 2006: 9).
[35] By the term 'scale economies' is meant the association between the scale of production and marginal cost or marginal productivity; in other words, decreasing unit costs result from an increase in the scale of production
[36] Transaction costs use to decrease once regard on concentration.

[RP], innovation policy [IP] and science policy [SP][37] [research and technology policy]; and as these three resembles facets of micro-economic [EP] and development policy [DP]. As a new 'policy practice' though, it has its own distinct repercussions on the respective policy forms.

**Figure 2**




## 5. An Evolutionary Public Policy Perspective

What in this point is argued is that the analysis of social, economic and political reality necessitates prisms of evolutionary and combinational perspectives. Notwithstanding public policies were always being interrelated as social forms, **new processes** (i.e. co-formation, co-implementation of policies, supranational institutions), **new relations** (i.e. increasing interdependence) and **new features** (i.e. policy tools) make their development even more interactive and interweaving. It is no longer enough for public policies to be interpreted in a separated and segregated frame, but only on a common ground of co-evolution. More specifically, the main characteristics of this **evolutionary public policy perspective** involve the:

- *co-evolution* of inter-related Public Policies (PP's)
- *interweaving interdependencies* among PP's
- *interactive shifts* of orientations and importance among PP's

Under the scope of formatting an all-embracing and inclusive framework of analysis or an experimental (as 'appreciative') analytical platform, specific guiding principles rise to prominence. The '**equation**' for the understanding of public policies in an evolutionary view involves a. the identification of core principles, b. the exploration of rationale, c. the disentanglement of the each time dominant policy paradigm and, d. the addressing of potential implications on technology resources, institutions and organisations by the evolution of 'nexuses'.

[37] Various definitions have emerged for science policy; Salomon defines it as '*the set of objectives, institutions and mechanisms for allocating funds to scientific research and for using the results of science for general social and political objectives*' (Salomon, 1994: 21).

First of all, one might discovers the **core principles** of any given '**public policy nexus**'; what is meant by 'core principles' include the main strategy behind the under consideration 'nexus', as the latter is forced by the *dominant market trends, the technology trends and the institutional trends*. For instance, core principles might regard 'external empowerment' in institutional terms (i.e. '*vincolo esterno*'[38]), technological trajectories (i.e. the emergence of ICT technologies) in technological terms and production-technological transformation in market trends (i.e. post-Fordism, tertiarization). Shifts in those fields might retain shifts on the core guiding principles of the nexus; however, core principles might include some *constant values* such as state role-interest, public finance surplus and political efficiency (i.e. employment, market potency).

In a second level of deduction it is important to identify the '**nexus rationale'**. Where rationale is used as a reference of the analytical framework, it includes the *core principles potential (input), the 'driver' characteristics and role, the 'reason for change' and the relations among these elements*. More analytically, the nexus rationale depends, at a great extent, on the 'driver of change'; where driver is meant either a specific policy measure (i.e. innovation policy as a driving development policy) or policy and economic actors. The reason for change constitutes also a major variable in the understanding of any nexus; the reasons behind the elevation of science policy or cluster policy in public policy agendas clarify much of the recent trends and directions of policy action. Last but not least, the relations among these elements offer a broader picture assisting the assessment of repercussions from policy forms and action.

In parallel to the exploration of the nature and character of a public policy nexus, the importance of dominant policy trends appears as crucial for the understanding much of the aforementioned relationships. The identification of the '*dominant policy paradigm*' [policy mix] in any given setting, stands significant for a holistic and valid analysis. The investigation of broader parameters determining the economic policy form and it's relation to the regional policy, technology and research policy constitute a necessary stage for the incorporation of the contextual role (i.e monetarism and industrial policy). The inspection for the emergence of a new policy paradigm similarly, might provide the required reasoning for transformation's driving forces.

Last but not least, the 'evolutionary view' is integrated through the addressing of the *implications* on technology resources, institutions and organisations by the predominance of a suppositious 'nexus'. Another evolutionary insight is the disentanglement of the interactive relation between those.

