

On structural change and democratic knowledge policies

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Introduction

This paper is a contribution to a book on structural change and strategic innovation policies. Structural change is characterized as the transition to a knowledge-based and innovation-driven economy. It is taking place in some regions of the world and not in others; nevertheless the whole planet is deeply conditioned by such transition in which a capitalist knowledge society emerges or is already being consolidated. In such context, the role of knowledge as the main resource of power relations generates social and geographic inequalities. Prevailing innovation policies foster rather than hamper such trend. But new opportunities are offered by different types of public policies and experiences, including some that connect directly innovation with social inclusion. They exemplify what may be called democratic knowledge policies, briefly defined as policies aiming to make knowledge a main tool of development as freedom à la Sen. In the sequel we start an elaboration of the above sketched approach, albeit in a very partial and preliminary way, hoping to learn from criticism and from much more mature work on power relations and innovation policies. This issue is unavoidable in order to connect innovation theory with development.

The following quotation is our starting point: “As a kind of countervailing power to the colonizing tendency emanating from market - oriented innovation policy we need to develop a wider field of politics – *knowledge politics* – that covers all aspects of knowledge production and takes into account that the production of knowledge has much wider scope than just contributing to economic growth” (Lundvall, 2010: 346).

We inserted the same quotation in two previous papers (Arocena and Sutz, 2012 a, b) on research and innovation policies for social inclusion, where we presented two conjectures:

(i) A new pattern for research and innovation policies seems to be emerging, characterized by its direct relation with pressing social needs; they can be seen as belonging to the field of knowledge politics in Lundvall’s sense.

(ii) Such policies, if they get to be strong, may foster in turn the emergence of Inclusive Systems of Innovation in developing countries.

Here we start trying to go one step further in the same direction of contributing to develop a subfield of the field of knowledge politics, the subfield of democratic knowledge policies.

We assume that the basic issue of the field of knowledge politics is the relation between, on the one hand, production and utilization of knowledge and, on the other hand, the distribution of power in society and related patterns of cooperation and conflict. In short, we are speaking of the actual relation between knowledge and power. That relation both promotes and shapes structural change in our time. Some aspects of this last issue are sketched below, where we try to connect our subject with Michael Mann’s theory of social power.

One of the main traits of actual structural change is the prevailing set of strategic innovation policies; in them “the colonizing tendency emanating from market - oriented innovation policy” is apparent. In turn, a main consequence of that type of

policies is that they foster inequality, that is, unequal distribution of power between peoples and within most peoples; thus, strictly speaking, they are non democratic policies. More generally, dominant features of knowledge politics in our time are a source of inequality, particularly in developing countries.

Thus, normative aims akin to the spirit of democracy lead to search for alternative policies that may be called democratic knowledge policies. When development problems are faced, such normative aims have been eloquently formulated by Amartya Sen in his celebrated theory of development as the expansion of freedoms and capabilities, so in such cases the policies we are considering may be seen as examples of strategic development-oriented innovation policy.

Innovation systems theory focuses its attention on a plurality of actors - agents and organizations - that, through their interactions, generate innovations and new capabilities. The type of innovations that effectively take place depends highly on the specific interests of those actors and on the relative power of the different networks in which such actors become inserted. This seems to be a main issue in the field of democratic politics. It includes the problem of which organized networks actually or potentially included in innovation systems may be interested in, and have power for, fostering democratic knowledge policies. The following tentative and preliminary remarks may be of some use in order to stress the relevance of such problem for the research agenda of innovation and development studies.

On the roots and reach of structural change

Structural change in this context is understood as a mainly economic process that consists in the transition to a knowledge-based and innovation-driven economy. It can be seen as the achievement of “The Second Economic Revolution” (North, 2005): the wedding of science and technology becomes the main propeller of productive capabilities.

