Identifying the structure of institutions to promote innovation and growth

Bruno AMABLE*
Pascal PETIT**

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Consulter le Web : http://www.cepremap.cnrs.fr

*CEPREMAP/Univ. de Lille-II 142 rue du Chevaleret- 75013 Paris
e-mail : bruno@amable.cepremap.cnrs.fr
**CEPREMAP/CNRS – 142 rue du Chevaleret-75013 Paris
e-mail : pascal petit@cepremap.cnrs.fr

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Abstract

This paper investigates the possibility of accounting for the role played by institutions in the dynamics of technical change and growth in a policy oriented perspective. The main question is to choose the institutions relevant for such an analysis. Approaches like that of the National Systems of Innovation starts from a sectoral point of view, i.e. science and technology, and progressively extend the range of institutions considered in the analysis with a logic of connection between institutions and fields. Other institutionalist approaches consider the whole range of institutions affecting economic behaviour and make no a-priori restrictions. This paper pleads for an intermediate approach where the selection of relevant institutions is guided by the concept of complementarity of institutions. We distinguish two types of institutional complementarities, and we indicate some possible developments relevant for economic policy.

Résumé

CARACTERISER LA STRUCTURE INSTITUTIONNELLE POUR PROMOUVOIR INNOVATION ET CROISSANCE

Cet article analyse comment rendre compte du rôle que jouent les institutions dans la dynamique du changement technique et de la croissance économique. La principale question est de sélectionner les institutions pertinentes pour une telle analyse. Des approches comme celles des Systèmes Nationaux d'Innovation partent d'un point de vue sectoriel…, c'est-à-dire d'un secteur science et technologie, et élargissent progressivement l'étendue des institutions retenues en s'appuyant sur une logique de connection entre institutions et activités. D'autres approches institutionnalistes considèrent l'ensemble du contexte institutionnel affectant les comportements économiques sans restriction. Cet article plaide pour une approche intermédiaire où la sélection des institutions pertinentes est guidée par le concept de complémentarité institutionnelle. Nous distinguons deux types principaux de complémentarité institutionnelle et nous indiquons les perspectives que cela offre à la formulation et mise en œuvre de politiques économiques.

Keywords : institutions, innovations, national systems, growth, complementarity

Mots-Clés : institutions, innovations, systèmes nationaux, croissance, complémentarité

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Bruno Amable (Université de Lille II and CEPREMAP)
Pascal Petit (CNRS, CEPREMAP)

I. Introduction

The aim of this paper is to investigate how it could be possible to account for the role played by institutions in the dynamics of technical change and growth in a policy oriented perspective. In this respect, two points are worth stressing.

- First, the institutional dimension is effectively crucial if one wants to go beyond a mere tautology between growth and innovation whereby economic growth not directly accounted for by increases in the quantities of inputs would give the measure of innovation, as in the growth accounting approach. Modern growth theories went halfway towards bridging the gap between some historical and institutional analyses of technical change and growth on the one side and formal economic modelling on the other side when they made technological change endogenous, i.e. a result of economic decisions, and no longer a gift falling from heaven. How potential growth is effectively achieved depends on how agents in an economy can take advantage of their interactions, of their environment and can learn from the past. Such competence is directly conditioned by the set of institutions which grounds the pattern of co-ordination of agents. This set, largely rooted in history, has a straightforward national dimension.
- Second, the treatment of technological change must be inserted in a more general approach of the importance of institutional features for economic development. If one believes that the institutional architecture of an economy should be apprehended as a fabric, with its inner coherence and logic, it may be counterproductive to restrain the analysis to a specific area of the economy as narrowly defined as the science and technology system. Any extension of results found in a specific area runs the risk of over-emphasising the importance of the specific area concerned for the aggregate economic development. Hence, scholars of technical change would explain every aspect of economic growth with the evolution of techniques, specialists of education would mainly stress the importance of skill acquisition, etc.

Confusion may arise from the understanding one has of an institution. One can start with the definition proposed by North [1990]: institutions are humanly devised constraints, which frame the interaction of agents in certain areas. This definition may take a broad meaning: institutions, in framing the behaviour of agents, allow for the establishment of organisations and facilitate the compatibility of individual actions. Institutions are thus formal and informal rules of very different kinds, largely overlapping. Therefore, if obviously institutions matter, the problem is to characterise their effects on the economy in an operational way. If institutions are so numerous and diverse, how is it possible to relate the various parts of this fabric of institutions to the issue we are concerned with ?

A first approach would consider that there exists for each economic issue a set of institutions more or less 'naturally' involved with the set of activities directly concerned. For instance, institutions dealing with science and technology would be considered as 'natural' objects of analysis by scholars of innovation systems. However, the existence of such a straightforward correspondence between activities on the one side and institutions on the other side is not guaranteed. Even defining the chain of activities related to a specific issue –e.g. growth- is not straightforward; there is ample room for interpretation regarding which context is relevant, and this contributes to differentiating the theoretical approaches. Still, the roots of such differences lie in the assumptions made on the relations between the structures of institutions and the structures of activities.

The investigation of national systems of innovation could be considered as such an approach and be summarised as follows. The starting point is the science and technology area, i.e. the area which is directly involved in the generation of innovation and technical improvements. By science and

technology area, one must understand research laboratories (internal or external to the firm), the universities, etc. Then, one moves to the areas connected to research and development, going upstream with the education system or downstream with the production activities, industrial specialisation, etc. The study may even go as far as introducing elements apparently quite removed from the realm of science and technology, as for instance the financial system once its importance has been widely acknowledged. Consequently, the institutions that should be studied are those considered as directly involved in the whole range of activities thus collected. Such an approach demands that the proximity between the subsets of activities be appreciated. Such an appreciation may be considered as an empirical fact, and the definition of the relevant areas a triviality: activities are considered as close to one another if agents involved in these activities interact or frequently enter into some interpersonal transactions. Still, defining the space of interaction (how broad, how detailed, how far ranging in time and space,...) is not that easy and refers to the vision one has of the influence of institutions on the economy.

A second approach would try to take a step further and work at the institutions level in order to retain a more comprehensive set of the institutions significantly influencing the activities under view and their outcomes. But to assess which institutions may significantly influence some economic activities, beyond the circle of institutions directly connected (those that would be immediately selected in the first approach), one needs to be able to appreciate a kind of complementarity relationship between institutions. At first sight the existence of such relationship should be explored at two levels, depending on how institutions influence the decisions of agents and the consequences of their actions. All of which implies taking a comprehensive account of the decision processes of economic agents, including their expectations on how binding or facilitating they consider the institutional context to be. Such an issue is explored in the last section of the paper. First are reviewed institutional approaches looking mainly at how they cover the field of areas under study, i.e. how they select the relevant areas of activities and institutions. Institutional approaches can range from comprehensive to restrictive selections of activities and institutions. Some take a rather focused and restrictive view of the sets of institutions concerned (the national system of innovation approach), others, such as the vintage *régulation* approach, take a broad view of the relevant set of institutions (Section II). We shall follow in Section III with a set of studies which propose 'intermediate' solutions, i.e. which are based on more or less motivated selections of subsets of relevant institutions.