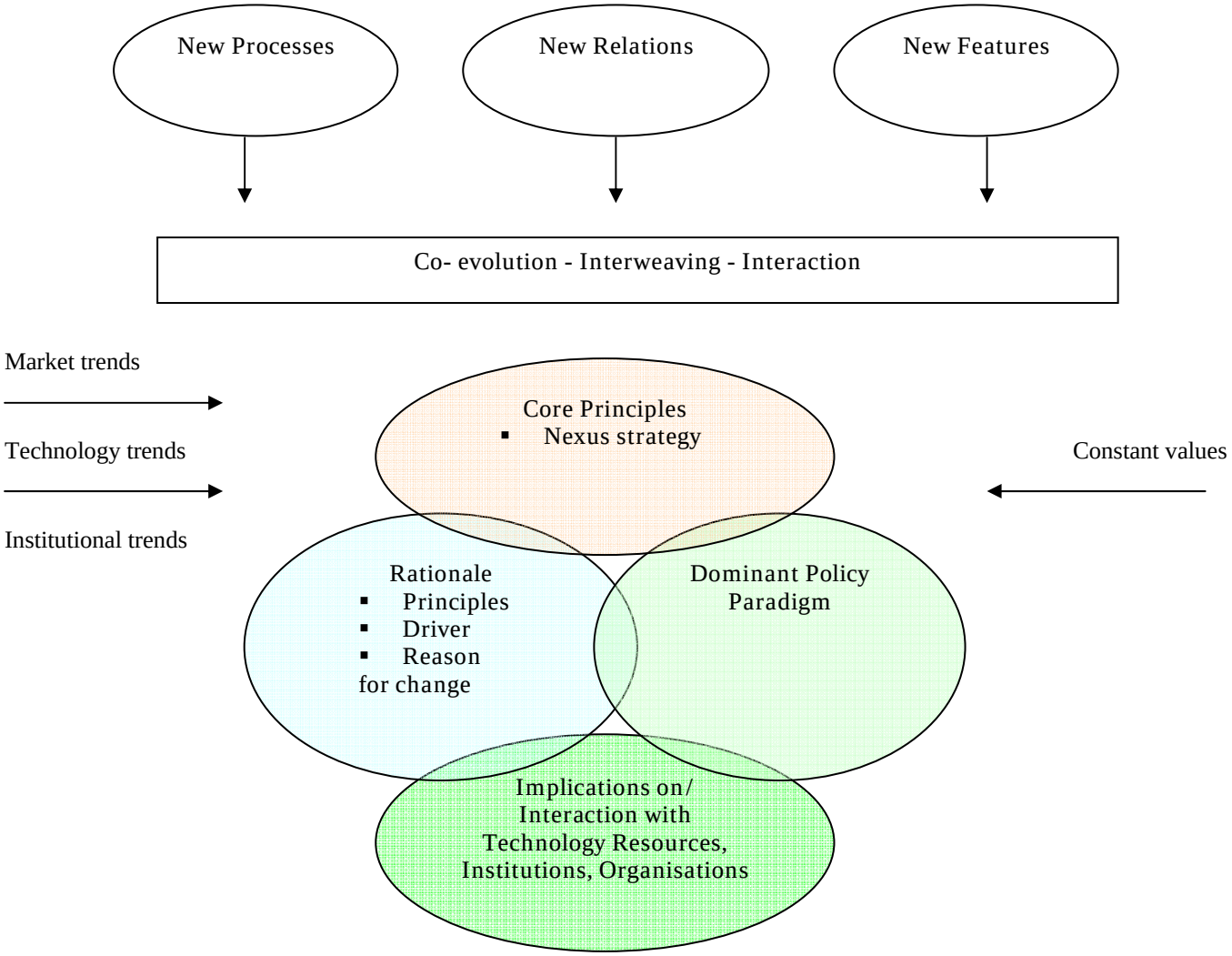
By the term 'technology resources'[39] is meant the broader technological mechanisms, actors, relations, processes but also the *total level of technological advancement*. Similarly, by the term 'institutions' is meant the 'tangible and intangible social routines'; in other words, it includes the role of specific and related institutional actors but also it includes laws, regulations, policies, and 'social habits' (culture, social capital etc). Under the same prism, as 'organizations' are defined firms, universities,

[38] The term "vincolo esterno" means external coercion/imposition (Dyson, K and Featherstone, K, 1996).

[39] As it has been mentioned, technology resources include industrial base, differential innovation character and productive systems as it is interact with them.

research institutions, public and private associations and agencies; broadly speaking, it involves veto groups, stakeholders and policy designers-makers.

**Figure 3**




What it is attempted through the above described experimental analytical framework is the formation of an 'co-evolutionary and combinational explanatory equation' for the scope of exploration of public policies in given contexts. More specifically, major aim is the developing of a hybrid pattern for a. the explanation of major shifts in public policy forms, b. the highlighting of implications these shifts have on technological resources, institutions and organizations and c. the interactive role technological resources, institutions and organizations retain on the co-evolution and transformation of the specific forms.

## 6. The case of Greece

It is within such a framework of analysis that I would like to approach the interrelation between dominant techno-economic paradigms, emerging technological and institutional trends, institutional and policy forms and national/regional specificities.

Greek regional, technology and industrial policy have undergone changes the last years due to the new EU level programmes and policy orientations towards a more co-operative, multi actor and place-based approach (OECD, 2007). Public policies implementation in the country could be approached as quasi-'Europeanised' and it is through within such a spectrum I should like to interpret shifts at the public policy rationale.