This process can be described à la Mokyr (2002) as the evolution of the role of “omega” for “lambda”. Ω knowledge is characterized as propositional knowledge or knowledge about “what”, by far not limited to modern science, while λ knowledge is characterized as prescriptive knowledge or knowledge about “how”. Historically the relations between both types of knowledge were distant: not only the cognitive background of the people performing them was widely different, but the institutions in which they produced knowledge had very few and non systematic contacts. This situation was responsible, in Mokyr analysis, for the fact that until the Industrial Revolution “growth was normally not sustainable and remained vulnerable to set-backs and shocks, both man-made and natural” (Mokyr, 2005: 286). But caution is needed. As he put it: “True enough: in the early stages of the Industrial Revolution, many of the important advances owed little to science in a direct way. However, had technological progress been independent of what happened at the loftier intellectual level, had it consisted purely of disseminating best-practice existing procedures, standardizing them, and hoping for learning-by-doing effects, the process would eventually have run into diminishing returns and fizzled out. What was it that prevented that from happening in the decades following the burst of macroinventions we identify with the classic Industrial Revolution? (Ibid: 289)” The answer has precisely to do with the wedding of science and technology or, as David Noble (1977) termed it, the wedding of science and the useful arts; in Mokyr terms it means that the epistemic base of λ knowledge, quite

narrow until the middle of the XIX century, became systematically widened through more tight relations to Ω knowledge.

The economic and social importance of widening the epistemic base of prescriptive knowledge is paramount: “the wider and deeper the epistemic base (propositional knowledge) on which a technique rests, the more likely is that a technique can be extended and find new applications, product and service quality improved, the production process streamlined, economized and *adapted to changing external circumstances, and the techniques combined with others to form new ones*” (Mokyr, 2002: 14, emphasis added). In other words, around one hundred and fifty years ago, in one relatively small part of the world, a process started of deep structural change related to knowledge that led the societies living such change into a process of sustained knowledge-based and innovation-driven economic growth. Such growth implied that new demands and new opportunities for all types of new or recombined techniques appear quite frequently, fuelling the process in a sustained way. It is important to stress here that this is not a normative appraisal of the process: we are now having a glimpse of the worrying environmental consequences of the path of technical change actually followed after being accelerated by the wedding of science with the useful arts. We are only reminding Mokyr’s bold assertion: “The effective deployment of knowledge, scientific or otherwise, in the service of production is the primary—if not the only—cause for the rapid growth of Western economies in the past centuries” (Mokyr, 2005: 287). Long term divergences in concrete economic output and, moreover, in development prospects, can be traced back to the “knowledge roots” of that period.

The differential consequence in the long term for different regions of the world of that process can be clearly seen in the remarkable tables presented by Bairoch (1993: 91, 95)

Table 1.- Levels of industrialization and of GNP in the Third World and the developed countries, 1970-1990

Years	INDUSTRIALIZATION (United Kingdom 1900 =100)				GNP (in 1960 US dollars and prices)			
	Total		Per capita		Total		Per capita	
	Third World	Developed countries	Third World	Developed countries	Third World	Developed countries	Third World	Developed countries
1750	93	34	7	8	112	35	188	182
1800	99	47	6	8	137	47	188	198
1830	112	73	6	11	150	67	183	237
1860	83	143	4	16	159	118	174	324
1900	60	481	2	35	184	297	175	540
1913	70	863	2	55	217	430	192	662
1928	98	1260	3	71	252	568	194	782
1938	122	1560	4	81	293	678	202	856
1953	200	2870	5	135	338	889	214	1180
1973	927	8430	14	315	810	2450	340	2540
1980	1320	9910	19	347	1280	3400	390	2920
1990	2480	12090	29	412	1730	4350	430	3490

Source: Bairoch, 1993: 91 and 95

The Second Economic Revolution clearly differentiated “centers” and “peripheries”. Following that evolution up to the present, it can be said in short that a knowledge-based society was fostered by structural change in the centers, also called developed countries. From this point of view, a peripheral situation means absence or

weakness of structural change. The set of all such situations can be termed “the South”, also called developing countries, the great differences within them notwithstanding.

Now, we are speaking of a knowledge-based society and not only of a knowledge-based economy. Advanced knowledge is becoming a fundamental resource of all the main types of organized power. We briefly comment this assertion, following Michael Mann’s social theory of power (Mann, 1986, 1993, 2006; Hall and Schroeder, 2006)

Recalling some aspects of Mann’s theory of organizational power

Mann elaborates what he calls a IEMP model where the main sources of social power are the Ideological, Economic, Military and Political relations in which human beings become involved when pursuing their needs and goals. Such relations foster the emergence of interaction networks that link concrete people. The influence of networks as such depends on their organizational reach, on the extension and intensity with which they are able to coordinate and direct the action of men and the use of resources. This is in a nutshell Mann’s theory of organizational power.