This overview will lead to stress that the selection of the relevant institutions is largely under-specified, leaving open the question of the specific relevance of a given set of institutions. How can one assess the complementarity between institutions that is required by such selection ? Section IV attempts to give a comprehensive assessment of what such complementarity relationships could be. It leads to distinguishing different types of complementarity which help ranking the influences of institutions on a related set of activities. All of which should lead to express some principles on which sub sets of institutions should be mobilised and monitored to constitute the back bones of policies aiming to promote innovation and growth.

II. RESTRICTIVE OR EXTENSIVE CHOICES OF INSTITUTIONS IN THE ANALYSIS OF INNOVATION AND GROWTH.

1. Opting for a more or less comprehensive assessment of the institutional context.

Technology has cropped up as a 'hot' topic for economic policy as well as academic research at least since the beginning of the 1980s under the influence of several factors: the productivity slowdown in most major industrialised countries led to asking questions about the role of science and technology in long-term economic development; the rise of new competitors in Asia and particularly Japan had the US consider a possible waning of their technological lead and prompted them to investigate the possibility of reversing the trend ;[1] the recurring inefficiency of short-term demand-management-oriented Keynesian policies to cure unemployment and boost activity convinced policy makers that long-run, structural policies should be implemented; the growing importance of non price competition on product markets shifted the emphasis on quality improvements, innovation and differentiation as sources of long-run competitive advantage. The 1980s and 1990s have consequently

[1] Dertouzos, Lester and Solow [1989] is an example of such preoccupations

witnessed a turn-around in the approach of the problem. Whereas the nature of technological change was a largely neglected factor in traditional growth theory, it became a central focus in modern theory of growth.

But innovation is neither an exogenous improvement of the production techniques given by 'God and the engineers' nor a stroke of genius of an isolated innovator whose behaviour is mostly unexplainable. Each of these conceptions, the former derived from the standard neo-classical growth theory *à la* Solow [1956], the latter from a certain approach to neo-schumpeterian theory are essentially unsatisfactory insofar as they tend to reject the possibility for an economic investigation of the origins of innovation and technological change. It is crucial to reckon that technical change is largely an endogenous process.

Making technical change endogenous is not that simple. One possibility, used by contemporary growth modelling, is to define technical change as the result of one unique activity, the most popular being of course R&D. If such a simplification is understandable in the context of theoretical modelling, it is far too restrictive for a more in-depth analysis of the impact of technology on the economy. To account for the main stylised facts on the dynamics of technical change one has to integrate into the analysis the influences of a more or less comprehensively defined institutional context. In our acceptance of the notion of institution, it means involving all the institutions which are compelling in some way the actions of agents in the field under view. This is a very broad definition of the institutional context which leaves many options at both ends, the level of activities and the level of the institutions influencing them. It covers a large area, from a genuine view of the subsystem that one can relate directly to the emergence and diffusion of new technologies to the broad context where all institutions at some stage impinge on the dynamics of innovation.

This does not mean that the selection is entirely arbitrary. Once the level of analysis is defined, when limits to the sphere of institutions which could be involved have been set, the coverage has to be consistent, e.g. include all the effects which are relevant at this level and in a structured way, avoiding duplications.

To take an example, one may consider at one end the approach in terms of National systems of innovations, which are concentrating on the set of institutions which are closely related to all the activities directly concerned with the production and diffusion of new knowledge and technologies. At the other end of the institutional approaches of the subject, one finds the vintage *régulation* approach where the issue of growth and innovation can be traced in a rather loose and unspecific way in the general account of the inter relation between demand and productivity regimes.

One may look at these two approaches to check their advantages and limits. The former carries too narrow an approach of the institutions influencing the innovation process, which underestimates the impact of institutions not directly connected to technical change but clearly linked to the overall process of innovation. The latter introduces, whatever the topic, a similar and comprehensive fabric of institutions, but influences are left too unspecific, which reduces the effectiveness of the institutional approach. Intermediate between those two, a certain number of approaches retain a handset of institutions pertaining to diverse areas.

Beforehand it is useful to clarify two points. First, as was already mentioned, in assessing the institutions which are worth taking into account for a given issue, one tends in fact to refer to an area of activity: diffusion of innovations, education, research activities,…more than to a subset of institutions. The notion of institution encompasses a wide range of "governance structures", and institutions are forming in each field a dense fabric of rules. Therefore taking an area of activity instead of a definite subset of institutions is one easy way to refer in fact to the set of all institutions that are framing one way or another the actions of economic agents in the concerned area.

Such a correspondence between areas of activities and institutions governing these activities may appear as a straightforward approach in institutional economics. But the definition of the relevant space of actions is not as straightforward as one would think. Social scientists may debate at length on the importance of some details or on the opportunity to go back to a more or less distant past or to extend the field to related sets of activities. The fact is that the dichotomy between a level of rules (the institutions) and a level of actions gives a biased view of a decision process which would account for

the actions taken. It gives the impression that every action is deliberatively taken, while from Veblen to Giddens many social scientists claim that actions are only partially deliberative and that institutions channel most of their influence by means of '*settled habits of thought common to the generality of men'* [2] With such perspective of partially deliberative actions the influence of the context and the space of action can be diversely extended. *In other words the emphasis put on the various kinds of activities involved around the issue selected implies that one should have a clear view of the chain of activities and contexts effectively concerned*. But this clear view is itself strongly conditioned by the set of institutions influencing the activities retained. There is somehow a reverse relationship between the selection of activities around an issue and the architecture of institutions which are thought to be governing these activities. The objective selection of activities will depend on the observer's expectations. Linkages between activities are not strictly given by experience[3] and prevailing views on institutions are strongly influencing this perception.

An illustration of such difficulties is precisely given by the innovation issue. Activities of agents directly in charge of monitoring the innovation process within firms are obviously concerned, as well as all the activities involved upstream in the building up of competence and knowledge, e.g. research and education activities. But it has been widely accepted that activities dealing with the financing of innovation are also concerned. This already constitutes a step away from the logic of looking directly at an area of activities, even if everyone one agrees that the way in which innovations are financed is crucial in their dynamics. A similar extension will take into account the general characteristics of the labour force, of work organisation in general and finally of potential users of innovations. Gradually and according to various institutional setting, activities could be integrated in the chain under view.