Innovation policy in Greece is coevolving and interweaving with industrial, technology and regional policy, presenting thus certain characteristics and symptoms of the certain policies. In order to analyse innovation policy in its constituents, one should take into account the broader national innovation system[40] and the national productive pattern.

For years, a main characteristic of innovation policy in Greece is the assimilation to the general productive pattern and the reinforcing of it. The latter is characterised by the non-production of knowledge and technology, the low innovativeness and the non- extroversion of businesses. The economic development of modern Greece has mainly based on the transfer of embodied technology from abroad, the exploitation of natural resources and the satisfaction of national demand (Commission, 2006: 1). Based still on low labour costs, traditional industrial branches and neo-Taylorist forms of production (Komninos, 1998: 47), Greek peripheral regions facing many obstacles to follow a '*new knowledge-intensive innovation policy pattern*'.

Similarly, the Greek Innovation System suffers from certain deficiencies. A first problem identified is the low participation of business in the production of knowledge (Research & Development). A second feature, as it has already been noted, is the low innovativeness and extroversion of business firms. Another problem identified is the under-developing of institutions for life-long training (Commission, 2006: ii) and a polyvalent legal status for intellectual property rights (IPRs) (Prastakos, 2003: 27) and cooperation between public-private or public-public institutions.

In the same framework, a significant systemic absence is the non-developing of intermediary institutions such as industry liaison offices as well as the lack of inclusive (i.e. university-industry-public sector) and participative programmes. As strengths of the innovation system could be considered research (human) potential, universities and research institutes together with the pro-active innovation policy of the last years, implemented from the Ministry of Development and the General Secretariat for Research & Technology (GSRT).

Finally, and since innovation policy in the country has been interweaving with regional and industrial policy, it is occasionally characterised by the same symptoms with them. The semi-autonomous and substituting (as non-crystallised) role to other policies is considered as main feature. Additionally, interrupted and fragmented

[40] The term coined by Lundwall (1992) and Freeman (1998). By this term is meant the general innovation system of institutions, actors, procedures and relations between them, such as business, universities, research centres, intermediary institutions, legal status, innovation policy, in any given spatial context. Innovation system can be also regional, local or micro (clusters of business firms or vertically integrated businesses). As national innovation system Freeman defines '*the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies*' (Freeman, 1995).

actions were a common pattern until 2000, at least. Similarly, innovation policy model has been characterised by a centralised or selectively (differentiated) decentralised character, but also determined by a top-down implementation pattern, in administrative terms.

### 6.1. An evolutionary perspective

Major aim of the present paper is to associate technological dynamics to institutional forms. In this scope an integrative evolutionary framework is developing which involves general technological trajectories, policy trends and specific institutions and policy paradigms. In the following page I will try to test the model at issue on the case of Greek innovation policy.

Since 2000, under the new **technological, market and policy trends,** a policy re-orientation has been identified. The technological progresses of the last two decades and the emergence of the new 'techno-economic paradigm'[41] (Perez, 1983 in Freeman, 1994: 87) together with the 'shrinkage of economic space' (through post-Fordism), have imposed new inevitable necessities to national policy and economic spheres.

Similar necessities for technological transformation have been imposed to all sectors of national and regional economies. The last two decades technological changes have been positively affected the innovation capacity and performance in manufacturing and services. The increased role of knowledge in the 'new knowledge based economy' has affected the interaction between technology resources, institutions and organisations and has re-oriented the policy priorities and initiatives. The role of Universities, for instance, is lately no more as exogenous to social and economic relations but gradually as involving/participial in societal processes.

Simultaneously, *policy trends* such as the increase of the economic international interdependence and the emergence of intergovernmental cooperation (European Union) heavily affected policy patterns and dominant policy paradigms. The assimilation to European Union's policy guidelines has tremendously changed the policy engineering, implementation (processes, relations) and rationale (goals) in Greece. Nevertheless, most of the policy practices implemented were simply duplicated and imported by international experience in a top-down pattern (Prastakos, 2003: 27), mis-matching thus to the native institutional and policy framework (IRPs, private sector research participation and experience, taxing framework, institutional framework for cooperation between public and private actors etc).