We elaborate the above assertions essentially by selected quotations. In general “power is the ability to pursue and attain goals through mastery of one’s environment.” (Mann, 1986: 6) Social power is the power stemming from social relations, fundamentally by means of organized action.

“*Ideological power* derives from the human need to find ultimate meanings in life, to share norms and values, and to participate in aesthetic and ritual practices,” (Mann, 1993: 7) “*Economic power* derives from the need to extract, transform, distribute, and consume the resources of nature.” (Idem) “*Military power* is the social organization of physical force. It derives from the necessity of organized defense and the utility of aggression.” (Op. cit.: 8) “*Political power* derives from the usefulness of territorial and centralized regulation. Political power means *state power*.” (Op. cit.: 9)

The primacy of the IEMP relations “comes not from the strength of human desires for ideological, economic, military, or political satisfaction but from the particular *organizational means* each possesses to attain human goals, whatever these may be.” (Mann, 1986: 2) “Sociological theory heroically simplifies, by selecting our relations that are more ‘powerful’ than others, influencing the shape and the nature of other relations and, therefore, the shape and nature of social structures in general. This is not because the particular needs they satisfy are motivationally more ‘powerful’ than others but because they are more effective as means to achieve goals. Not ends but means give us our point of entry into the question of primacy. In any society characterized by a division of labor, specialized social relations satisfying different clusterings of human needs will arise. These differ in their organizing capacities.” (Mann, 1986: 5)

The IEMP model operates at a concrete level of analysis, paying attention to interaction networks that connect real people. As Collins (2006: 22) explains, each network is a “chain of connections linking people together. One advantage of this conception is that power is never free-floating; we are never tempted to treat it merely as an abstraction, something existing inherently in the ‘system’ or the ‘logic’ of social form [...]. Networks do not have logics; they are real connections among people, empirically observable as to where they spread out in space.” A most important consequence is that networks “are emergent, but also ephemeral; they come into existence, expand by adding new links and intensifying the flow through them, but also contract, die down, fade out.” (Idem: 23)

The IEMP model offers a “pluralist” approach. No privileged type of social relation or source of social power offers a more or less “monist” or mono causal interpretation of history. “Distinguishing between four distinct power sources generates a model which is in some ways pluralist. Ideological, economic, military and political power, though entwined, are not normally merged. Capitalism, states, ideologies and militaries are not normally staffed by the same people, serving the same interests, mobilizing the same emotions.” (Mann, 2006: 387)

Depending on their organizational power, some networks stemming from different social relations are able to obtain a relative primacy; when that primacy gets institutionalized, it generates some degree of stability and permanence in the evolution of societies. But institutionalization is almost never the only game in town. Prevailing networks don’t usually cover the whole set of social activities; some “interstices” remain open. Recalling Marx’s description of the emergence of bourgeois society between the “pores” of feudal society, Mann speaks of the interstitial emergence of new organized networks that bring with them changes and alterations of institutionalized patterns of social behavior. In general, there is always space open for such type of emergence of transformations and new networks. “Despite the increasing ‘caging’ of people within modern nation-states [...], these have never been powerful enough to constitute whole ‘societies’. Human activity comprises multiple, overlapping, intersecting networks of social interaction. This model has become widely accepted since I initially advanced it. It enables us to identify the root of social change, since plural power organizations can never be fully institutionalized or insulated from influences coming ‘interstitially’ from cracks within and between them. Social changes results from a dialectic between the institutionalization and the interstitial emergence of power networks.” (Mann, 2006: 343)

This seems a good place to quote the two statements by means of which, according to Mann, his approach can be summed up. The first is: “*Societies are constituted of multiple overlapping and intersecting sociospatial networks of social power.*” (Mann, 1986: 1, italics in the original). The second statement is: “*A general account of societies, their structure, and their history can be given in terms of the interrelations of what I call the four sources of social power: ideological, economic, military, and political (IEMP) relationships.*” (Op. cit: 2)

This approach stresses a basic distinction between collective power and distributive power. The first one is outward power, that is, the power that an organized group has over other groups or over nature. Distributive power is inward power, the power within an organized group of those with a major role in coordination and direction over those with a lesser role.