[2] A quote from Veblen given in Hodgson [1988], p.8.
[3] This discussion is somehow parallel to the discussion between agents and spaces in the societal approach, see Maurice [1998].

2. A short overview of the " national systems of innovation" approaches.

The concept of innovation system (IS) has been the focus of many studies[4] and a few papers have already surveyed the field,[5] displaying large differences in the set of activities actually covered. Following Smith [1998], one may distinguish two levels of analysis :

- The most basic level revolves around a firm and its local environment. Innovation involves complex interactions between a firm, its network of suppliers and customers, and sustained interactions between users and producers of technology. Inter-firm linkages are more important than arms-length market relationships. Institutions affecting the pattern of interactions between economic units are to a large extent national and hence all interactions in the same country will have common determinants.

- The wider context : refers to broader contexts conditioning innovative activities such as cultural aspects, social customs, national traditions and regulations,…

Regarding the former point, this view is sometimes opposed by those arguing that the influence of national-specific institutions is limited and that the influence of regional or even sectoral systems of innovation is more important. As a consequence, the supporters of the regional or sectoral IS view tend to downplay the importance of macro-level institutions and inter-sectoral determinants and to emphasise more localised channels of interactions. A further consequence is that in this context, strictly technological determinants tend to dominate other possible influences : local knowledge externalities flowing within regions are considered the main structuring factor for regional IS, or the sector's technology is considered as the most important factor for the pattern of firms' interrelations.

Influences at the latter, wider, level explain why one may speak of a national system of innovation and not just local systems centred around particular firms or networks. The pattern of relationship is not just specific to a particular network, but to all economic units belonging to a given 'culture'. But the macro-level is not only a matter of national culture, whatever this concept may be. It will be argued below that the pattern of co-ordination of economic units involves macro-level institutions, which somehow gives a macro-level coherence to more regional or sectoral patterns of interaction.

The next important idea of the NIS approaches, and the prime reason for the comparative study of IS, is that national structural differences are taken to explain diversity in growth performance of the different countries. This involves a two-step procedure.

- The first step is that technology and more generally the accumulation of competence is organised along very different lines across countries. It is thus possible to split countries according to the structure of their science and technology system, and the way science and technology interact with other parts of the economic system.

- The second step is that innovation, and more generally technological change and the accumulation of competence, are the main factors influencing the competitiveness of firms, industries, regions, nations. This hypothesis may not seem controversial at first sight -in the light of recent theories of endogenous growth, the new international trade theory, etc. It is however where the risk of 'techno-mania'[6] lies, i.e. explaining everything with a reified technology.

An implication of the IS approach is that technological differences coming from differences in national IS can be observed with the pattern of technological specialisation, the latter taken to be the

[4] Freeman [1987] and the collection of papers in the books edited by Lundvall [1992] and Nelson [1993].

[5] Freeman [1995], Edquist [1997], Smith [1998]…

[6] No offence.

ultimate expression of competitiveness. This is why the bulk of empirical work done on IS has paid a great deal of attention to the pattern of industrial specialisation in relation to the pattern of scientific or technological specialisation. The fact that there exist significant relationships between science and technology on the one hand and competitiveness on the other hand is then taken as a confirmation of the importance of technology. Differences in national IS could then be reflected in the different variants of the relationships between technology and competitiveness: different elasticities, functional forms,… in econometric relationships.

But econometric testing is not the only empirical route followed by IS scholars. On a practical level, one may again follow Keith Smith in distinguishing two approaches to IS, both rooted in the studies of innovation:

- Firm-level studies of interdependence between users and producers of technology. This type of studies has led to the 'Danish' approach of IS[7] : the national system is an expression of the importance of interactive learning between users and producers of technology. Learning processes and competitive specialisation co-evolve in a process which is national-specific partly because some national-level institutions have an influence in shaping the interaction process, and partly because interactions are facilitated when firms belong to the same country. However, the importance of firm level interactions in this scheme leaves the door open for the consideration of industry-level or regional IS.

- National-level policies and factors shaping firm behaviour[8]. Less emphasis is put on the co-evolution aspect of firms' behaviour and national characteristic and a greater weight is given to the policy aspect.

This dichototomy may be refined and Table 1 gives other possibilities for the study of innovation systems.

To sum up, Smith [1998], gives three basic conceptual underpinnings of the IS approach :

- Economic behaviour rests on institutional foundations. The consequence is that different modes of institutional set-up lead to differences in economic behaviour and performance.
- Competitive advantage results from variety and specialisation, it has path-dependence inducing effects. Successful specialisation are self-replicating, with system creation as an outcome.
- Technological knowledge is generated by interactive learning. This gives different knowledge bases among different types of economic agents.

The first one is an important element which puts the whole range of IS approaches in line with other institutions-based approaches in economics. The second point stresses the focus of IS approaches on external competitiveness and activity specialisation in their assessments of national trajectories. The third point is more evolutionary in spirit. It may also be seen as hinting to the structure of interaction between institutions which should be outlined in the approach.

Most IS approaches are thus focusing on the set of activities which are explicitly commonly linked with innovation. But the third point hints at the fact that this chain may be expanded very broadly! Things tend effectively to become more complicated and open to take into account all kinds of institutions if one counts among the activities involved in the innovation process all kinds of learning processes. Hence the distinction between narrow and broad definitions of IS put forward by Lundvall whereby :

- the former limits itself to the areas of science, research, technology and in some cases education.
- the latter extends to all economic structures and institutional set-up affecting the production system and innovation.

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[7] i.e . the IKE group.

[8] Freeman [1987].

This goes beyond the restrictive view specifically taken in IS approaches. It is even open to what we shall call general purpose institutional approaches.

Table 1. Different definitions of IS and different levels of analysis

	Approach			
Definition	Firm-level	Sectoral	Local/Regional	National studies
Narrow	Almost every evolutionary economics study of firms' competitiveness	Breschi & Malerba [1997]; Malerba [1999]	Many empirical studies, e.g. Dalum et al. [1999]	Nelson Ed. [1992] Freeman [1987]
Broad	The Danish approach	-	Piore & Sabel [1984]	Porter [1990]

3 General purpose institutional approaches : the case of the Vintage régulation approach

Several approaches relate the whole institutional architecture of an economy to its main economic characteristics in order to account for the long-run evolution of various modes of production. Because of their fully-fledged nature, one may call them *general purpose institutional approaches*. Their specificity is precisely a policy of including all institutions in a small number of categories, whatever their function is, from governing work to leisure, providing education and health but also ensuring central government activities. Such a holistic approach is in the tradition of the classics. The vintage *régulation* approach is one such approach[9]. It organises the analysis of activities around five sets of relationships: the wage-labour nexus, the forms of competition, international relations, money, public authorities[10]. The relations between these five forms characterise the overall mode of *régulation* of the economy. The SSA (Social Structures of Accumulation) approach gives another example of such general purpose institutional approach although it is very much country specific, adapted to the case of the US economy, and period specific, tied in its structure to the institutional context of the pre-70s with a special attention given to the pressure put on workers in the labour market[11].