As constant values of the innovation policy, until 2000 at least, are *identified the (non-endogenous) reproduction of existing structures both as separate entities but also with no strategic long-term orientation of restructuring*. Implications of this short-term rationale are a. the *fragmentary synarthrosis* of business and research sphere (Komninos, 1993) and the absence of a favoring legal framework for interaction, b. the absence of a concrete and specific legal framework for intellectual property rights, c. the Taylorist orientation of business firms, characterised by the low IFGERD, d. the

[41] With a main reference to Information & Communication Technologies and their application in other branches of the economy.

absence of intermediary institutions such as technology transfer agencies and business knowledge-intensive services e. the absence of motives for regional and local cooperation on knowledge production activities (i.e. technological partnerships), f. the lack of an intense investment period; although industrial firms have showing profits, total industrial production remains static since '*there are no new sectors to ensure satisfactory returns on investment*' (Komninos, 1998: 39), g. the relatively absence of an endogenous technological and productive basis and which has been influenced by the state non-intervention in fixed asset investments and endogenous technological infrastructure (Vaitsos, 2001: 12, 13).

As *constant values* of innovation policy the last decade are identified the orientation (even under a '*vincolo esterno*') towards both an increased role of knowledge in productive process but also to a systemic support of innovation processes. By the term 'systemic support' is meant the improvement and transformation of framework conditions rather than the targeted and fragmented subsidization of innovative activities. Systemic innovation, institutional cooperation and geography are taking, (most notably under the EU's guidelines) a new considerable role for public policy measures. The creation of technology transfer infrastructures in specific spatial contexts (i.e. technology parks) and the supporting of 'clusters' (localized or 'virtual' partnerships between business firms, universities, institutes) denote a clearer realization for the importance of systemic character of innovation and the facilitating role of space for regional innovativeness and production activities, although the legal framework is not always supportive.

Even under the external coercion of EU, Greek innovation policy appears to be shifting towards a more collaborative (financing of collaborative research) and inclusive model [common needs of firm groups (SMEs mostly), technology absorption]. The impacts for many of these policy initiatives are confined though due to systemic and institutional deficiencies which are still present. However, the mis-matching of the 'knowledge-intensive innovation policy form' to the institutional and systemic and legal framework denotes both the exogenous character of **policy change** but also the 'quasi-shift' of dominant policy paradigm.

For instance, the bringing of local actors and assets together and the enhancing of national and regional innovation systems do not determinate the positive **implications** on technology resources, institutions and organisations. The progressive shifting of policy form and style towards a more integrative and systemic innovation policy pattern is not enough evidence to argue for a change in policy rationale and values, as they identified to *the non-endogenous reproduction of existing structures both as separate entities but also with no strategic long-term orientation of restructuring*.

The public policy forms consequently have caused a shift on the relations between technology resources, institutions and organisations, but there is still no evidence for positive repercussions on technology resources themselves (i.e. endogenous technological basis and correlation to extroversion or productivity). The relatively absence of an endogenous technological and productive basis, as that has been influenced (partly at least) by the non-intervention of state in fixed asset investments and endogenous technological infrastructure, (Vaitsos, 2001: 12, 13) is still an issue and implies the non-evolution of constant values for the innovation policy.

Notwithstanding the non-assimilation of core policy rationales to more general technological and policy trends, the **implications** on public policy forms generally are evident. Indicatively, the regionalisation of innovation policy, the policy micro-interventions (technology transfer agencies, business incubators, technology parks), and the inclusive policy strategies[42] are becoming 'constant'[43] features of Greek policy rationale.

Furthermore, the matching of externally imposed policy guidelines to nationally or regionally originated institutions might results to a 'public policy genesis' or the emergence of new public policy fields. The latter might contains features of interrelated policies as well as characteristics by the 'best practices' originated. An example of *'policy genesis'* might be the cluster policy in Greece, as it will be more analysed in the following pages.

Cluster policy comprises both international experiences (best practices as exemplars) but also incorporates regional or local technological, institutional and policy features. Additionally, and since it has no autonomous character, it is gradually derives through the co-evolution of regional policy (it is evolving mainly in the periphery), industrial policy (it is developing as a new form of systemic cooperation between businesses firms and other institutions), innovation policy and science policy[44] (it is evolving through the incorporation of research institutes and it is targeted to an integrated enhancing of specific technological fields).

*Mutatis mutandis*, the majority of the policy measures in Greece (as regards to issues of regional, industrial and technology policy) denotes both an *'innovation turn'* but also a 'geographical sensitivity', in intentional terms at least. Regional and industrial policies, since 2000, adopted objectives more targeted towards technical change and knowledge production and dissemination such as:

- to increase the demand for new knowledge and research results (incentives for technical change, incentives for new entrepreneurship)
- to reorganise the research system and knowledge supply in the country
- to develop RTD[45] infrastructures
- to open the research system to international cooperation
- to support knowledge intensive activities and thematic priorities (rewenable energies, ICT, e-learning, e-business)
- to increase the GERD[46]/GDP to 1.5% and IFGERD[47] to 40% by 2010 (Commission, 2006: i)