Thus democratization, understood as empowering “people”, can be seen as the set of processes countervailing the expansion of distributive power. Now, every democratization process has to face a dilemma highlighted by the relation between these two types of power: since social power rests fundamentally on organization, creating collective power usually generates distributive power as well. “I do not say that those who hold power perform ‘indispensable functions’ for subordinates. I do say that distributive power derives originally from collective power, i.e. that stratification derives from social cooperation. So did Marx and so have many others.” (Mann, 2006: 366)

Since we are concerned with democratization, this issue deserves one more quotation. “In most social relations both aspects of power, distributive and collective, exploitative and functional, operate simultaneously and are intertwined. Indeed, the relationship between the two is dialectical. In pursuit of their goals, humans enter into

cooperative, collective power relations with one another. But in implementing collective goals, social organization and a division of labor are set up. Organization and division of function carry an inherent tendency to distributive power, deriving from supervision and coordination. For the division of labor is deceptive. Although it involves specialization of function at all levels, the top overlooks and directs the whole. Those who occupy supervision and coordinating positions have an immense organizational superiority over the others." (Mann, 1986: 5-6)

Organizational reach is highly dependent on available techniques. Here technique is understood in a wide sense that includes the use of tools, weapons and alphabets, that is, productive, destructive and communicative techniques, all of them rooted in knowledge. They are examples of infrastructures of power. In particular: "The fundamental infrastructure of all four sources of [...] power is communications. Without effective passing of messages, personnel and resources, there can be no power." (Mann 1986: 136) Changes in techniques generated revolutions long before the Industrial Revolution. For example, with the appearance of iron the "balance of power shifted"; changes in agriculture and war "amounted to a technologically unified revolution. Iron inaugurated a social revolution" (Mann 1986: 185).

The approach to the (First and Second) Industrial Revolution exemplifies the role of technological infrastructures of organizational power as well as the nature of collective power: "There was now indeed an unparalleled, truly exponential transformation in the logistics of collective power" that becomes apparent by considering "three measures of collective power: the capacity to mobilize large numbers of people, the capacity to extract energy from nature, and the capacity of this civilization [i.e. Western] to exploit others collectively." (Mann 1993: 12-13)

Revisiting his up to now two volume *Sources* (of Social Power, Mann 1986 and 1993) in a collective book dedicated to analyzing his theory (Hall and Schroeder, 2006), Mann somehow acknowledges that he should have given more relevance to science, in European history and in general: "Science also played a major role in European development, one that I mentioned but did not stress sufficiently in *Sources*. Goldstone and others have shown that the new technologies of the industrial revolution can be traced back to the English 'scientific revolution' of the seventeenth century. Though (as I noted) most of the major inventions did not come from scientists, but from the 'micro-technologies' of engineers and artisans, it has now been shown that they had absorbed the general principles of scientific theories, and they shared a common technical vocabulary and method. They had imbibed the ideology that natural phenomena were orderly and predictable, mastered by means of scientific method of exact measurement and reproducible experiment." (Mann, 2006: 375). "Goldstone is right that I neglected the role of science in the industrial. I have remedied this not by making science a fifth source of social power, as he suggests, but by putting more science into my four sources." (Idem, 377) This puts in evidence the advanced knowledge base of power relations in our time.

Mann's social theory is complex, subtle and still evolving. Let us put an end to this rough and risky presentation by quoting his own summary of an open ended approach to human history.