Régulation theory has incorporated institutional determinants in its analysis of modern capitalist economies. The basic idea was to attribute the properties of growth regimes to a special mix of institutional forms[12] . Five structural forms are supposed to be able to account exhaustively in an orderly way for all the whole institutional fabric of an economy.

The theoretical set up of the *régulation* bears the mark of the period to which it mainly applied, e.g. the fordist era, a.k.a. the Golden Age for the SSA approach, and emphasises therefore the main traits of the institutions of the time. The five structural forms of the vintage model are presented in table 2. These forms are complementary to each other -a notion that will be discussed further in Section 3- in an intuitive sense as they correspond to the whole set of institutions influencing the whole fabric of inter-related activities. Taken together, they define a partition of the whole institutional fabric. This complementarity is loose, as activities are not all inter-related. Nevertheless, this patchy description of the institutional fabric also accounts for some key linkages existing between broad structural forms, all of

[9] cf. the first works of the *régulation* school with M. Aglietta, R. Boyer, A. Lipietz,...

[10] Aglietta [1979]. See Boyer [1990] for further explanations.

[11] Kotz, McDonough and Reich [1994].

[12] Defined as a special configuration of a basic social nexus. A configuration is to be distinguished from a system in the sense that in the former case, the compatibility of various institutions is partial and not necessarily long-lasting.

which characterise the mode of *régulation* of the economies under view[13].

The role of technology in this theoretical set-up is interesting to explicit. It is somehow at the interplay between the productivity and demand regimes[14]. It conveys a dynamics of innovation close to that sketched by Kaldor in the description of his cumulative causation model. In that sense it is very specific to a period and a set of countries. Regarding the fordist regime it stresses altogether the development of increasing returns mainly based on scientific organisation of work within large firms and a monitoring of demand by means of new modes of market intermediation, as provided by restructured large service networks. The view it takes of technology is thus more comprehensive than usual as it concerns not only the production processes but also the infrastructures monitoring demand formation. The drawback is that the very process of innovation seems to be diluted altogether with general matters of organisations on the supply and demand sides.

Although this perspective has a genuine Schumpeterian flavour in its approach of innovations it ignores some of the specific features of the innovation processes such as the intentional aspect of new technology creation on the firms' side. The risk here is to underplay the central role of some feature shaping the innovation process. It is thus crucial to recall that in the so-called fordist period, most countries under view, except for the United States, were catching-up economies, transferring in various ways processes and products which had been tried and tested in the US markets. Under the "technological" hegemony of the US economy the matter for other countries were not so much to find new products and processes than to adapt the dominant technological paradigm of mass-production or mass consumption to local conditions. It then follows that in the fordist period, the crux of the mode of *régulation* was a regular expansion of markets made possible by the redistribution of productivity gains by means of wage increases. The main institutional and organisational constraint that could hamper the dynamics of innovation was thus coming from the whole set of institutions governing the wage-labour nexus.

The situation changed when Japan and Europe (at least partially) caught-up to the US level of productivity and when the fordist production model seemed to lose its momentum, entering a crisis which had external (a fixed exchange rates system ill-suited to monitor an increasing internationalisation of economies) as well as internal causes (increasing conflicts over the wage profit sharing). Competition among firms became more centred on improvements in product quality and differentiation and less on the possibility to produce mass-consumption goods cheaply. The rapid diffusion of information and communication technology-based products contributed to this change in the principles and forms of competition, as they deeply transformed the large network services of market intermediation as well as the possibilities to differentiate products. It also contributed to a new balance between industrial and finance, much in favour of the latter in great contrast with the previous era. In this new regime the whole focus for the dynamics of innovation was thus not so much on the institutional context given by the labour nexus but evolved more centrally around the changes in the forms of competition (with its implications in the realm of finance and international relations)[15].

It follows that if comprehensive approaches like the vintage regulation approach help to give a general frame to the whole institutional context of innovation, these frames remain rooted to one historical phase and under specified in terms of the diverse components which actually explain why growth rates differ. To follow the dynamics of growth and innovation in a comparative way, for countries which have all experienced a similar shift towards a new growth regime it is important to be more specific about the ingredients of success. These are likely to depend on the matching between long term characteristics of countries and the requirements of the contemporary regimes. There is clearly a need to combine the very long term cultural view underlying some NIS approaches with the requirements of contemporary regimes that a vintage regulation is stressing, if one wants to analyse national trajectories and design relevant policies to sustain economic growth.

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[13] The link between the Taylorist mode of organisation and a principle of wage formation, distributing the productivity gains, is a good example of such linkage at the roots of a fordist growth regime.

[14] For an exposition a growth model based on a demand and a productivity regime, see Boyer [1988].

[15] See Petit [1998].

The approaches retaining more specific subsets of subsystems are less opened to such criticisms and may represent, in view of the two objectives set above (e.g. account for the requirements of contemporary regimes and take advantage of historical national traits) good compromises. We shall rapidly present and discuss the pros and cons of studies which made a deliberate choice to retain a subset of systems of activities.

III REASONNED SELECTIONS OF INSTITUTIONS AND ACTIVITIES.

To avoid the charybde of a narrow delineation of the relevant institutional context, which will miss a large part of the influence of the institutional fabric involved, and the scylla of a representation of the whole fabric of institutions, too broad to compare national trajectories on the issue, one can choose to select a subset of systems as the proper description of the relevant institutional context.

To compare these reasonably selective approaches and assess their relevance in accounting for the dynamics of innovation and growth one cannot simply appreciate how complementary the activities selected are. It becomes clear at this stage that on top of the complementarity between activities (which is already filtered by some vision of the world) the selection intends to focus of some specific governance issues. In other words to strike a balance between a fully comprehensive approach of the institutional context and a fully comprehensive approach of all the activities directly involved in the process of innovation, a small number of determining issues have in each case be retained. Critics of such selection can thus bear on the coherence of the choices.

Table 2 gives some of the main examples of such approaches in explaining its content (the set of activities retained, column 2), its implications or the issues selected as prevailing in the overall governance of the dynamics of innovation and growth (column 3) and the analytical tools employed in the assessment (column 4).