Since the 3rd CSF (2000-2006) innovation has being introduced in the Regional Operational Programme as a policy practice and development measure, although the 'innovation turn' of regional, technological and industrial policies is still problematic due to systemic reasons analysed above, and hereinafter. Regional innovation policies during the certain period were mostly oriented to industrial RTD, cooperation

[42] i.e. Regional Innovation Technology Transfer Initiative-RITTS.
[43] 'Constant' is a term must be carefully used for policy cultures where 'discontinuity' constitutes a dominant characteristic for policy actions or in evolutionary policy terms, a 'common policy routine'.
[44] Technology and research policy.
[45] Research, Technological and Development.
[46] Gross Expenditure for Research & Development.
[47] Industry Financed Gross Expenditure for Research & Development.

activities between Universities and industry and S&T incubators. Under the same time frame, clustering measures and technology transfer and research results dissemination activities have been incorporated.

Similarly, the Greek Annual 2005 Report on Competitiveness clearly states that a general priority is the 'Support of business clusters' (ECO[48], 2007: 17); the latter contribute to regional development and 'combine the activities of the agricultural economy, manufacturing and services' (NCCD[49], 2005). In the Report it is also stated that industry clustering is a powerful framework for regional economic development; it seems that a clustering approach is emerging on some strong technology market areas. Particularly, emphasis is being given to:

- the need for the support of SME's,
- the creation of shipping cluster in the broader region of Piraeus,
- the implementation of policies to support and create clusters of tourist businesses

In the following pages specific policy measures will be explored, as they might resembling a more general trend towards a policy realisation for the necessity of a coordinated-comprising policy framework of knowledge (technology, innovation, technological change) and space (proximity, cooperation in localities).

### 6.2. Technology-innovation policy

As it is generally considered, where science and technology play an ever more central role in economic and social development, local concentration of research and production activities create networks of high added value and contribute to the international competitive advantage of local economies (Sofouli, 2007: 527). Under this prism, science (technology-research) and innovation policy [STI] are surmounting in importance within the nexus of public policies. The specific policy was developing for years through the measures of industrial policy[50]. The crystallization of technology and innovation policy the last years is both an outcome of new internal changes (productive sphere, technological evolution, research demands) but mostly a result of EU's policy platforms and the adoption of them. The case of science and innovation policy in Greece is not one of *policy genesis* (namely bottom-up); it is rather constitutes a case of policy mutation, policy expansion or better, one of *policy evolution and policy transfer* [top-down]. Not surprisingly however, principles and concepts related to economic and social development such as 'technological change' and 'space', are becoming intrinsic conditions within policy conception, policy engineering and implementation.

#### 6.2.1. The Case of Science & Technology Parks

The theoretical foundation for the establishment of technology parks and business incubators lies on theories of development and space. As it has already been noted, agglomerations and clusters are *ceteris paribus* associated to physical and virtual economies of scope. Low transaction costs and external economies are usually some

[48] European Cluster Observatory.
[49] National Council on Competitiveness and Development.
[50] As Vaitsos illustrates, technology policy in Greece was oriented for decades towards the importing of 'embedded knowledge', the foreign direct investments and towards contracts via *royalties*.

of the benefits for participants. However, more intangible resources such as knowledge, information, know-how and exchange of personnel are additional positive externalities of these new 'Marshalian districts'. Overall, the rationale of these initiatives is twofold. On the one hand lies on the market failures which limit the ability of small innovative firms to survive during the start-up and early phases (Sofouli, 2007: 526). On the other hand, specific policy initiatives aiming to substitute institutional and systemic 'thinness' and failures by offering opportunities for research, funding and information bridging but also for innovation management services.

### 6.2.2. Cases

In Greece several policy initiatives have been developed the last years towards the establishment of technology parks. First, the Patras Science Park was established in 1989 to exploit the research capabilities of the University of Patras but also to bridge these to local economic environment. The main services of the Park include a. the business innovation center (start-ups), b. the business incubator (new companies in a growth phase), c. the technology transfer center and d. the innovative business administration techniques unit (Sofouli, 2007: 532).

In 1990, the Thessaloniki Technology Park was established by the FORTH[51] to enhance the exchange of ideas between industry, local universities and reseach institutes (Sofouli, 2007: 530). The main activities of the Park include regional development, technology transfer, research and education.

Similarly, the Science and Technology Park of Crete was established in 1993 and the Park incubator was established in 1996. Main role of the Park is the strengthening of linkages with the local productive environment and the supporting of member companies to their technological potential and opportunities. The main activities involve technology transfer, incubation (tenant companies), product innovation and education (Sofouli, 2007: 533).

In 1996 the Technological and Cultural Park of Lavrion was established, with main objectives the technology transfer, the supporting of knowledge-intensive companies (Sofouli, 2007: 534) and the creation of synergies with the local efforts for economic restructuring and development.