"We start with human pursuing goals. I don't mean by this that their goals are 'presocial' – rather that what the goals are, and how they are created, is not relevant for what follows. Goal-oriented people form a multiplicity of social relationships too complex for any general theory. However, relationships around the most powerful organizational means coalesce to form broad institutional networks of determinate, stable shape, combining both intensive and extensive power and authoritative and

diffused power. There are, I suggest, four such major sources of social power, each centered on a different means of organization. Pressures towards institutionalization tend to partially merge them in turn into one or more dominant power networks. These provide the highest degree of boundedness that we find in social life, though this is far from total. Many networks remain interstitial both to the four power sources and to the dominant configurations; similarly, important aspects of the four power sources also remain poorly institutionalized into the dominant configurations. These two sources of interstitial interaction eventually produce a more powerful emergent network, centered on one or more of the four power sources, and induce a reorganization of social life and a new dominant configuration. And so the historical process continues.” (Mann 1986: 30)

Some remarks on techniques and organizational power

Social relations in general were profoundly changed with the appearance of agricultural and husbandry techniques, the “First Economic Revolution” according to Douglas North. It shaped the emergence of agrarian-based societies, where extracting and managing the surplus of agrarian production was a key issue for IEMP organized networks, their coming into being, success and failure.

The immense majority of human beings lived in such type of societies up to a little more than two centuries ago, when that started to change in a small area of the world. By then, power relations opened possibilities – we don’t say “caused” – to a new technological revolution, the Industrial Revolution, that shaped the emergence of industry-based societies.

Associated techniques greatly increased the economic and political power of the industrial West, strengthening its domination over almost all the Rest (of the world) as well as its capacities to sustain economic growth at levels unknown in other places or times.

In this way underdevelopment appeared, in one way or another, as a reality in those societies that still had a fundamentally agrarian productive base; they became “peripheries” of the industrialized “centers”. These have never been homogeneous and they are not exactly the same today as yesterday; both assertions are even more apparent concerning peripheries. Nevertheless, that very rough binary classification highlighted a very real asymmetry of power, quite evident concerning economic and military aspects, also noticeable in the realm of politics and even relevant some times in ideological terms. Thus, when after the II World War, the problem of development appeared at the top of political and ideological agendas, a central role was attributed to industrialization in very different strategies aiming to overcome backwardness in the peripheries and their subordination to the centers.

But by then another major transformation in the knowledge base of power relations was underway. One of its sources was the so-called “wedding of science and technology” that took place in the industrial West during the second half of the 19th century. It meant that practical tinkering, methodical and systematic but with limited cognitive foundation, began to be superseded, as the main propeller of technical change, by highly sophisticated scientific knowledge. Their effects are apparent in the accelerated techno-productive innovation of the last long century. It started in the last decades of the XIX century and, up to now such process has as its culminating stage the “TIC revolution”, but perhaps life sciences and technologies will show not smaller impacts. Anyway, the change that has taken place may be summarized by saying that

the “centers”, old and new, that have a dominant position in international power relations are becoming or have already become “knowledge-based and innovation-driven economies”, in de la Mothe and Paquet (1996) short and precise characterization.

Now, two fundamental facts need to be stressed: first, advanced knowledge is nowadays the most influential technological basis not only of economic relations but of social relations in general; second, the technological basis neither determines nor is determined by social relations. Concerning the last, one approach to Marx’s theory of productive forces and relations of production tends to see the former as determinants of the latter; other approaches, also rooted in Marx’s texts, present a more complex, interactive and conflictive relation between them. From this point of view, a given society can not be described satisfactorily only by means of its technological basis. At least, it is necessary to consider also the fundamental social relations. Bell (1999: xxix-xxx) elaborates this as follows: “The appeal of Marxism as a sociological theory is that it is probably the only one that is both synchronic and diachronic, namely a theory of social structure (the synchronic) and a theory of changes (the diachronic). The difficulty is that while Marx’s two dimensions, social relations and *techne*, are yoked together, if one looks at the changes in modes of production over time, there is no clear and consistent relation between the two [...] . What I suggested, therefore, is that there is a considerable gain from Marx’s scheme if we ‘de-couple’ the two dimensions”.

