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ABSTRACT

The Commission's general approach with regard to competitiveness is inspired by the 1990 Communication (Bangeman I), the White Paper «Growth, Competitiveness and employment» of December 1993 and the 1994 Communication (Bangeman II). The European Commission has repeatedly stressed the need to sharpen Europe's competitiveness. The latest proposal suggests Europe action to implement benchmarking as a tool for improving competitiveness.

There are a number of reasons why the EU should become involved in benchmarking. First, the impact of policies developed at Union level which influence competitiveness must have as positive an effect as possible. Second, regular monitoring and evaluation against best practices is required to ensure that these policies are indeed providing the necessary benefits.

The complexity arising from the multi-dimensional character of the interest at stake renders difficult a conclusive evaluation of the implications of Community and national initiatives on competitiveness on an univariate base. Nevertheless, some insights can be gained by adopting an analytical framework which allows the identification of some of the critical issues to be considered in this debate. By highlighting how these policies work in practice toward the strengthening of competitiveness at Community level, evaluating their complementarities and some of their inconsistencies, this framework can serve as benchmark to assess to which degree the objectives of the White Paper and other EU actions aimed at improving european competitiveness have been achieved, and illuminate policy makers on the roots of the existing problems in the way forward (Ist part).

The ability to sustain economic growth, increase its standard of living depends in many ways on EU's success in developing commercializing new products, processes, etc. Such concerns have prompted much debate about the proper role of the Commission in encouraging innovation and the commercialization of new technologies. To analyse how the EC promote industrial benchmarking as a tool for identifying weaknesses and improving competitiveness, we first establishes some stylized facts on innovation, in particular how knowledge generation is location specific; second, what are the factors identified as determining the functioning of innovation systems, and last section discusses policy issues (IInd part).

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***INNOVATION AND EUROPEAN COMPETITIVENESS :
BENCHMARKING AS A TOOL FOR COMPETITIVENESS***

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Introduction

Why worry about competitiveness? The answer might be found in a quest for highest level of economic performance for better living standards. But if competitiveness is a well-understood and accepted concept at the level of the firm, competitive firm is one which is profitable and is able to maintain its profits, this definition cannot be transposed directly at the level of the economy.

The concept of competitiveness is mainly useful at the level of the firm where it is meaningful because it is clearly related to observable measures of performance (profitability, market share, etc). However, at the level of nations, competitiveness remains an ill or vaguely defined concept «standard of living» which can lead to inappropriate policy conclusions.

According to the OECD, the following definition can be adopted : a competitive economy is an economy which uses existing factors (capital, labour, human capital and knowledge) and accumulates them efficiently. More precisely, we define competitiveness as the ability of a country to adapt process and product innovation to trade shocks and other changes in the overall economic environment. Another important dimension of

competitiveness is the ability of countries to adopt new production functions (technologies) and products in response to economic shocks. Competitiveness could therefore be understood as a long-term, dynamic concept describing the ability of a country to innovate and adjust or, in other words, to produce and sell goods and services generating high and rising levels of income.

This perspective has three direct corollaries : first, if factors are used efficiently, there is a presumption in a market economy that the income they generate will be maximised (so that a competitive economy is one which reaches a high level of total factor productivity and hence income per head). Second, an economy which leaves some factors of production idle (for instance labour) can hardly be competitive. Third, this approach suggests that the measurement of competitiveness is not solely a matter of international comparisons; the competitiveness of an economy can, at least in principle, be measured against domestic counterfactuals (how well is the economy doing relative to its potential?). From this condition, it also follows that the competitiveness (sustained profitability) of firms is not a sufficient condition for the competitiveness of the economy as a whole.

Benchmarking has been formally defined as a «continuous systematic process for evaluating the products, services and work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement» (SPENDOLINI, [1992]). In practice, however, benchmarking essentially involves one company's evaluating another company's ideas, practices, or methods, and if possible, applying them to its business. Through benchmarking companies try to improve the performance of their organizations by emulating or borrowing the best techniques of other companies. Companies that benchmark are therefore able to learn from the successes and mistakes of others.

There are a number of reasons why the EU should become involved in benchmarking. International comparisons as implied by the competitiveness debate can be useful because they provide benchmarks and indicate the need for improvements. But last but not least, the impact of policies developed at Union level which influence competitiveness must have as positive an effect as possible. Regular monitoring and evaluation against best practices is therefore required to ensure that these policies are indeed providing the necessary benefits.

The complexity arising from the multi-dimensional character of the interest at stake renders difficult a conclusive evaluation of the implications of Community and national initiatives on competitiveness on an univariate base. Nevertheless, some insights can be gained by adopting an analytical framework which allows the identification of some of the critical issues to be considered in this debate. By highlighting how these policies work in practice toward the strengthening of competitiveness at Community level, evaluating their complementarities and some of their inconsistencies, this framework can serve as benchmark to assess to which degree the objectives of the White Paper and other EU actions aimed at improving European competitiveness have been achieved, and illuminate policy makers on the roots of the existing problems in the way forward (Ist part).

The ability to sustain economic growth, increase its standard of living depends in many ways on EU's success in developing commercializing new products, processes, etc. Such concerns have prompted much debate about the proper role of the Commission in encouraging innovation and the commercialization of new technologies. To analyse how the EC promote industrial benchmarking as a tool for identifying weaknesses and improving competitiveness, we first establish some stylized facts on innovation, in particular how knowledge generation is location specific; second, what are the factors identified as determining the functioning of innovation systems, and last section discusses policy issues (IInd part).

I. Benchmarking as a Tool for European Industrial Policy

Criteria of convergence imposed by the Maastricht's Treaty clearly illustrate the modalities of evaluation and control related to the performances of national macro-economic policies. They constitute real benchmarks used to reinforce nominal convergence and translate medium-term orientations of public policies in order to strengthen the competitiveness of European countries. However, the macroeconomic environment is not the sole determinant of European industry's competitiveness. In a context of market globalisation, the European Union has to be attractive in terms of investment, activities and employment compared to

other foreign economies. This requires to put in place the so-called «framework conditions» to favour the growth of structural factors affecting industrial competitiveness, i.e. mainly innovation, the information society, etc. Two reasons can briefly be drawn to explain why the European Commission is interesting in the concept of benchmarking : first, it allows an evaluation and an improvement of the impact of EU policies; second, it reinforces the coordination and the efficiency of member's States policies.

1)-Viability and feasibility of the benchmarking method

Originally, benchmarking is a managerial practice which try to lay down organisational objectives and productivity programs from the observation of methods « supposedly » efficient (CAMP [1989]). An examination of competing businesses provides guideposts by which firms may evaluate their own businesses, identify weaknesses and target areas for improvement and answers to such key operational and strategical questions as : are their products of higher quality than ours ? Do they have more efficient production methods and distribution techniques ? What prices have they charged in the past and what are they going to charge in the future ? Are their labor costs lower than ours ? What kind of new products or marketing plans do they have on the drawing board ? By examining these and similar issues, firms may better understand their position in the market hierarchy. In doing so, they might also learn the means by which their position can be improved.