Table 2. Analyses of innovation and growth using subsets of sub systems to account for the institutional context.

Notion	Content	Implication	Analytical tools	Author(s)
Comparative Institutional Analysis	Firms Financial system Labour market	Interactions between financial and labour market institutions	Theory of growth and innovation, principal agent	M.Aoki
Innovation performance	Firms Finance Business association Trade unions	Central problem of coordination and information flows	Socio economic analyses	Soskice D. Hall P.
Worlds of production	There exists a multiplicity of co-ordination principles for social and economic activities, giving as many national or sectoral configurations	There are at least 4 worlds of production: interpersonal, market-based, industrial and unmaterial, that have no reason to converge	Socio-economic analyses, data analyses on sectoral statistics, history of industrialisation paths, international comparisons	Salais and Storper [1994]
Social Systems of Production	Complex of scientific and technological organisations, education systems, industrial relations, financial systems, governing production.	The different SSPs are more or less efficient according to the international context and the nature of the dominant production paradigm. Because of institutional inertia, there is no convergence among SSPs	Comparative study of the current configuration of SSPs for the large industrialised countries. Long run historical studies.	Hollingsworth [1994]
Social Systems of Innovation and Production	The interactions between six sub-systems define the logic, coherence, contradictions and possible ways for evolution of the SSIPs and their macro-economic performance	No necessary institutional convergence,. Differentiated patterns of technological and economic specialisation. Different implications in terms of macroeconomic performance	Theoretical analysis (growth theory and institutional approaches, *régulation* theory). Empirical analysis of 12 developed countries	Amable, Barré and Boyer [1997]

Some of these approaches are very comprehensive without claiming to be as universal as the ones surveyed in the previous section. For instance, *the Social systems of production approach*, which could be considered as incorporating the largest set of institutions, investigates the way the different institutions or structures of a country or region are integrated into a social configuration, governing production processes. The concerned elements are:

- the industrial relations system
- the training system
- the internal structure of corporate firms
- the structured relationships among firms in the same industry or between suppliers and customers
- the financial markets of a society
- the conceptions of fairness and justice held by capital and labour
- the structure of the state and its policies
- a society's idiosyncratic customs and traditions as well as norms, moral principles, rules, laws and recipes for action.

The main hypothesis, common to all systemic approaches, is that all these elements cohere together, but Hollingsworth and Boyer [1997] stress that the different elements vary in the degree in which they are tightly coupled with each other onto a full-fledged system. Varying degrees of coherence explicit how these authors see the interactions between institutions working in related fields. Coherence here

may mean that institutions in these sets are re-enforcing each other which as we shall see in the last section can mean that less ruling is needed (because institutions are creating trust) or that the ruling is all the more binding. Clearly it goes some way towards an assessment of the interaction between systems of activities/institutions. One may criticise this approach on the ground that the list of elements under view is long and vague with regard to some of its items, which makes it close to a general purpose institutionalist approach.

By contrast *the worlds of production* à la Salais and Storper split the economy and define consistent worlds of production, highly coherent and where activities and institutions are strongly complementary. With such segmented worlds, innovation and growth occur mainly in one world. The criticisms concern the nature of the interaction between these worlds and on the role of innovation in each case during the growth process

Another example, with six sub systems, is given by the analysis in Amable, Barré and Boyer [1997] in terms of *Social systems of innovation and production*. In their empirical analysis, twelve developed countries have been classified according to their institutional characteristics in the six following sub-systems :

- *Scientific activities (academic science),*
- *Technological and innovative activities;*
- *Productive activities,*
- *Labour market activities,.*
- *Education and training activities*
- *Financial activities*

The macroeconomic *performance* (for the 1980s) indicators constitute a 7th set of parameters which helps to assess the main correlation between institutional profiles along the six sub systems and economic performance. The six sub-systems define *Social Systems of Innovation.* Emphasis is thus put on the fact that interaction between institutional contexts is not limited to the STI system (Science, Technology and Innovation) but encompasses also the effects of the institutional setting prevailing in other sub systems. However, patterns of consumption and characteristics of way of life have been discarded despite the logic of complementarity between demand and productivity regimes underpinning the approach.

These intermediary approaches based on a subset of (sub)systems do improve our understanding of the various growth patterns of contemporary economies. They also raise issues of interest regarding the selection of subsystems one should operate as well as the validity over time and across countries of these approaches. In other words the selection depends on the question raised, but also on the period and the countries. Basically, these subsystems approaches also revealed some assumptions (sometimes drawn on empirical investigations, sometimes following appreciative theorising) on the interactions between institutions (or between institutional contexts). Whether these expectations are deceived or not, they enlarge the view of complementarity of institutions we started with.

While one basic type of interaction between institutions basically relied on (i) a direct relationship between institutions and areas of activity (e.g. the area of technical change and the science and technology institutions) and (ii) a notion of connection and proximity between activities extended to the institutions related to these activities which drew on experiences and observations, the above developments invite us to consider a genuine institutional complementarity, concerning directly the interactions between the various ways in which institutions actually govern behaviours in various activities. One may distinguish three levels. The first one is the institutional level proper, and for the sake of simplicity, one may consider that this level gives the rules that will govern behaviour. The second level is that of actions, the actual behaviour of agents. The third level concerns the consequences of these actions for the economic system. At a first stage, complementarity may exist between the rules themselves, with regard to their joint influence on a certain behavioural pattern, or on the type of actions taken by agents. Rules can be more or less effective in influencing behaviour depending on whether some other rules are practised or not. At a second stage, the actions directly induced by different rules or more generally different institutions may interact and have joint effects, improving the effectiveness of each action in each area. Rules can also have antagonistic effects. Introducing new dimensions to the notion of complementarity between institutions invite to explore

further the logic of the relations between institutions.

Such investigation should help to select the more satisfying selection of sub systems and therefore allow us to compare the relevance of different selections as displayed in table 2. Section IV attempts such an investigation in the architectures of institutions.

IV SORTING AND RANKING INSTITUTIONS AND THEIR ARCHITECTURES

1 Institutions and their architecture

The triteness of the proposition '*institutions matter*' compels one to study *architectures* of institutions rather than one particular institution or organisation, how different institutions interact with one another, how the different opportunities and constraints they set constitute a coherent framework for individual strategies through their influence on some selected sets of activities. The notion of coherence calls for the notion of complementarity of institutions[16]. The former implies that the features of the economy are such that they are to some extent reproducible over time (but not necessarily for ever), and the latter suggests that the institutional components of an economy are not a mere random collection but that they actively contribute to the establishment of coherence.