Such scheme with two “de-coupled” dimensions, *techne* and social relations, seems to be consistent with Mann’s approach: “The pursuit of almost all our motivational drives, our needs and goals, involves human beings in external relations with nature and other human beings. Human goals require both intervention in nature - a material life in the widest sense- and social cooperation.” (Mann 1986: 5)

Bell stresses that similar technological configurations may appear together with quite different social relations: history has shown during the 20th century examples of societies based on industry with capitalist and non capitalist social relations. Touraine and Castells make similar points but we shall not elaborate on this here. We adopt a “conceptual scheme” that includes: (i) the two “de-coupled dimensions” of social relations and their technological basis; (ii) Mann’s IEMP model of the social relations that are fundamental sources of organizational power; (iii) a “two ways” and not deterministic set of interactions between such “dimensions”. In order to be brief, let us call it the *techne and IEMP relations* conceptual scheme. It seems to be one step towards understanding what may be termed the Marx / Weber / Mann synthesis (see Collins, 2006).

Now: “No conceptual scheme ever exhausts a social reality. Each conceptual scheme is a prism which selects *some* features, rather than others, in order to highlight historical change or, more specifically, to answer certain questions.” (Bell, 1999: lxxxviii) As said, our interest is to explore the possibilities of democratizing knowledge policies in the context of structural change.

In the new “knowledge-based and innovation-driven economies” the dominant configuration of social relations is capitalist. This exemplifies the long term organizational power of economic relations. “Economic networks exercise the most massive impact on collective power in the cumulative long term. Industrial capitalism may have changed the whole population’s lives more than any other power process in human history.” (Mann, 2006: 386) Going back to the first fact stressed above, advanced scientific and technological knowledge is the main technological basis of productive capabilities, and also of destructive and communication capabilities. That is evident concerning the infrastructures of economic and military power, but it seems true also of political and even ideological power.

That means that the main structural change can be more fully described as the transition to a capitalist knowledge society. And in this process financial capital plays a dominant role, today as yesterday as Braudel and Wright Mills among many others explained. The old and new “centers” of the globalized capitalist world are the countries or regions where a capitalist knowledge society has emerged; that quite asymmetric process is far from happening all over the world; but power relations everywhere are deeply shaped by such process.

The logic of the capitalist knowledge society fosters a powerful trend to capitalize knowledge, which implies its privatization. This trend towards knowledge privatization has two main consequences. The first is a general one that has been called “the second enclosure” (Boyle, 2003). Another consequence, particularly visible in developing countries, relates to: (i) difficulties to follow promising development paths, the “kicking away the ladders” process evoked by Chang (2002), and (ii) impossibility of relying on advanced knowledge to improve the quality of life of the poor, a trend that in the realm of health has been compared to the effects of “weapons of mass destruction” (Weber and Bussell, 2005: 82).

The term “second enclosure movement” of intellectual proprietary rights echoes the first agrarian enclosure, “the process of fencing off common land and turning it into private property” (Boyle, 2003: 1). In present times, “common land” has turned into the broad world of ideas and “facts of nature” unearthed by intellectual efforts, leading to the “the enclosure of the intangible commons of the mind”, where “things that were formerly thought of as either common property or uncommodifiable are being covered with new, or newly extended, property rights”. (Ibid : 37) The “second enclosure” is a distinctive characteristic of the emerging capitalist knowledge society. Warnings regarding its negative effects for the advancement of science, technology and innovation have been made (Dasgupta and David, 1994; Nelson et al, 1998). The closure of the possibilities of reverse-engineering and technological tinkering-around kicked away some ladders that were functional in Japan’s and South Korea’s processes of development. Moreover, the actual strengthening of the intellectual property rights granted to pharmaceuticals, so harmful for developing countries (Stiglitz, 2004), is hard to defend in terms of fostering innovation, given that “chemical substances remained unpatentable until 1967 in Germany, 1968 in the Nordic countries, 1976 in Japan, 1978 in Switzerland and 1992 in Spain” (Chang, 2002: 175). This trend has gone so far, that the World Bank states in a recent text: “There has been much pressure, particularly from the United States, to have developing countries adopt stronger IPR laws and enforcement. This pressure is reflected in WTO agreements, and countries that do not comply face stronger sanctions. (...) Developing countries should resist those pressures and think carefully about what makes the most sense for them at their particular stage of development” (World Bank, 2010: 147).

We contend that prevailing “strategic innovation policies”, deeply rooted in this “second enclosure movement”, for several peripheral countries are less than optimal from a productive point of view and far from optimal from a social point of view. In order to elaborate the last assertion, we turn to a brief consideration of the role of knowledge in development.