The original feature of this practice is to allow performance comparisons in key-fields, identification of best world practices and the measure of how these results have been obtained. Benchmarking might be applied to all levels of the organization, i.e. to basic products and services, as well as to various processes necessary for the conception, manufacturing or commercialisation; it might also concern final users of these products, either intern or extern to the organization.

There are several recognized forms of benchmarking. Competition benchmarking is an analysis of the performance and relative strength of actual competitors. Through competitive benchmarking efforts, companies identify and analyze the processes employed by competitors to ascertain the most efficient, and use that process as a point of reference to alter their own

operations². Process benchmarking involves evaluating non-competing firms that are known for superior performance in generic administrative and manufacturing processes (such as billing, collection, and order entry methods). Internal benchmarking involves the evaluation and comparison of the methods and functions of a firm's own departments, business units, and subsidiaries. Within each of these forms of benchmarking lies strategic benchmarking (forward-looking evaluations) and problem-solving benchmarking (evaluation of specific techniques and processes). The objectives and scope of each benchmarking exercise can vary greatly depending upon the practice or procedure benchmarked and senior management's commitment to the exercise.

While there are many variations, as its core benchmarking involves four steps. First, a firm must decide why it wants to undertake a particular benchmarking exercise and then identify the precise area, practice or procedure to be benchmarked. Second, the performance variables to be measured must be identified (such as products offered, production processes or distribution efficiency). Third, there must be an identification of the «best in the class» company or specific competitor to be benchmarked and a follow-up investigation, examination and evaluation of that company's performance. Finally, details comparisons must be made between the benchmarking and benchmarked company, and determinations must be made about if, when, and how the benchmarking company's processes will be modified to incorporate the learnings from the study.

Structured benchmarking can result in substantial procompetitive benefits that should be given through consideration. While the benefits of particular benchmarking efforts are related directly to who and what is being benchmarked, benchmarking can enhance competition for the direct benefit of consumers by setting performance standards, encouraging increased quality of products and services, fostering production and distribution efficiencies and inducing firms to increase their cost-reducing efforts. Benchmarking also might be employed to establish universal specifications for emerging technologies (such as high-

²Competitive benchmarking focuses on key production methods and characteristics than can provide a competitive advantage over a company's direct competitors. It is the most similar to traditional competitive assessment of all the benchmarking approaches, yet it is markedly different. The target is not knowing the score but rather changing it. If competitor A can deliver the product in one week while it takes company B three, company A has a competitive advantage. Knowing this fact is not comforting, but is undoubtedly action-generating.

definition television). Moreover, benchmarking enables the best practices from industries to be creatively incorporated into the benchmarker's processes, stimulates and motivates those who undertake the benchmarking studies and those who implement the benchmarking findings, and fosters the identification and introduction of technological breakthroughs in the market.

Public concern about the generation of innovative activity and technological change has risen sharply in recent years. This has led the EC to announce a series of initiatives aimed at promoting benchmarking as a technique for enhancing the competitiveness of European industries. According to the European Commission, « there are a lot of unexploited potentialities as regards the technology frontier. Additional gains can therefore be gained from an acceleration of innovation processes » (COM (96), p. 4). But if we consider the technological evolutions and the increasing integration of the European industry at the international scale, we need to examine two aspects in relation to benchmarking: first, the partners' selection problem and second, the problem of the institutional framework.

a)-The partners's selection problem

Because of the internationalisation of the economy, national and corporate interests are no more convergent. Manifestly, some measures have very little to do with competitiveness; international competitiveness has nothing to do with aggregate trade balance (notably because of hysteric effects and the consequences of exchange rate misalignments and also due to the fact that many companies are losing their nationality in a narrow sense). In the same way, one has to be careful when interpreting the evolution of factors productivity, because the development of information technology industries since the '80s did not in reality translate into better productive performances (ROECK, [1987]). This negative link between investment and the stock of capital or between information and the productivity trend is known as the «productivity paradox» (SOLOW, [1962]). Two aspects of this paradox can be taken into account :

- First of all, there is a problem of definition: what do we understand by information technology industries ? Shall we adopt an approach in term of fonction or rather only take into account computing invested in the service industries ? Do we integrate telecommunication

networks ? It is clear that according to the definition and the timetable adopted, the impact on productivity will not be evaluated in the same way.

- Second, there are some difficulties with aggregation of datas. It is obvious that the more datas are aggregated, the more it is difficult to measure the performance gains of these new technologies. In contrario, if the analyse is too fine, networks externalities and quality-effects (product innovation or process innovation) will be neglected.

All these problems of performance stress the difficulties in using datas for the selection of partners (firms, countries). Indeed, one cannot be sure that differences in performances directly relate to comparative advantages of direct competitors. In particular, it is always difficult to ensure that the differentiation of performances comes from adaptation delays along the efficiency frontier or from national trajectories.

Beyond the comparison of what is comparable in time and space, one can add issues on the pertinence of the maximisation criteria used by firms to decide between production and investments choices in a context of a destabilizing rythm of technological innovation, market size (presence or not of increasing returns) or of differentiated price structure. Therefore, the probability is high that in reality observed gaps in terms of performances cover a vast range of behaviours (cost minimization, profit or marketshare maximization, imitation of competitors, etc...)

b)-The problem of the institutional framework

The second limit to encounter the development of benchmarking is the institutionnal framework which directly or not, through the Treaty of Rome (articles 85 and 86) prohibits all agreements between firms which disturb or threaten to disturb the competitive process. Benchmarking will be most beneficial (and likely most procompetitive) when firms having similar product lines or operational processes are examined. Depending on the specific benchmarking effort undertaken, benchmarking can lead to the express or implicit standardization of competitive variables. It may also reduce uncertainty in the market on the actual or likely behavior of competitors. It is generally believed that the more information firms have about their competitors, the better they will be able to respond to each other's

actions and to take their competitors's probable reactions into account in their decision-making-process. This could lead to competitive stagnant markets.

Thus, by invoking benchmarking, a probability not equal to zero exists to observe that cooperation and information exchanges among and between competitors lead to collusive practices. The risk of collusion is a minima if the firm, as a reference point, is not a competitor. In the opposite case, the risk of collusive practices increases if the structure of the market is oligopolistic. In this context, benchmarking might be an effective tool for firms to monitor each others by acquiring a better knowledge of industrial and commercial practices and the way it is used. In reality, far from being procompetitive, benchmarking leads to a weakening of market mechanisms (HENRY, 1994), and disrupt (in some way) innovation.

As far as benchmarking is concerned, industrial cooperation and constitutive networks are inherent modalities. If we suppose that these modalities are not in infraction with the principles edicted by articles 85 and 86, then according to the Commission, they consist in « effective tools for the settlement of an european way of doing things and for the development of an european culture for quality » [COM (96), 463 final, p. 18]. However, at the Community level, it is important to underline that the Council and the European Parliament still have to institutionalize this practice. Two main reforms can be envisaged:

- The first one, proposed by the Commission, would be to put indicators, benchmarks and also an european information networks and data system at firms's disposal.
- The second one, would be to establish narrow and sustainable cooperations between the Commission, Federations and Members-States in order to integrate, at all levels, benchmarking programs (by fonctions or in a general way). These cooperations have already been developped in the car industries, in the information technology industries and also in the electronic goods sectors (in collaboration with the MITI).