The Science and Technology Park of Epirus was established in 1999 with a core mission to integrate and connect research and productive activities in the region and to provide an interface between innovative actions.

The Technology Park of Thessaly was established in 2001 and its main mission was '*to facilitate the transfer of technology and knowledge from research institutes to private companies*' (Sofouli, 2007: 536). The main activities include incubation of start-ups, acceleration of spin-offs and integration to local economic and social context. Under the same prism, the Technology Park of Attica[52] was established in 1991 in the National Center for Natural Science Research 'Demokritos' in Athens. It

[51] Foundation of Research & Technology Hellas.
[52] 'Lefkippos'.

facilitates and supports the collaboration between innovative ideas, existing companies/start-ups and R&D laboratories of 'Demokritos', aiming at the incubation and promotion of new knowledge, high added value technologies and innovation (Sofouli, 2007: 531).

During the period 2000-2006 the new programme ELEFTHO (€68 m.) had been developed. ELEFTHO was aiming at the provision of incentives for the establishment and operation of S&T Parks and business incubators and the consequent development of innovative and knowledge-intensive firms; major difference in this perspective was the increased role expected for private initiatives.

Although the aforementioned initiatives, Greece is has a rather limited number of parks and business incubators compared to other EU countries as long as the systemic (bureaucracy, legal framework for cooperation and knowledge exploitation, institutional fragmentation and path dependency of 'sectarian' local and regional development) and financial (venture capital, seed capital) problems are major anti-stimulus. As Bakouros clearly illustrates, formal links between University and industry have only been developed either for the firms located at the parks or they are at an infant level (Bakouros, 2002: 127). In addition, synergies between companies in the parks are limited only in commercial transactions and social interactions but not in research type synergies (ibid: 127).

### 6.3. Cluster Policy

As it has already been noted, the international progressive realisation that macro-economic policy is not enough to sustain growth, shifted strategies to more micro-interventions. New policy forms such as the encouragement of technological partnerships-consortiums, SMEs networking, clustering and the establishment of scientific parks, incubators, industrial parks and innovation poles are ought to an emergent rationale concerned with micro and targeted interventions. Recent theoretical advances about the importance of 'endogeneity' of growth and the systemic character of innovation advanced policy instruments more concerned to bottom-up and integrated strategies.

#### 6.3.1. The Case of Clusters

The concept of clusters derives from the idea that 'concentration' (being that spatial or knowledge based-'virtual') produces 'positive externalities', 'institutional economies', competitive networks of high added value.

The policy measures of clustering for Greece have their roots on EU policy initiatives. Clusters are defined by the European Commission as '*the co-location of producers, services providers, educational and research institutions, financial institutions and other private and government institutions related through linkages of different types*' (European Commission, 2007: 3).

Cluster policy appears becoming gradually an even more autonomous policy measure in the country, for institutional, political, technological and economic reasons. First, it is another form of regional redistribution. Secondly, it is offering a 'development multiplier' through synergies and economies of scope. And thirdly it is offering to the

participants the 'bypassing' of many of the institutional and legal obstacles (IPRs issues, consortium agreements).

Although initiatives are in a closer to the regional markets and societies needs direction, overall implications are still questionable since many of these projects are still having an 'experimental' policy character.

### 6.3.2. Cases

The Hellenic Technology Cluster Initiative (HTCI)[53] constitutes the first systematic national cluster policy in Greece. In 1997, the Ministry of Development aiming to promote companies' competitiveness in the fields of manufacturing, marketing and technology transfer, created 23 clusters with the participation of at least 6 participants each and the financing of National Initiative of Small & Medium Enterprises. After the positive evaluation (besides the ever present problems of coordination and communication) for the project, the Ministry of Development promoted, since 2005, the establishment of a framework for targeted clusters, '*focusing on a few technology market areas in export-oriented segments that can yield world-class marketable results*' (ECO, 2007: 18). This framework was the HTCI the initial goal of which is to foster the growth of new and existing technology companies of the semi-conductor, microelectronics and embedded systems sector as to support centres of excellence in R&D and product development (ECO, 2007: 15).

A biological food cluster was established in Thessaloniki[54] in 2006. The Organic Product Cluster (OPC) is a recently established cluster covering the whole country and aiming to promote organic products and support organic farming in Greece. Cluster's activities include policy making, supporting international/national cooperation and information on new technologies/methods in organic farming. The cluster comprises of organic food producers, food industries, organic farms, consulting and certification organizations (Ignatiadis & Saitakis, 2007: 4).

The Hellenic Semi-Conductor Industry Association (HSIA), similarly, is comprised by a group of more than 20 organisations (firms, Universities, research institutes) including Greek SMEs and multinational companies (ECO, 2007: 4). Major aim of this cluster is a. the promotion of Greek Semiconductor industry by facilitating contracts, interaction and coordinated activities among partners, b. the expansion of cooperation among the industrial partners, research centres, universities and c. the study of issues of common interest among its members.