Knowledge, peripheral countries and inequality

Structural change as previously characterized has some major prerequisites. A main one is the incorporation of highly qualified people and first level knowledge to the

whole set of activities related with producing goods and services. Those are the main resources of a knowledge-based and innovation-driven economy; in turn, such economy strongly demands those resources. A main obstacle for structural change in several developing countries – particularly in Latin America - is the weakness of knowledge demand stemming from internal economic dynamics. That obstacle has hampered knowledge policies in those countries for the last sixty years. Briefly stated, weak knowledge demand is the main obstacle for structural change for many “developing countries”. It hampers the expansion of productive capabilities. Prevailing “strategic innovation policies” have not been very successful concerning this main obstacle for structural change. [The brief assertions in this paragraph are elaborated and exemplified in Arocena and Sutz 2010.]

The East Asian developmental state of the late twentieth century seems to have been able to overcome such obstacle by means of a strategy that systematically upgraded the level of internal knowledge demand, thus paving the way in the long run to structural change. Perhaps its success stems from a sort of alliance between diverse “national” organized power networks; in the case of Japan and South Korea two organized power networks seem to have been functional to development: the rather stable leadership and top bureaucracy of the state on one side and sets of big entrepreneurs on the other side.

An unexpected alliance of global capitalism and a communist party-state forged during the last decades the role of China as the new workshop of the world. Is that a threat to the “centers” of the knowledge-based and innovation-driven global economy or, seen from the US, is it “playing our game”? (Steinfeld, 2010) If the last is true, we would have a new type of peripheries, the industrialized peripheries of the centers of the knowledge economy. But it seems that powerful members of the above mentioned alliance are pushing forward in China a structural change that goes beyond the industrial workshop to structural change. Data on the growth of Chinese university engineering and science students, science and engineering PhD students and researchers in general are astounding. (Dahlman, 2012) That would be a momentous historic change, surpassing the industrialization of China in a sense comparable as to how the wedding of science and the useful arts surpassed the (First) Industrial Revolution and set in its way actual structural change. Perhaps “catching up” is taking place in a country with a population as big as the population of the whole world in the second half of the nineteenth century.

Be that as it may, a structural trend that fosters inequality stems from structural change. It is quite obvious as inequality between countries, when the comparison is between those where structural change took place and those where it did not (“North” and “South” in brief). It is also apparent as inequality within countries, particularly big countries, when they are not “catching up”, also when they are “catching up”, and even when they already belong to the “centers”.

Such trend is particularly relevant in connection with social exclusion, a most striking consequence of inequality. Prevailing market-oriented innovation policies do not face some aspects of exclusion related with knowledge and even make worse some of them.

Such assertion can be elaborated as follows (Arocena and Sutz, 2012 b). In a taxonomy of exclusion presented by Sen (2000) four situations are considered: (i) constitutive exclusion happens when being excluded is in itself a deprivation which can be of intrinsic importance on its own; (ii) instrumental exclusion refers to causally significant exclusions that may not be impoverishing by themselves, but can lead to impoverishment of human life through consequences of great instrumental importance; (iii) active exclusion happens when exclusions come about through policies directly

aimed at that result; (iv) passive exclusion is the result of policies that have not been devised to bring about that result but nevertheless have such consequences. Thus exclusion can be constitutive or instrumental, and also active or passive. In this way, four combined categories of exclusion are characterized by means of Sen's four single categories; each of them can be directly related with knowledge politics (which includes both policies and absence of policies):

(1) Constitutive and active exclusion is exemplified by TRIPS agreements affecting access to generic drugs.

(2) Constitutive and passive exclusion is exemplified by the so called 90/10 gap (90% of the resources for research in health are related with health problems of 10% of world population) and by the prohibitive costs of some medical equipment.

(3) Instrumental and active exclusion is exemplified by the utilization of genetic data to exclude from jobs or from insurance.

(4) Instrumental and passive exclusion is exemplified by gaps or "divides" stemming from different rhythms of diffusion of innovations.