Without any exhaustivity, these reforms are an answer to the urgency and the need to promote a global approach of the notion of competitiveness in a context of world market integration of markets (MARCHIPONT, [1995]). These reforms most certainly illustrate the past period, coinciding with a critical phase of the Single Market's building (1986-1993),

the competitiveness of Community industry was mainly associated with national markets competition and degree of openness. Today, if the institutionnalisation of benchmarking had to be revealed, in any doubt, the Community would dispose of a real instrument to oriente a Community industrial policy (cf. infra). In return, this evolution would be like going back to the debate prevailing between the supporters of a sectorial policy and those supporting an horizontal approach of industrial policy : the tenants of the first approach (France, Spain, Portugal) being in favor of the constitution of « Made in Europe » industrial groups through an active support policy to R & D; partisans of the second approach (Great Britain and Germany in a lesser extent) considering competition policy (state aids control, abuse of dominant position) as a prealable and a sufficient condition for the development of competitiveness.

The compromise, on this point, expressed by the Bangeman's Report, the White Paper, Articles 113 and 130 of Union's Treaty, remains extremely delicate. By giving a greater place to the resolution of industrial problems in a framework of competition and commercial policies, the conceptual and the legal basis of this compromise are desajusted in comparison with the principles of functioning of a globalized economy. This is notably the case in the internationalized information technology industries, in which competitiveness of european firms is low and where the strenghtness of competition can not any more be considered as an end in itself. *A contrario*, benchmarking can be used as an appropriate and a complementary tool to compare these policies rather than as a competitive one. In these sectors, at least, benchmarking can help to take into account the evolution of production and change of structures in the definition and use of instruments of renewed trade policies.

2)-Differentiation and mesure of « competitive performances » :

What are we speaking about ?

The principle of benchmarking (in broadly defined terms : « improving efficiency by adaptation - incorporation of selected productivity methods ») is based on the competitiveness concept. However, its use at macroeconomic or sectorial level stresses a number of problems.

Moreover according to A. JACQUEMIN, the debate is of different nature on each side of the Atlantic (JACQUEMIN, [1979]). In the US, competitiveness problems are perceived as resulting from foreign policies and actions : « The concept of competitiveness focuses on commercial exchanges and is characterized by an economic confrontation between Nations » (JACQUEMIN, op. cit., p. 175). This mercantile vision in which contest appears as a zero sum game has often been used to sustain an aggressive conception of commercial policies (BRANSON, SPENCER, [1985]). The objective of these policies is to improve national income compared to others Nations by creating specific advantages (manipulation of exchange rates, protectionnist mesures, etc) in favor of national firms confronted to international competition.

In Europe, the concept of competitiveness is directly associated to total factors productivity and the ability of european economies to improve welfare and standards of living. It is recognised that improving competitiveness requires domestic action. So, far from being an objective in itself, competitiveness is first and foremost a « mean for guaranting an attractive european area (...) and finally for allowing a sustainable development » (JACQUEMIN, op. cit., p. 176). From the Community's point of view, competitiveness and social cohesion appear as indissociable terms. This divergence of point of view between the EU and the US is not without consequences at the level of structural factors' analysis affecting the competitiveness and the interpretation of performance gap between Europe and its main competitors (Japan, USA). In the Community approach, competitiveness is not only reductible to technological progress and the improvement of market mechanisms.

In some extent, the extensive conception proposed by the Commission (cf. COM (96), 463 final ; MARCHIPONT, [1995]) formally records that markets' globalisation is an economic process faster than the integration process of national productive systems. This gap explains that the building of the Single Market is a necessary but not a sufficient condition to improve competitiveness. Since the start of 90's, the Report stresses that unexploited potentials or losses in terms of productivity shifted the debate on innovation process and the ability of labour and asset's market to respond to new forms of investments and labour organisation.

Thus, in these terms, delays in Community's industrial competitiveness can be explained less in terms of factors flexibility or in terms of distance from the efficient technology frontier than in terms of coordination's efforts in R & D, adaptation of material and immaterial infrastructures to requirements for a best integration of national productive systems, harmonized development of national educative and training systems, etc. This diagnosis, if correct, put into question the relevance of benchmarks able to distinguish between static and dynamic efficiency. Whereas static efficiency is measured on the basis of indicators related to input/output, dynamic efficiency refers to specific links between industry and research (national innovation systems), to cooperative games between individual or collective actors, or again to specific learning and valorisation of knowledge processes whose effects are not necessarily immediate and fully measurable.

Therefore, in order to identify the « best practises » able to improve european firms' performances, benchmarking method has to be put into a medium or a long term perspective and has to rely on an qualitative as well as on a quantitative analysis of productive efficiency. This precautionary measure is all the more justified because most difficulties about european industries come from factors which are considered as non-price determinants of competitiveness. Under this label, several categories of phenomenon are brought together :

- The insufficient ability of european firms to produce and commercialize high quality and strongly differentiated products, and difficulties in responding to the specific needs of customers.

- Difficulties to integrate R & D results into industrial and commercial processes (BOYER, AMABLE, [1995]). This weakness constitutes a serious handicap in terms of « flexibility of initiative » (MOUHOUD, MOATI, [1995]) and/or rapidity of reaction to markets evolutions and newness demands. We might consider that product and process innovations are not the only things that matter. As suggested by the White Paper, organisationnal, distributive or financial innovations are believed to give a better integration of R & D in firms' strategies.
- Sustainable and expensive requirements for the transformation of labour relations on the basis of active participation of workers at all the levels of the firm's organisation. This requires important investments in human ressources (for accumulation of new competencies, know-how, more flexibility in labour organization, etc) and information system (development of interactivity, simplification of operational processes...).

Although this list is not an exhaustive one, it shows that one has to be careful when observing the relative and uncertain characters of the benchmark's method. At the sectorial level, and even more at the macroeconomic level, it's a perilous exercise to know with precision if gaps of performances are going to widen, to decrease or to remain stable. For a large part, the improvement of « competitive performances » goes through the fixation of objectives and through the instauration of new practices that suppose a lot of changes in the organisationnal framework and in the functioning processes of firms. So, in one hand, we require mesures at sectorial level and means to implement, whereas in the other hand, we have effective means at the firm's level. One consequence is that the integration of results of benchmarking may lead to a strategic reallocation of resources that is not necessary adequate with the organisational and hierarchical structures. In other words, even if it is defined as a managerial practice which introduces more efficiency in action plans and decision processes, this doesn't mean that benchmarking is a satisfactory method.