The Hellenic Biotechnology Cluster[55] started in 2004 and was set up in 2006 as a legal entity. The location of the cluster is in Athens, Greece. HBio is aiming at the promotion of the Greek Life Sciences business sector and the facilitation of business and research collaborations between Greek and foreign companies and research groups. The Foundation of Research & Technology Hellas is the main driving force for HBio's establishment and the founding member/animator of the cluster. The

[53] The programme is co-financed by the Ministry of Development/GSRT, the Structural Funds and by the private sector (ECO, 2007: 3).
[54] http://biofood.sbbe.gr
[55] http://www.hbio.gr/

Cluster's activities include a. networking with basic players in Greece, b. HBio & member's activities promotion at Greek and international level and, c. facilitation of international co-operation and technology transfer (Ignatiadis & Saitakis, 2007: 7). The cluster comprises Greek companies in the sectors of Biotechnology, Diagnostics, Medical Devices, Pharmaceuticals and Services.

The Social Economy Cluster is another cluster initiative under development, with location to Crete. The organization profile involves the development of a cluster based on the Leader+ and EQUAL EU programmes and social economy enterprises which have been established through Leader & Leader+ programmes in the rural areas of Crete (Ignatiadis & Saitakis, 2007: 9). The main activities of the cluster include production of local products (women cooperatives). The cluster which is supported through EQUAL programme and includes women cooperatives, individuals working in rural areas and cooperations of handicapped people, is expected to start late 2007 or 2008.

Regional Innovation Poles (RIP)[56] are cluster programmes based on the cooperation between public and private entities '*aiming at the enhancement of the innovative performance of the regions and the improvement of the competitiveness of the regional economy*' (ECO, 2007: 11, 12). Participants in RIP are S&T institutions, universities, technological colleges, business firms and chambers of trade. The programmes support the development of research and technological activities, the implementation of RTD projects for linking research to production and innovation such as spin-off creation, transfer of technology and knowledge, operation of technology platforms, technology foresights, business plans and R&D strategic management, training and promotion. RIP scope is to establish an endogenous structure of innovation and knowledge production, reproduction and dissemination in a specific regional context, acting as a major institutional factor to regional competitiveness.

**A Synthesis: final remarks**

An innovation system is a comprising framework for the interaction of institutions which produce and re-produce technological development, in a certain spatial domain, being that national, regional, local, or industrial. Innovation systems, according to their initiation, are usually distinguished in three main types: grassroots, network and dirigiste (Cooke, 1994: 27). In parallel, and according to their internal dynamics and the interrelation between their parts, innovation systems might be distinguished between research-push, industrial-driven or policy-driven.

Based on the above presented analysis Greek innovation system can be characterized as a *dirigiste*, *disorganized/disjointed* and *fragmented innovation system*. The reason why it is characterized as *dirigiste* is because of its dominant centralist character. Similarly, it is characterized as disorganized/disjointed and fragmented since although it maintains certain systemic strengths (research system, some specific, dynamic industrial sectors, some dynamic institutional and policy initiatives), it lacks the ability to integrate them in an organized and efficient entity. Consequently, due to its

[56] Established already in Crete, Thessaly, Central and West Macedonia and Central Greece (Patra).

systemic and technological deficiencies, it can be categorized neither as a research-push nor as industrial-driven but rather as a policy-driven system.

Innovation policy is shifting towards an ever more appreciation of technological development and its spatial conditionality. It is still nevertheless an open question if there is a shift of the development policy towards the support of a more knowledge intensive, endogenous based, extrovert and integrated productive and technological basis. The dominant developmental rationale and the core principles of the dominant policy paradigm in the country is mostly oriented towards the 'price based competition' (Sofouli, 2007: 529); although the aforementioned analysed initiatives are scoping to an 'innovation and knowledge based competitiveness'.

Major aim of the present paper is to associate technological dynamics to institutional forms and to describe their potential co-evolution in certain geographical contexts. To elaborate this experimental theorizing let me put forth a rather concrete example. As knowledge becomes an increasingly important part of innovation processes last decades, universities as knowledge producing and disseminating institutions play a larger role in industrial innovation (Etzkowitz, 2000: 314). Consequently, the new role of universities (knowledge producer, human capital, seed-bed of new firms) creates new interactions between private, public and academic spheres. Thus, the certain emerging spiral pattern of linkages necessitates new institutions (laws, rules) and policies (inclusive, cooperative, interactive) to consolidate, secure and reinforce the new social interrelations in given spatial frames.