A necessary step is to clarify what is meant by institutions that we considered so far as 'rules' governing behaviours of agents. In effect, definitions vary according to authors. We already mentioned that for Veblen for instance, institutions consisted of '*settled habits of thought common to the generality of men*'. Does such a definition include on the one side habits and routines, and on the other side rules which are strictly enforced by law ? According to their paradigms, economists will opt for a restrictive or comprehensive approach. A crucial element of appreciation depends on the deliberative nature of the decision associated with the 'rule' under view. Habits and routines imply for many people rather unconscious actions. For the neo-classical or Austrian schools though, all actions, habitual or otherwise, are purposeful[17]. Still the dividing line between more or less deliberative actions is not so clearly cut even for those admitting the large extent of automated actions. Conventions between agents are thus of a very mixed nature. Institutions are in most cases distinguished from organisations on the basis of the specificities of organisations, taking place around one definite project.

But these distinctions which are clear in a static view, may become more uncertain when looking in a more dynamic perspective, where some practices can extend, generalise to other groups of agents and thus become true institutions. The time dimension is an important criterion to define an institution, whether it has a distant origin or future, as well as the number of people concerned, whether it concerns a specific group of agents or can apply to a wider and perennial group. Boyer [1996] distinguishes different components for institutional analysis and characterises the constitutional order as applying on a longer horizon and to a wider set of people than institutions or organisations (see Table 3). An important element recalled by this reference to a constitutional order is the nature of enforcement of a rule. We have considered with the deliberative dimension whether agents were acting consciously or automatically in some context; this time we question whether conforming to the rules is compulsory or left to the appreciation of agents. These two dimensions : a) how much deliberative is the application of a rule, b) to what extent is it enforced, which are present in all current institutions will help us to qualify them. There are very broad view of institutions which encompass all the items of table 3. Reversely there are restrictive views of institutions which would exclude all items in table 3 except for the one specifically called "institution". It leads in practice to some difficulty to distinguish for instance between organisation and institution. We would argue that institution combine in different ways all the dimensions evoked in table 3. A whole category of institutions have thus links with the constitutions and do function through some kind of organisation while the specific feature of such bodies is strongly forged by the customs, conventions and habitus which uses and users have built up along time.

[16] On this topic, see also Amable [1999].
[17] as underlined in Hodgson [1988].

Table 3. Components of an institutional economic analysis

	Definition	**Principle**	**Factors of change**
Constitutional order	A set of rules governing relationships between individuals, organisations and institutions	Legitimacy by deliberation (in democratic societies)	Political process
Institution	An intangible way of structuring interactions between organisations and individuals	Reduces uncertainty associated to opportunistic behaviour. Favours cooperation	Structural crises
Organisation	A power structure and a set of rules that organises the actions of agents	Incentives and penalties defined in reference to external institutions and conventions	Weak performance in the competition with other organisations
Convention	A self-enforcing mechanism of social coordination	The loss of the origins makes it appear a 'natural' behaviour	Changes in the pattern of interactions which render the old conventions 'obsolete'
Habitus	Pattern of individual behaviour adopted during the socialisation process	Adaptation to a certain 'field'	Switch to another field; New learning

Adapted from Boyer [1996].

The dichotomy between players and rules, that we linked above with the definition of institutions, tends mainly to make sense and to become operational for economists once the enforcement and deliberative aspects are included and once it has been acknowledged that institutions may be enabling devices just as much as they are constraints. By contrast sociologists tend to refute such a dichotomy as skipping the context of interactions which they consider as crucial to account for the process of decision making. The space cannot be dissociated from actors and systems. There is a concrete embeddedness of activities and organisations into space. Economics is accused, as a whole, to develop a very stylised view of actors[18].

Economists broadly appear as more open to a dichotomic approach where the effects of institutions are not so tightly mixed up with the local context of actions. Decoupling the effects of institutions from the specific situations in which sociologists root the determinants of the decisions of agents has its advantages. First it stresses influences and interactions of institutions at more general levels, and second it is open to dynamic approaches where effects evolve along time, or where institutions emerge, in particular from organisations. In the present analysis it may simply help to clarify a notion of complementarity among institutions which we have seen is important in order to assess which institutions matter regarding a specific issue.

2 Three levels of complementarity.

A zero-level of complementarity can be associated with a selection of intistitutions directly induced by a selection of connected activities. The connection between activities may seem a straightforward notion as it refers to activities effectively directly interacting in some transactions. The institutions "monitoring" these activities appear thus 'de facto' connected , which may constitute a

[18] As Callon [1991] puts it, sociology by contrast proposes the images '*of actors whose behaviour is understandable only in reference to the common space which they are building and in which they are merged: actors and systems for Crozier and Friedberg, historicity for Touraine, rules for J.D. Reynaud, agents and fields for Bourdieu and roles and functional necessities for Parsons'* , all of which echoes a similar statement made earlier by Parsons (as quoted in Hodgson, 1988, p123).

notion of 'weak' complementarity. It could thus be applied to the selections of institutions used in now 'classic' systems of innovation approaches, although this notion of complementarity of institutions is not claimed for, precisely because of the weakness of the notion thus defined.

A first genuine and specific notion of institutional complementarity corresponds to the case where two or several institutions may have a joint effect on, say, macroeconomic performance or more generally on the shape of the growth trajectory. Such interrelation may occur in different ways. The existence of one institution can thus make the others more efficient with respect to the system taken as a whole. This approach is roughly that adopted by recent papers that have explicitly studied the complementarity of two institutions (or forms of organisation): the complementarity between a non-accommodating central bank and centralised wage-setting in Soskice and Iversen [1999], between a main bank based financial system and a team based production within the firm in Japan in Aoki [1994], etc. Each institution or mode of organisation defines a set of constraints, incentives and possibilities that will determine agents' strategies. The point is that the final impact of one institution on some economic issues is reinforced when the other complementary institution is present. The set of incentives to the firm defined by the main bank financing relationship makes team-based work organisation all the more efficient, which defines a specific model of the Japanese firm based on a specific mode of organisation and a specific relationship with the main bank. In other words, one institution, or one system if there is an isomorphism between systems (finance, education, etc) and institutions[19], functions all the more efficiently when the other institution is present.