3)-Benchmarking and the New Stakes of the Community Industrial Policy

The Commission's general approach with regard to competitiveness is inspired by the 1990 Communication (Bangeman I), the White Paper «Growth, Competitiveness and employment» of December 1993 and the 1994 Communication (Bangeman II). The European

Commission has repeatedly stressed the need to sharpen Europe's competitiveness. In this end, one needs to identify areas in which Europe needs to improve in order to catch up with the world leaders in a given area. The latest proposal suggests Europe action to lay foundations for Europe's future competitiveness and to implement benchmarking as a tool for improving competitiveness.

It's the 1990 Communication (Bangeman I) which, for the first time, introduces the term of « Community industrial policy » into official European texts. This Communication deals with « the reinforcement of the technology capacity and the competitiveness of European industries (...) to continue positive adjustment policies for creating a favourable environment to private initiatives and investments in the EU. Industrial policy must promote permanent adaptation to industrial changes in an open and competitive market » (COM (90), 556 final). As a result of the Maastricht Treaty, a new provision (Title XII, art. 130) has been introduced in the EC Treaty to deal specifically with industrial policy and competitiveness issues. This establishes that industrial policy measures must comply with « a system of open and competitive markets » and underlines that it may not serve as « a basis for the introduction by the Community of any measure which could lead to distortions of competition ».

Through these different texts, we can characterize Community industrial policy through three main orientations :

- The improvement of industrial competitiveness under constraints to respect the principles of contestable markets,
- The organization of a regulatory and a fiscal environment in favour of SME's and industrial cooperation,
- The research for a better exploitation of Community's industrial potentials through the promotion of innovation processes, research and development.

De facto, through the reading of official texts, Community industrial policy appears less as a specific policy like the Community agricultural policy than like a heterogeneous unity of measures aimed to sustain the development and the restructuring of European industry. That's why some prefer to speak of competitiveness as industrial policy acts through different tools as R & D policy, commercial policy, competitive policy and even fiscal policy.

a)-Industrial Policy and the Benchmarking of the Environmental Framework

The « environmental framework » is an important part of public authorities intervention. This framework mainly consists in setting up public infrastructures and equipments as well as a reglementary environment to promote research and economic cohesion.

From the Commission's point of view, the benchmarking of the main elements of this framework for industry would first allow to evaluate the attractive capacity of Europe as a productive area. In this matter, many study fields have been listed [COM (96), 463 final] :

- Labour and financial costs,
- Infrastructure services (telecommunication, resources, transport...)
- Competences (qualifications, knowledge...)
- Environment (water, air...)
- Public administration of member States,

Moreover, the Commission has launched several pilot projects aimed at encouraging the exchange of experiences and best practices. These cover themes such as the impact of globalization and new technologies; financing of innovation; logistics and transport, and human resources development.

Secondly, developed in a transversal optic to sectors and Nations, this analyse could help to establish a list of most urgency action's plans to improve and harmonize the quality of productive resources at the Community level. Thus, for the Commission, it would not only be favour resident firms but evenly to attract foreign firms in order to allow localisation of value added in the EU. In fact, if benchmarking is set up, this practice would lead to a radical critic of the comparative advantages theory. This theory is based on initial dotations in favour of constructed advantages based themselves on the ability to valorize mutual advantages thanks to the organisational dynamics of the firms. This rupture in the economic theory principles of the Commission (PORTER [1996] and REICH [1993]), might not surprise. It is logically

registered in the continuity of the pragmatic philosophy adopted by the Commission in industrial affairs.

Benchmarking would simply allow to operate in a precise and systematic way to improve the research bases which are not sufficiently directed towards markets, and more generally, to accelerate the innovation process at a pre-competitive level in respect of the optimal allocation of resources and competition. For example, as suggested by the Commission in its last Report [COM (96), 453 final], technology licences, adoption's rate of generic technologies, speed of market's penetration, degree of application of total quality concept constitute criteria which could be used for an assessment of « competitive performances »

In this context, Community industrial policy could become more autonomous compared to trade and competition policies. On this basis, there is no more antinomy between these policies which could complement one another : on one side, competition and commercial policies guarantee free market's mechanisms through state aids' and concentration's controls (Art. 85, 86, 94, 96 of the Treaty) ; on the other side, as in the past with technology programs (JESSI, RACE...), Community industrial policy would be in charge to adapt R & D to the needs of the industry, to concentrate Community budgetary resources on some strategic multi-sectorial technologies and to coordinate more efficiently national programs of R & D. In reality, a strong dependency exists between the relative and absolute competitiveness of european companies and Community policies on market regulation, trade and competition in the Single Market. The degree of coherence between the three policies generates the environment where firms themselves can take responsibility for industrial competitiveness, as envisaged by the 1990 Communication to the Council of Minister on industrial policy in an open and competitive environment which determines the perceived business opportunities of companies operating in the Single Market and thus the combined effectiveness of these policies in promoting productivity, growth at country and pan-european level.

Benchmarking might also allow a better use of public funds, but this rationalization doesn't necessarily imply a recombinaison and a creation of specific ressources to favour a

territorial implantation of firms. In fact, Community industrial policy seeks to attract firms into European area, but in return, firms have a tendency to behave as predators. From this, there is a « vicious circle » difficult to overpass because Commission doesn't admit to practice benchmarking at the level of the firms.

b)-The Task Forces Research-Industries

Conceived to measure and to control « competitive performances », benchmarking not only allows more reliable and precise interventions in industrial affairs, but it even permits a more consistent use of all the policies (fiscal, R & D...) which, directly or not, have an influence on competitiveness.

The initiative recently taken by Commission to promote industrial, thematic, pluridisciplinary and inter-sectorial programs (the « Task Forces ») is a concrete expression of this global approach of competitiveness. Among selected areas, we find for example, « New generation's plane », « Car of the future », « Vaccines against viral illness », etc. Such approach helps to define and select many research fields in which European industries are present and for which clear and commercial outlets exist. In other respects, this approach offers a possibility for a better internalization of R & D externalities, whose point of departure is related to some behaviors or competencies built on interfaces of industrial relations, at once geographic, strategic and politic. By means of Task-Forces, the creation of scientific and technological clusters, the founding of technology watching bodies and the development of cooperation networks between research institutions and industries (small and large enterprises), are closely linked to the logic of industrial integration and to the dynamic of markets.

In one sense, these initiatives take into charge a part of the transaction costs between independent enterprises and also growing learning costs (WATKINS, [1991]). But in fact, these initiatives don't necessarily substitute to the measures taken in the past. As J. NIOSI and B. BELLON underline it, « More than often, they (these initiatives) add to the previous ones » (NIOSI, BELLON, [1995], p. 223) because of the multiplicity of decision levels and private/nationalist interests (competition between States, lobbying, budget constraints, rigidity of behaviours...). Another reason to relativize the efficiency of the Task Forces is

linked to the diversity of technological and scientific cultures, technological trajectories and national specialisations. Far from converging, these characteristics can on the contrary lead to compromises *a minima* about the definition of programs and the objectives to be reached.