A general note is necessary herein; macro-economic policy mix does not constitute an exogenous variable in this framework. Any given dominant economic policy mix influences the forms of policy actions and initiatives. Monetarism for instance is usually associated to 'supply-led' measures while more Keynesian logics are developing through demand-led actions. However, social and policy practice reflect a recognition for the 'non-diminishing returns' of 'complementarities'; as much of the literature and policy experience indicates, complementarities in policy actions (demand vs supply) and policy implementation (public vs private) are positively associated to terms of 'efficiency' and 'competitiveness'. And it seems that complementarities evolving beyond long-established 'dualities'.

It seems that industrial societies are becoming increasingly depended on the creation and exploitation of knowledge (Martin, 2007). It appears that economic development is '*inherently endowed with a spatial dimension which derives from the important cumulative effects of synergy and feedback which are activated by spatial proximity both in a macro-functional sense and in a micro-behavioural sense*' (Pompili, 1994: 680). As long as economic interdependence and competition is intensified in a global scale, *'place' or 'locality' is becoming an even more important arena for economic, policy and institutional activity but also for interaction amongst them.* Overall, space does not constitute a 'container' for knowledge, technology, or other social activities, but it is being derived by them as long as it is generating those (Skayannis, 2004).

Another factor underlined regards the role of 'surrounding environment' which appears as one of highly importance. Some of the major factors identified through *vis a vis* contact with experts currently involved in such projects are a. the physical, social and technological infrastructure, b. the 'incubating period' for certain projects and the

possibility to start with an initial 'venture capital' as well as a pilot strategy, c. the extroversion and the networking to similar successful experiences, d. the local demand and the existence of competent local clients.

Another issue I explored in the pages above was that of '**institutions**'. What evolutionary and institutional economics admit is that innovation and technological change is rooted both in the production sphere but also in the institutional frame. Innovation and technological development are increasingly depending on the absorption, the diffusion and the production of knowledge. These entire different but interrelated aspects of regional innovation are *ex definitione* associated to the institutional context and its advancement.

Public policy practice (successes and failures) seems to reveal an interactive and multi-level nature for technological change and innovation (Cooke, 2001: 38). Innovation systems performance is strongly depended on the spatially specific policy regime, the intermediary institutional base and the degree of interaction between private, public and knowledge institutions/organisations. As Cooke claims, the creation of '*associational economies'* (Cooke & Morgan, 2001) are strongly associated to 'competitiveness' and 'development for regions'.

The main hypothesis of this paper is that the evolution of technology is interconnected to the physical, social and mainly institutional-policy environment. The contribution of the present paper regards both the exploration of the mechanisms associate technological change to policy engineering and implementation but furthermore, the understanding of their *co-evolution*. I suppose the above presented analysis offers a first provisional and experimental fertile ground for further analysis. Nevertheless, the Greek case more controverts rather than confirms the co-evolution hypothesis. The technological and productive characteristics of Greek economy, its technological evolution but also the embedded institutional features are not consistent to innovation policy measures as they have been applied in the industrialised countries of Europe. As Kourliouros seminal work illustrates, Greece's historical sociospatial evolution has been characterised from intertwined problems of late industrialisation and incomplete development, acute socioeconomic and territorial inequalities, political divisions, assymetrical power relations and incoherent contradictory and ineffective public policies (Kourliouros, 2003; Leontidou in Kourliouros, 2003). Greek case appears as following an ***inverted route of change,*** *from policy instruments and style to technological and economic-industrial needs; and this is evolving in a relatively stagnant institutional environment, namely within an institutional inertia.* Co-evolution scenario appears after all as a 'fitting-all-process' –, however its policy-driven or industry-driven (market-driven) character unreservedly alters the policy outputs. Institutional or policy innovations are emerging as facilitating parameters for 'catching-up', especially as regards to peripheral and less developed regions such as Greece. Nevertheless, and regardless the institutional form and character of *policy genesis* [bottom-up], *policy evolution* or *policy transfer* [top-down], institutional and policy innovations should be considered as processes and relations enhanced with the policy values of ***responsiveness, continuity and completeness***.

Apparently, public policy is not developing in a vacuum. The interaction of continuous and discontinuous technological change affects the policy practice. The extent in which institutions and public policy forms assimilate to technological

evolution and the evolution of knowledge, will be determinant for the 'competitiveness' of any given economic-spatial entity. As Nelson claims, although it is useful to think of public laws, policies and organisations as being part of the landscape, these, like private sector activities, undergo *continuing evolution* (Nelson & Winter, 1982: 371) in time and space. However, it is worth to mention that policy practice in economic governance is not *ex officio* oriented towards social efficiency (Vaitsos, 2004). Public policy it is a process, overall, through which different preferences and interests are revealed and prevailed respectively; namely, *an evolutionary power arena*.

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