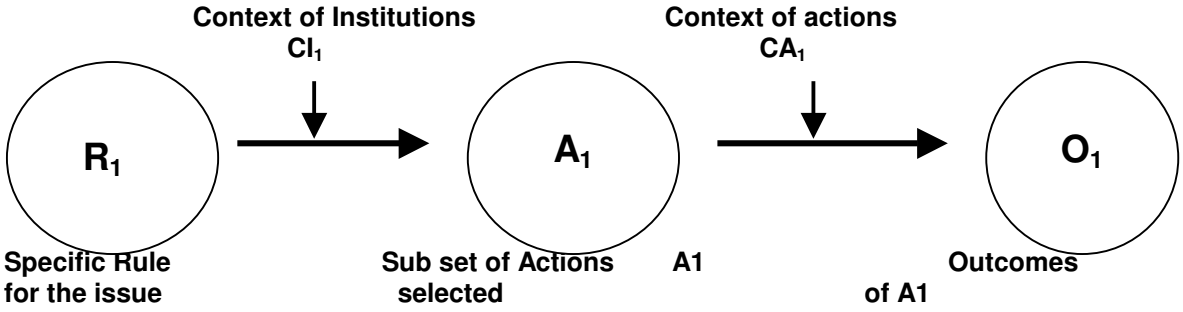
A second specific notion of institutional complementarity, which is seldom claimed as such in the economic literature, refers to the relations between the deliberative and enforcement aspects of 'rules'. The co-existence of two institutions (regardless of the issue which they are directly connected to) may reinforce or hamper the application of the rules, but totally independently from the consequences of the applications of each rule. The emphasis is no so much on the relationship between an action and its consequences, as in the first type of complementarity, but on the rule and the action. For instance the rules of transparency practised in one institution are re-enforced if used in other institutions. Similarly the criteria of tax exemptions retained in, say, education and health institutions will be more systematically applied and less likely to be changed if widely shared. This complementarity relates to the syntax of the 'rules' that institutions represent. It thus has a cognitive dimension which has some analogy with the problem raised by changes of preferences when evaluation in a decision process are made separately or jointly[20]. To clarify the two categories of effective complementarity between institutions that we have just distinguished we can feature them in a scheme of decision where agents are first structuring their scope of actions and second acting according to this frame and the condition set by external influences. In the first phase of this decision process agents feature somehow the rules of the games, what will be the frame of their action, it depends on their perception of the relevance and of the conditions of application of a whole set of institutions. The second phase is more classic and actions are taken within the previous frame in response to what the external conditions turn out to be. Complementarity (C1) at this last stage implies that the coexistence of different rules of decisions influence the outcomes. Complementarity (C2) at the level of structuring the frames of actions means that the perception of the "syntax" of one rule influences in specific ways the perception of others. Briefly speaking, complementarity of type 2 refers to interactions in the understanding of the rules, while complementarity of type 1 refers to the cumulative or detrimental effects at the level of the outcomes of actions. This scheme is presented in insert 1.

[19] This is mainly a methodological problem which corresponds to the level of analysis chosen.

[20] see Bazerman et al. [1999]

LOOKING FOR COMPLEMENTARITIES BETWEEN INSTITUTIONS
INSERT 1

Let us assume a decision process with a first stage of evaluation of the rules applying to some kind of actions, then a stage of action where the choice depends also on the general context in which actions are taken



1 Strong complementarity of type 1 : C_1

~ R1 and R2 are C1-complementary :

If when A(R2), sub sets of actions governed by rule R2, belongs to the context of actions, CA1, then the outcome of A(R1) is stronger.

2 Strong complementarity of type 2 : C_2

~ R1 and R2 are C2-complementary :

If, when R2 belongs to the institutional context in which agents are building their frames for actions, then the conditions of implementation of R1 are improved, meaning that the implications of the rule R1 are clearer and therefore the sub set of selected actions more relevant.

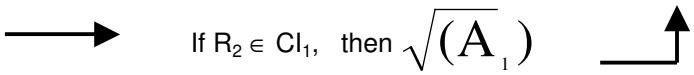


Table 4 recalls the main features of the notions of institutional complementarity that we have defined.

Table 4. The notions of institutional complementarity within a decision process

Institutional Complementarity	… Rules .. ..conditions of application	Actions … … governed	Consequences.. ..of subsequent actions
Type 1 Defined at the level of joint effects of governed actions			A complementarity defined by the existence of joint effects in the consequences of actions influenced by the institutions under view
Type 2 Inferred by interactions in the Conditions of application	Complementarity stems from some interaction between the conditions of enforcement and deliberation of the decision rules implied by a set of institutions.		
Type 0 Induced by the proximity of areas where actions are taken		Sets of "complementary activities" define a "formal" or "nominal" complementarity between the " corresponding" institutions	

This notion of complementarity, in its true forms (types 1 and 2) is fundamental in asserting the coherence as well as the pattern of evolution of an economic system. The 'coherence' of a system is then the 'macro' expression of the complementarity between specific institutional forms and the outcome in terms of economic performance (growth, employment,…). It differs across systems according to the type of complementarity. One immediate consequence of this approach in terms of economic policy is to preclude any sort of 'institutional tinkering' that politicians may have in mind when they mention the absolute necessity of reforming a specific area of the economic system. Changing one element of the system may have consequences well beyond the element concerned. Taking into account these links, with their complexity, strongly and specially conditions the relevance of any policy which aims to promote innovation and growth. Both types of complementarities are relevant in that respect, one to take avantage of cumulative effects and contradictive ones, the other to allow the implementation of structural policies which are often dismiss precisely as untractable.

3 A more dynamic approach

The above perspective is expressed in static terms. Bringing in a more explicitly dynamic perspective enlarges the scope of the analysis. As noticed most definitions of institutions effectively encompass a strong time dimension, they imply some repetition and stability over time. Still this does not rule out the idea of learning processes, of changes cumulating over time. Institutions imply a stability over a time period of their own as well as possible evolutions beyond, including their disappearance. It follows that sets of institutions can evolve and reinforce or weaken each other over time. Still this more dynamic perspective does not transform much our appreciation of system coherence, unless one wants to pay attention to the possibility of a breakdown of a set of institutions - for instance of a national model, be it German, French or whatever-. The static notion emphasises coherence and stability, the dynamic one allows for the emergence and disappearance of this coherence.

At this stage a distinction could be made among the approaches of economists between 1) the analyses seeing the architecture of institutions as so coherent that they could be featured as a solid block, specific to each nation, forged all along its history and 2) analyses that allow a more or less extensive separability of the effects of various sub sets of institutions .

1) When institutions are seen as so coherent as to constitute one national block, one speaks readily of one institutional structure governing the behaviour of agents (as does Zysman [1994] in a rapid extension). This assumption of a national infrastructure should not prevent the discussion of the dynamics and the strength of the impacts of this institutional structure. As suggested above, a dynamic perspective would help to assess the only valid question in this case, i.e. the viability of this national institutional infrastructure. Culturalism would correspond to the extreme assumption that this infrastructure is near-eternal or unexplainable by economists.
2) Alternative approaches effectively assume a more or less important possibility to separate between the effects of sub sets of institutions. Such separability is important in terms of economic policy. It helps to feature how institutional change can be monitored. In that respect cohesive forces between institutions are not uniformly distributed and any attempt to monitor institutional change must preliminarily explore these rankings.