In a such context, the question is if, initially, benchmarking constitutes an efficient tool to explore synergies through industrial cooperations. What is usually understood by selection of the « best practices » must be precised. While, in a perfect competition perspective, « best practices » are supposed to be the most efficient along the factor's prices frontier, the contractual feature of the Task Forces suggests that « best practices » are those which satisfy the socio-technical constraints of the greater number (« workable practices »).

This second learning radically changes the terms of the debate on industrial policy. The reinforcement of industrial Community's competitiveness would be less if not as much a question of costs and / or technological catching up compared to EU's main competitors than a question of normalization/standardization of practices, know-how, products, etc in order to favour the learning process and the experience transferts at the international and Community level. In this view, Task forces and benchmarking would combine in order to lay down the foundations for an european productive system based on mutual interest's and the necessity of an international and regional integration dynamics.

Broadly outlined, the advent of benchmarking as a tool for industrial policy would attest of an important change in the regulation of firm's activity by a more and a more frequent substitution of concerted programs [which include different Directorate Generale, Industrials, State-Members and even Workers' representatives (JACQUEMIN, [1995]) to formal decisions or / and ad hoc solutions which are most than often inadequate because of the complexity and of the evolutive characteristics of the problems to solve.

To conclude this first part, we would like to emphasize that one has to be cautious when transposing benchmarking at the level of public policies management. Without any doubt, benchmarking and its integration in Framework Programs and Community structural funds will help to set out the necessary adjustments to give more precision, efficiency and coherence to actions taken by the Commission. However, uncertainty is strong to known if

this integration will bring or not the Community with sufficient means to carry out an offensive industrial policy compared to the legal and financial instruments which US and Japan authorities have at their disposal (cf. National Competitiveness and Research Act (NPRA), the 301's section, Supercar project for US authorities; the very strong integration between the Kereitsus and the MITI in Japan). In others words, if benchmarking can help in the building of an integrated productive area, it can also be, at the level of the Triad, the source of non cooperative industrial strategies.

II. The Benchmarking of Innovation Policies

Improvement of competitiveness has become one of the cornerstones of the EC agenda with the Maastricht Treaty. This has lead the Commission to identify benchmarking as a tool to monitor progress on an on-going basis and to assess the situation against continuously improving best practices worldwide. It goes beyond competitive analysis by providing an understanding of the process and skills that create superior performance.

One key aspect of this approach is to determine the structural determinants of performance in Europe's business environment, ie. is Europe a suitable site for business activities? Such an analyse imply to study to what extent business can find in Europe everything they need to succeed on world markets. While stopping short of delineating specific policy options for improving EU competitiveness, the discussion illustrates that during the last years, European industrial policy experimented a dramatic change whose main component is a shift from a defensive sectorial policy to a horizontal, offensive policy based on competitiveness.

In this perspective, Commission's general approach with regards to innovation is that although innovation basically is a decentralised process with contributions from individuals, it demand joint efforts. Indeed if the EU is to be in a position to compete effectively with other Nations, the unification of specific strenghts of single States in the area of recognized competence has to be strenghtened. But in reality sectorial traditions are still alive within most member States, and we observe a technological diversity rather than a convergence within the EU.

1)- National System of Innovation and Technological Diversity

It is traditionally hold that the establishment of the EC would lead to convergence and cohesion between its member States. However, the economies of the EC, and to a larger extent its Nations have remained substantially different. The member States of the European Union show a number of differences with respect to scientific and technological activities and their economic and social impacts. Different member States have different areas of comparative advantage in production, in turn related to scientific and technological activities.

In this perspective, ERGAS ([1987], p. 52 et p. 83) distinguish countries following diffusion-oriented policies from those following mission-oriented policies. By diffusion-oriented policies, ERGAS refers to policies oriented by incremental adaptation to structures. On the other hand, by mission-oriented policies, he refers to policies oriented towards radical technological innovations released through national programmes. The first approach is aimed at deepening the comparative advantage of one country: ERGAS (*ibid.*, p. 77) speaks about deepening strategies. For the latter one, he refers to the notion of shifting strategies.

And indeed, just by looking at the basic technological indicators of the member States of the EC, we can confirm the existence of a high degree of dispersion in their present stages of technological development. Inputs in the innovation process, proxied by R&D expenditure has not converged within the OECD area. In many cases, innovation is embodied in processes, so that patents are not a good proxy for innovation. For instance, organizational routines are not patented, though they play an important role in the innovation process.

Most importantly, substantial differences in their respective historical trajectories have produced over the years a large variation in the accumulated stock of intangible capital, technological skills and research and technological development infrastructure among European countries. Despite all the efforts made in the field of economic policy coordination (it was not just the result of different endowment of resources throughout Europe), the main macroeconomic indicators still maintain significant degrees of dispersion in Europe. These discrepancies at the macroeconomic level have their correspondences at the microeconomic

level in the differences in the prices of the basic inputs. As a consequence of these differences in factor prices, introduction of a given new process technology often implies different cost reductions depending on the country where it is introduced. The main implication of this disparity is the existence of different «best directions» of technological change for different member States.

Moreover, it is empirically observed that there is a non-random distribution across countries of firms' revealed performance. These differences in corporate capabilities persist over time, and there is also difference on the presence of important country, sector, and firm specific effects. These are reflected in different rates of innovation and dynamics of production. For instance, one observes high persistence of Germany's performance in sectors such as chemicals and pharmaceuticals, despite important currency fluctuations. DOSI & Alii [1994] stressed that the question is not one comparative advantage in the classic sense, but that of created comparative advantage. An interpretation of the above phenomena imply some location heterogeneity. It is in this context that one should put the analysis of national systems of innovation.

Innovation and the broader concept of innovation systems are best designed as the generation, accumulation and transformation of knowledge into productive use. Innovation systems are therefore «rooted» within a given set of national or sub-national institutions. Technological advances is best understood as a system of behavioural responses and institutions that interact in the production and application of innovation to changing market demands. Putting it another way, NSI shape the specific relations between (i)-the generation of scientific opportunities; (ii)-industry-based technological innovation; (iii)-corporate organizations and strategies; (iv)-the broad institutions and context conditions in which firms are embedded; (v)-revealed competitiveness; (vi)- and growth and employment creation.

The underlying proposition is that NIS should endure because they are rooted in entrenched national institutional and social arrangements. The argument is the following one : technology, like all market processes is not disembodied, it has local roots. Indeed, it is observed that the generation and accumulation of economically useful knowledge is unequally

distributed across countries and regions, and these differences appear to persist over time. This diversity is reflected in terms of inputs, outputs and revealed technological performance.

Yet the existence of path dependence gives a warning that policy recommendations are unlikely to be universal. Indeed, there are however important differences among sectors and countries in the way in which comparative advantages can be accumulated depending on the nature of technology and the context in which the innovation takes place. For instance, in the case of the US, new technological opportunities tend to be grabbed by new entrants. By contrast, in Japan, innovation into new sectors and technologies occurs within existing firms. Accordingly, the lessons drawn after examination of success stories in one country in sectors where path dependence is at work, can not be transposed to a different institutional context.