The notion of institutional complementarities links together different institutions and modes of organisation in a certain architecture. A notion of hierarchy of institutions insists on the relative importance of one or a few institutions for the architecture as such. We shall not develop this notion but only hints at what it may refer in order to link the above developments with specific uses made in other works (Amable & Petit [1996], Petit [1998], Boyer [1999]) of a notion of hierarchy. In a static perspective, hierarchical relationships qualify a link between institutions and should therefore be explored starting with the different kinds of complementarities that we have distinguished. Still it is difficult to assess an asymmetry in the two kinds of complementarity relationships that we defined above.

One needs to take a more dynamic perspective in order to introduce asymmetries between institutions. The asymmetry could be that one institution changes when the other does not. A more genuine hierarchical relationship would stem from the fact that changes not only occur in one institution but do induce changes in other institutions. The changes may concern the conditions and rules of application of an institution or the way in which it affects economic issues. Transformations of specific institutions may be difficult to conceive and to follow comparatively. Such dynamics may be more relevant when applied to sub sets of "coherent" institutions, as shown in the following example drawn from the *régulation* approach.

One can observe some hierarchy between the "structural forms" of the *régulationniste* analysis, given by their internal dynamics and the relative strength of their spill-over on the dynamics of the other forms. For the *régulation* approach for instance, the post-war fordist golden age was centred around the wage-labour nexus. The necessities of a parallel evolution of mass consumption and mass production for the coherence of fordism put the institutional arrangements of the wage-labour nexus at the centre of the whole institutional architecture. The 'Golden age', i.e. the post war high growth period, was derived from the central role of the capital/labour accord (a.k.a. the *wage/labour nexus*) and this accord permeated the whole economic system via a new style for State intervention, an oligopolistic type of competition, a particular type of credit regime and a stable international regime. In this respect, during this period, the wage-labour nexus was the driving institutional form of the growth regime. In the current period, this prominence of the wage-labour nexus is challenged since the forms of competition and forces coming from the international regime directly affect the inner organisation of the post W.W.II capital/labour accord[21].

Table 5. A modification of hierarchy among institutional forms

Structural forms	When the dynamics of the wage labour nexus is prevailing	When the dynamics of the forms of competition is prevailing
Wage labour nexus	Expanding coverage and formulas	Expanding non wage income, reducing welfare
Forms of competition	Oligopolistic price competition	Expanding new markets and non-price competitiveness
International relations	Mobility of labour No Mobility of capital	Mobility of capital Limited mobility of labour

[21] see Amable and Petit [1996].

Money	Fixed exchange rates	Floating regional exchange rates
State	Developing welfare state	Workfare and market supports

Following on this, the interpretation of the structural transformations of the past 20 years is based on a reversal of the hierarchy. To cut it short, the basic proposition (Amable and Petit [1996]) is that the forms of competition, i.e. the complex of institutions and organisations that concern competition on the product market(s), are now the driving institutional form. It means that the new constraints imposed by the relatively autonomous evolution of the institutions and organisations pertaining to the 'forms of competition' realm are not compatible with the ancient arrangements in other areas (wage-labour nexus,…) and (a) threaten the coherence of the whole system (the fordist mode of régulation) and (b) impose a particular type of coherence for the new mode of *régulation*. (Table 5).

Giving all the aspects concerning these transformations is well beyond the limits of this paper, but one can give a few indications:

- the deregulation of the financial systems favours market-based systems (Anglo-Saxon countries) and threatens the stability of bank-based systems (Germany and Japan). This has implications for the pattern of financing of firms as well as opportunities concerning private savings. A new type of complementarity between the new features of financial systems and other systems (industry, innovation, labour relations,…) will have to be found.
- New opportunities for internationalisation of production give firms (large ones at least) the possibility of escaping from the constraints given by a particular national institutional system. This has destabilising effects for the wage-labour nexus.

The above only hints at the notion of hierarchy between institutions as a key element, along with the more "classic" notion of complementarity to feature the architecture of institutions and how to monitor their transformation. We can now draw some preliminary conclusions on how institutions matter in a special field like innovation and growth.

V Preliminary conclusions and policy recommendations

Our analysis of the relationships that structure the fabric of national institutions, even if tentative, leads to some important implications. First the role of institutions cannot be isolated from a context , if only of other institutions. The way in which institutions influence behaviour in one field may well have to do with the existence of complementary institutions. These complementarities can take place at various levels. One is directly linked with the impacts of institutions on economic issues (the increase in employment, the stimulation of innovation and growth). The other concerns the level of the implementation of the rules corresponding to the institutions under view. In other words one level deals with the semantics of institutions, the other with the syntax of institutions. Both relationships have similar implications. To appreciate the impact of one institution one has to take into account the graph of connections that these complementarities imply. It is difficult to say a priori whether this graph is far ranging or not. Some connections may be stronger than others so that one could well imagine to consider only the connections which have a certain weight. All these considerations are important when one assumes that institutions matter in most aspects of economic activities. In some cases this statement amounts to recall the importance of fundamentals which cannot be altered or transferred. In some other cases it seems that institutional changes can be undertaken and are part of the policy tools.

Such seems to be the case regarding the innovation capability of a country. The central role of this capability in determining the competitiveness of countries helps to suggest that institutions supporting the dynamics of innovation can somehow be copied and transferred. Our argument stresses that such reverse engineering could be very misleading if one did not take into account the various complementarities conditioning both the implementation and the impact of institutions.

Even if one accounts for these complementarities, it is still difficult to know what will come out of a policy transferring a full set of institutions from one country to another. Almost by definition, the notion of institution is strongly linked with an idea of habits and repetitions (see Hodgson, 1998). Therefore a policy to import institutional changes has to be especially cautious. One is forced to take a

more dynamic perspective to clarify the issue, to see how the implant will fare. It may also be the case that institutions gain new properties in the process and lose some others. We also hinted at the fact that a dynamic perspective led to discover that asymmetric, hierarchical relationships between institutions could occur. All of which shows the complexity of policies that plan to reproduce some institutional context. Investigating the structure of the national fabric of institutions may help to reduce the problem posed by the complexity of the laws of institutional change. It can lead to some pragmatic principles which would help to some broad targeting of objectives.

Our investigation displayed the shortcomings of a too straightforward approach of institutional context. It may well be the case that transplanted institutional settings behave quite differently. To achieve any finer targeting of policy transferring institutional setting one clearly needs to know more on the learning curve of the new fabric.

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