Nevertheless, if the rate of innovation is understood as the «underlying rate of technical and scientific progress» then one can look upon patent statistics as one observable indicator. Despite their well-known deficiencies, patents represent an observable indicator of innovative output, or at least of the appropriate component of the knowledge factor. Datas from the European Patent Office (EPO) on patent applications according to some familiar technologies and sectors revealed existing differentials in the rate of inventiveness across technologies, from which it may be possible to say something about different sectoral propensities to invent even if one can say little about the mean value of patents in the different sectors. Diffusion of innovative technologies and products, the rate of such diffusion and the associated spillover effects, are also elements that are relevant for understanding the process of innovation.

From this perspective, there are at least three questions of particular interest to the policy maker: can innovation be left to market forces ? There is a substantial body of literature as well as stylised results from empirical studies that suggest that market failures induce sub-optimal allocation of ressources necessary for innovation. There is either under investment in basic but non-appropriable knowledge, and over-investment and duplication elsewhere. The optimal amount of innovation, whatever this means, may not be obtained if innovation is determined primarily by market forces.

There are four overlapping and complementary analyses of NSIs.

- A first definition emphasises the specificities of national institutions and policies supporting directly or indirectly innovation, diffusion and training in industry.

- A second approach emphasises the importance of user/producer relations and the associated development of collective knowledge bases and commonly shared behavioural rules and expectations (LUNDVALL, [1992]).

- Third, PAVITT, PATEL and Alii [1988] stress the links between national patterns of technological accumulation and the competencies/innovative strategies of a few major national companies. They also provide robust evidence that, with a few exceptions, even multinational perform most of their innovative activities in their home country, thus indicating the persistence of location specific effects. Therefore, country specific institutions are unlikely to disappear. This suggests that, even when these effects are present, foreign direct investment and trade, coupled with increasing returns, can result in fostering divergence rather than convergence.

- The fourth approach on NSIs focus upon the specificities of organisational routines/strategies/forms of corporate organisation embedded in equally specific national institutions including the forms of organisations of financial and labour markets, training institutions.

But if cohesion (a sticking together) and coherence (connectedness) in the EU refer to forms of integration, they also leave room for diversity. Indeed, a policy for cohesion cannot be a policy for technology uniformity. Therefore, there is a third line of promoting cohesion ie. the valorisation of diversity (HINGEL, [1990]).

Diversity plays a rather minor role in the mainstream economics, but is central in evolutionary economics. In the neo-classical theory, differences in opportunity costs between countries, leading to comparative advantages (natural resources, endowment of other factors of production including the nature of institutions) is the main reason and explanation of the division of labour and trade. In this context, technology is considered as an information which is available for all and freely floats across national borders. The result are first that this theory admits the existence at a given moment of time of the «best technology», the modes of usage

and diffusion of which do not matter. Second, local technologies play a minor and passive role; most of the time these local technologies are deduced by marginal, adaptations from the ideal model given by the best technology. But many theoretical and empirical works reveal the limits of a concept of diversity linked to given endowments. In particular, diversity also arises from differences in behaviour.

In fact diversity in the usage of technologies and differentiation strategies of enterprises lead to a rather similar industrial structure within the different countries of the EC and a high level of intra-industry trade. HINGEL ([1990], p. 19) talks about the concept of a lower limit of development and provision of science and technological development infrastructure below which no forms of synergy can be initiated, which is the «very logic of the actions of transfer (ie. solidarity)».

More generally, there are different modes of creation, usage and diffusion of new technologies and innovation processes locally dependent. Traditionally, diversity has tended to be viewed either in negative terms, as evidence that some producers lag behind according to some criteria of technological success or where technological diversity exists amongst successful market competitors, as economically irrelevant. However, the evolutionary approach lend theoretical weight to investigations of the potential economically positive consequences of diversity (DOSI & Alii [1988]).

Diversity between member States is an advantage. It allows different learning and selection processes on the basis of which what is a best practice (benchmarking). Application of a certain technology are enhanced. In many cases national differences lead to different forms of application of a technology which are in relation to their specific context.

One also find diversity in competences and learning processes as local contexts interfere with the process of technical change. While in the neo-classical theory, we reduce the impact of technology on the local context to a simple quantitative difference in the speed of diffusion of technology, what matters in the evolutionary theory is the interaction between technology and local contexts, which means that a local context is an entity playing a role in the process of creation and diffusion of technologies through specific learning mechanisms

that mostly rely on the specific institutional framework of the local entity considered. Therefore, different local contexts due to different institutional frameworks will exhibit qualitatively different processes of innovation. Instead of passive competitive advantages we should rather speak in terms of creative advantages attached to a local entity.

But if diversity is interesting in the initial stages of trajectories, it has also its limits as far as valorization in direction of cohesion is concerned. When technologies enter a more mature phase, the possible cost of diversity appears clearly. There is, indeed the risk of duplication of mature processes of production and therefore of a lack of economies of scale which could prevent the Community as a whole from being competitive. It is for example well-known that in Europe on average there is an overcapacity in the field of chemical plants for producing intermediate bulk products. Each country following its own trajectory has implemented its own capacity without taking into account the other members of the Community. To sum up, it appears that valorizing diversity implies some organisational devices: norms, gateways technologies, modes of appropriation, etc.

2)- Current academic thinking on innovation systems

If we look at current academic thinking on innovation systems, there exists a consensus on the central role played by innovation in the growth process. Although influenced by the strengthen of the international community as a whole, the ability of any particular Nation to capitalize on new technological development depends heavily on its system of innovation. Public policy has therefore concentrated on correcting market failures associated with the innovation process with an eye toward developing a more complete understanding of the multiple pathways linking innovation and competitiveness. There is also general agreement on the central role of private incentives picking winners and large mission oriented projects have been discredited as a means to foster innovation. Indeed, such projects have usually resulted in rent seeking and inefficient outcomes.

The linear model of innovation (basic science followed by innovation and finally commercialisation of products) has been abandoned. Empirical research has shown that there are feedback loops in that process. Until recently, the policy consensus was that subsidisation of pre-competitive research would be sufficient to stimulate innovation. This has resulted in an imbalance in the nature and thrust of technology policy. The inadequacy of this type of policies has been highlighted by research on «national innovation systems». The latter play a key role in correcting market failures linked to the presence of significant spillovers. Because of the importance of tacit knowledge as well as location-related costs, innovation systems are made of regionally concentrated clusters. This suggests that innovation systems are rooted within national borders.

However, this systems' approach to innovation could be regarded as a basis for techno-mercantilist policies geared towards the full appropriation of benefits. This negative view of NIS must be contrasted with a more positive view of the national element of NIS. In DAVID's view [1994], the power of a NIS will depend on its ability to distribute and diffuse the existing stock of knowledge. The national element derives from the existence of country-specific institutional characteristics that determine the distribution power of a NIS.

Three classes of parameters enter the analysis of innovation:

- the extent to which knowledge is tacit, as opposed to easily codifiable knowledge
- the degree of disclosure versus secrecy in the innovation process
- whether the innovation is publicly or privately owned

In turn, the knowledge product space will have boundaries defined by:

- intellectual property rights
- the cost of codification to make knowledge publicly available
- the incentive structure whether diffusion is preferred to secrecy

The link between knowledge distribution and economic performance is empirically observable. Science based sectors tend to grow faster than the rest of the economy. Secondly, wide knowledge distribution allows economic agents to make informed decisions. Open

information systems increase the reliability of information as findings are replicable and results can be rapidly generalised; duplication of research efforts can be avoided.

Finally, a new technological paradigm has emerged, which stressed that innovation is increasingly the result of the bundling of existing knowledge. Thus, the power of distribution of a NIS is a key variable. From this perspective, transnational corporation lay an important role in diffusing knowledge through foreign direct investment. This is particularly relevant for small open economies, whose national stock of knowledge may not have reached a critical mass.

Recognition of these facts leads to policy conclusions that are different from those of the past. From the perspective outlined above, policies that aim to improve the marginal return on R&D investment should strive to reduce costs to access knowledge. This prescription is markedly different from policies centered on large subsidies to a few participants, and highly protective intellectual property rights (IPR). DAVID (Op. Cit.) argued that IPRs could be designed with a view to maximise diffusion, e.g. IPR that encourage licencing and that disclose information. A higher degree of standardisation that would help codify knowledge would also facilitate knowledge diffusion. Therefore, the thrust of technology and innovation policy should strive to maximise knowledge distribution.

3)-Estimations and simulations of the impact of different policy initiatives

In our view, the focus on appropriability of R&D results misses the point. The problem that firms face is not one appropriability but rather one of valuation, ie. firms do not know what the true value of their R&D output is. Firms invest in R&D and knowledge, which in turn generate a set of options for the firm. As a result, R&D investment improves the firm's core capabilities, and increase its absorptive potential. In other words, R&D serves the purpose of broadening the firm's options.

Empirical studies by GEROSKI [1992] tracked that performance of innovative and non-innovative firms over time. He found that innovative firms weathered macroeconomic shocks much better than their non-innovative counterparts. This suggests that there are two

main benefits associated with innovation: an increase in profit streams and a better ability to respond to shocks.

He then turn to to issues of public policy and examined the impact of three potential levers of innovation: R&D subsidies, demand stimulation and tax breaks. His simulations indicated that the most effective tool was R&D subsidies. However, even in this case, the impact of public intervention was rather small and he estimated that the direct value of innovations triggered by such subsidies would not exceed one sixths of the subsidy. One might therefore argue that, given the limited impact of policy and contrary to accepted wisdom, there are no market failures that require public intervention. On the other hand, it could also be that market failures do exist only in sub-segments of industry. This would militate of more targeted actions.

If we examine the various explanations put forward to explain this poor performance, none of which provide of a satisfactory explanation. Excessive duplication of R&D has been advanced as one possible cause behind this apparent failure. Excessive replication could be due to insufficient cooperation across firms and insufficient specialisation in a particular technological field. Another explanation put forwards for Europe's poor performance is that research is too academic and not sufficiently receptive to the requirements of industry. Last, it has been argued that EU research is too discovery oriented, as opposed to being market oriented.'

In reality, Europe's weakness is fundamentally one of transforming scientific breakthroughs into marketable innovations. The key issue is how investments are translated into marketable products. Investment in intangible assets which from the basis of firms' competitiveness, is central to Commission policies. To grasp the full implications of this problem requires an analysis of the interactions between R&D efficiency, production systems and the management of human resources. For instance, a key question relates to the emergence of efficient organisational routines within firms.

Competitive performance can be measured along such lines as quality, costs, prices, financial ratios, logistics, standards, management techniques, reliability and responsiveness to

the market. Benchmarked companies do not have to be, though many times are, competitors of the benchmarking company. Benchmarking can be done either individually or in cooperation with other firms. The best performers in any market are always looking ahead, measuring and forecasting the actions of their competitors and other market participants.

Scarces resources are rarely spent on efforts to benchmark firms that are perceived as poor performers. In fact, just the opposite occurs. Those firms perceived as leaders in the area to be benchmarked are those that are benchmarked. Benchmarking is thus, by its nature, procompetitive. Any activity by which firms examine market leaders, evaluate the means by which they became and remain leaders, and consider if and how to incorporate the best practices of those leaders into their operations is inherently beneficial to consumers. Improvement in corporate performance through independant and redundant trial and error is an antiquated technique. Corporate performance can be improved more rapidly and more effectively by evaluating and adopting other companies' proven ideas and methods. Benchmarking encourages corporate creativity through exposure to different means of competing and may even provide the confidence that many firms may need to spur them to attempt to make improvements to their believed-to-be tried and true methods.

If and when such evaluations begin to occur, great weight should be given to the potentially significant procompetitive benefits of benchmarking. While some may consider benchmarking as merely a game of catchup that encourages copying and discourages innovation, this is shortsighted. Much like joint research and production efforts, benchmarking can be a highly competitive exercise. The realization of a need to improve is directly encouraged by innovative firms that are continually trying to advance their competitive positions in the market through improved products, processes and overall performance. Benchmarking is a forward-looking process that fosters the recognition of the need to improve and thus should be encouraged, not discouraged by antitrust authorities.

Group benchmarking may raise an inference of the creation of industry standards that are not created by the marketplace but instead imposed on the market by those participating in the joint benchmarking effort. Moreover they raise the issue of whether firms that are not invited to participate may lawfully be excluded.

From this perspective, one might ask if innovation can be left to market forces? There is a substantial body of literature as well as stylised results from empirical studies that suggest that market failures induce sub-optimal allocation of resources necessary for innovation. There is either under investment in basic but non appropriable knowledge and over-investment and duplication. The optimal amount of innovation, whatever this means, may not be obtained if innovation is determined primarily by market forces.

If market forces cannot be entirely relied upon then the question arises: can intervention by public authorities systematically and in predictable way lead to an optimal allocation of resources for innovation? To answer to this depends to an important extent on what are the key determinants of innovative activity and which are amenable to policy tools. The obvious items for consideration are R&D efforts, investment in intangible factors, human and physical capital investments, training, organisation of firm, market structure, etc. Less obvious but no less relevant are items such as patents and intellectual property rights legislation, fiscal incentives, regulatory oversight applicable to innovative technologies and resulting products, provision of venture capital, mobility of scientific input between academia and industry. It is not that economic literature does not provide an answer on the key determinants of innovation : on the contrary such a number of different answers are on offer that, not surprisingly, industry and research policy has tended to turn to the simplest of instruments, R&D subsidies and R&D task forces.

Public policy towards innovation can only achieve its declared objectives if appropriate instruments can be identified and be developed. One approach in the literature has been to explicit the key determinants of innovation and devise the policy tools accordingly. A more common alternative in practice has been to put into place well tried systems of R&D subsidies and programmes of collaborative research. In reality, the EC needs methods for estimating production frontiers and measuring technology and a minimum extrapolation from observed data. The purpose is to introduce a new methodology that can be used to evaluate the impact of operating strategies on efficiency and relate efficiencies to the competitive position of the firm. There is also an ongoing interest in evaluating the effectiveness of operating strategies that are intended to enhance competitiveness position by contributing to efforts to

impose production and throughput reduce inventory holding costs and otherwise reduce costs and enhance revenues.

Once again, there is a clear need for economic assessment of the efficacy of the following different policy instruments, for example science and technology policies have been directed toward fostering the generation of new knowledge as the basis for commercially exploitable innovations, rather than toward improving the distribution of existing scientific and engineering knowledge and increasing the accessibility of the latest additions to the knowledge stock. But in reality, a key determinant of the economic performance of an innovation system is its capacity to effectively and efficiently distribute knowledge, i.e. what DAVID and FORAY ([1995], p. 87) call the knowledge distribution power of the system. Therefore the knowledge distribution is the crucial issue of the relation between the stock of knowledge and the flow of innovation. Tacit knowledge cannot be dissociated from the work practices of research and production units.

We argue that policies based on market failures are not best suited to technology markets because they adopt a short-sighted approach. This short-sightedness refers to the work by SHARP and PAVITT ([1993], p. 130). They show that new technologies are often multidimensional, non-codifiable and cumulative and that their mastering is based on learning by doing. Therefore, it is difficult to measure the value of a technology, independently of its environment and of its property rights. This point represents a further difficulty for the commercialisation of new technologies and hence for the use of the benchmarking method. It is therefore necessary to take into account the characteristics of new technologies, as in the evolutionary approach.

4)- Current technology policies

Sectoral targeted intervention has progressively been abandoned in all countries. Secondly, policy makers have become more modest as to what technology policy can achieve. The main lesson from the recent past is a negative one: policies that do not work have been identified, but still very little is known about successful policies. Thirdly, there has a growing

trend in international technological cooperation, not only involving large firms but also SMEs.

But despite the marked degree of convergence, country specificities have remained. Targeting still occurs only at the end of the innovation process, in close consultation with all actors involved. But as for the EU, national innovation policies are so diverse that it is not possible to draw any firm conclusion.

If we refer to the contributions made by the evolutionary school, we see that this literature has drawn attention to the complex interactions that characterise NIS. This suggests that solutions that appear to be working in one environment cannot be easily imported into another and that variety is at the core of the competitive process.

Therefore, benchmarking should focus on how domestic, ie. european, innovation systems function, so that weaknesses can be identified. Attempting to introduce solutions developed in other environments would probably be counter-productive.

So, if we look at some elements that the European systems of innovation and production have in common, we identify lagging organisational innovation, a trouble weakness in many activities belonging to the information technology sector, and systematic difficulties in bridging university research and industrial innovation.

The emphasis on increasing returns, path dependence and location specificities could be used as a justification for old style direct intervention in the innovation process. But policy should not focus on whether more or less direct support to innovation should be provided. The key issue is how to induce a better organization and organisation design of innovation systems in order to make them more efficient.

This dilemma is at the heart of what we call the «European paradox»: high levels of scientific output but a poor innovative performance. This reflects serious deficiencies in the transformation function, ie. turning scientific advances into innovations.

At the Community level, there is the Framework Programme and the associated specific thematic transnational collaborative R&D programmes. Given that there are at least five or eight models of NSI in the EU, is the Framework Programme an adequate response? Is it complementary to national efforts and is the transnational collaborative aspect a stimulant to innovation or redundant and costly requirement? Finally, what is the optimal level of the Framework Programme budget and how does one go about setting up the optimisation criterion?

A second instrument has been to increase the industrial input in R&D programmes. The Common approach has been by increasing the involvement of industrialists (e.g. the Round Table in electronics). What is the evidence on the efficacy of such an instrument?

The impact of general framework conditions, particularly regulatory oversight of new technology and products derived therefrom or antitrust rules for pre-competitive research alliances is worth re-examination since such factors can have an important impact on the location of innovative activities in a world of international capital and skilled labour mobility and global markets. Therefore we require to devise optimal policies.

In a profit maximizing world, characterized by a high degree of uncertainty and positive externalities associated with R&D, it makes sense for public authorities to subsidise research. Given the initial condition, providing a pecuniary incentive will increase R&D. On the other hand, in industries where X-inefficiencies are present, and where innovation is only undertaken in a defensive manner, the policy prescription is entirely different. Providing R&D subsidies in this case gives firms an incentive to delay adjustments. Rather than the subsidy «carrot», what is required is the «competition stick» in order to foster innovation.

The role of public authorities should principally be to solve coordination problems. It is also a question of shaping institutional constraints affecting production, research and the management of human resources in a manner consistent with the objective of maximising innovation. If we look at DG III's policies, it is obvious that they are not geared towards supporting particular technologies; the emphasis is on generic applications.

For all these reasons, it is impossible to have a typical technology policy. Technological policies have to be different according to the types and characteristics of technology they deal with, from one country to the other according to their respective national systems.

Conclusion

Competitiveness is at the essence of Community interests, on the grounds that is recognised that only the creation of a competitive industry will allow the EU to maintain its position in the world economy and accomplish the Community statutory goal of creating a balanced and sustainable social and economic progress.

The Community approach to industrial policy is based upon an active policy of positive adjustment that attempts to avoid defensive strategies by industries in difficulty, so to foster the development of new technologies in order to increase the growth opportunities of the Community's industry via the adoption of horizontal measures. This policy is pursued in a context characterized by competitive markets, both within and outside the Community and within the stimulus of an open trade policy.

Addressing the issue of the European paradox, we argue that nations are following distinct technological routes and consequently distinct patterns of growth. The market for technology has become global but nonetheless, sources of technology traded remain national and there is evidence that differences in the degree of technological specialization has actually increased (ARCHIBUGI & MICHIE [1992-93]).

We also stress that innovation systems are intrinsically dynamic, and thus need to adapt constantly. However, there is a high degree of institutional inertia, which means that changes are costly. However through benchmarking, one try to compare what is comparable but not to put the emphasize on institutional specificities. In this context, it is unclear what the contribution of public policy should be.

Therefore, if the NIS perspective is correct, the added value of an EU innovation policy is doubtful since innovation is strongly embedded in a particular institutional context. To illustrate this point, we refer to the work done by LICHTENBERG [1994] on Eureka projects, which indicates that firms have not changed their behaviour following the EU initiative. In other words, EU funded research had not created collaboration networks different from those already in existence and the EU Commission is not in a position to select particular technological trajectories because the risk of capture and collusion is important.

Because of the myriad factors influencing innovation and the fact that if the Green Paper on innovation has identified all possible instruments available to foster innovation, it has failed to establish hierarchy amongst them, policymakers interested in facilitating the commercialization of emerging technologies must consider not only the means by which firms develop particular products, processes or services but also the need for creating and supporting the necessary institutions and institutional relationships. For all these reasons, we suggest to apply the subsidiarity principle to innovation policy in the EU.

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