The examples of the combined categories (1) and (2) are cases of exclusion resulting from actions designed purposefully to exclude by means of economic power; they can only be challenged by political struggle. In fact they have been challenged by such means, showing some possibilities for organizing political networks as a countervailing power to the knowledge-based prevailing economic networks. They illustrate the highly conflictive dimensions of knowledge politics. Overcoming situations as those exemplifying the combined categories (3) and (4) will probably need, in several circumstances, specific research and innovation policies. Neither designing efficiently such policies nor backing them with organized power will be easy in most cases.

Inequalities stemming from the increasingly knowledge-based dynamics of power are of course not restricted to cases of social exclusion. For example, in many countries increasing income differences are related with different educational backgrounds.

As stressed by the Aalborg school of Innovation Theory, if knowledge is the main resource of economies, learning becomes the fundamental process. That is more so when advanced knowledge may be considered as the fundamental basis of the whole set of power relations. As some facts already recalled suggest, different possibilities for learning are the root of important inequalities. Perhaps this is a structural trend stemming from an obvious but nonetheless characteristic aspect of processes of advanced learning in general: in such processes what is learnt is above all to go on learning and to open new possibilities to learn. That is true of one way of learning, studying at advanced level in a research environment, which is the defining characteristic of university teaching. But the self reinforcing dimension of advanced learning is even more important in another way of learning, not always taken into account in educational studies; we refer to learning by working in creative environments where challenging problems are frequently faced by teams that include different competences, so an interactive learning by cooperating in solving problems takes place.

Now, for good or for bad, that happens not only in productive activities but also in every organized network where advanced knowledge is used as a main resource and, consequently, demanded. Generally speaking, that means that knowledge is a resource which increases when it is used. And, in some sense symmetrically, knowledge decreases when it is not used, be it for lack of demand or for weakness of supply. This reminds the famous concept "Matthew Effect", due to Robert Merton (1968), to explain the reward system in science. Quoting the Saint Matthew Gospel, he claims that what it

is said there describes the dynamics of such rewards system: “For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath.”

A “generalized Mathew effect” seems to be operating concerning knowledge and learning. In a knowledge-based society, this generalized Matthew Effect tends to widen distributive power. If that is so, then the general trend towards widening inequality that most scholars detect since the 1980s (see for example Held and Kalla, 2007) has its causes not only in prevailing neo liberal policies but also in the increased role of advanced knowledge itself.

Emerging strategic policies for development

If things are more or less as sketched above, instead of prevailing strategic innovation policies we need strategic democratic knowledge policies, including policies in science, technology and innovation aiming to favor structural change by means that positively interact with diminishing inequality. In some sense, such policies seem to be emerging. We have elaborated a bit more this conjecture elsewhere (Arocena and Sutz, 2012 b). We can summarize it as follows.

Economic growth has not delivered in every place where it occurred a notorious diminishing of social inequality; the need to focus directly on social inclusion to obtain some results has replaced the trickle-down hypothesis that put economic growth and its requirements almost alone in the vertex of the developmental policy realm. Innovation policy reflections as well as innovation policies recommendations were in general terms rather slow in taking the issue of social inclusion on board, a situation that has been changing in recent times. The task is not easy. Recognizing that understanding and promoting innovation in developing countries cannot be done only with the theoretical tools provided by developed countries took time; blending social inclusion and innovation policies is even more difficult. But it is clear now that the need for such blending is being recognized. For instance, the World Bank document mentioned earlier states: “Top-down, supply-driven initiatives have often proved ineffective for addressing the needs of the poor. Inclusive innovation policy presupposes a change in institutional culture and mandates the involvement of the poor in identifying their development priorities and in providing incentives for various actors to serve their needs more effectively. This change will entail closer collaboration among public R&D entities, industry, universities, nongovernmental organizations (NGOs), donors, and global networks.” (World Bank, 2010: 338)

We can assert that innovation policies directed towards social inclusion have won legitimacy; this is in part a result of a pendulum shift in which demand-side innovation policies are being proposed. (OECD, 2011) This has potentially great relevance, because focusing on innovation policies from the demand side will certainly need to pay attention to fostering innovation demand, that is structurally weak in developing countries. To overcome the weakness of knowledge and innovation demand, rooted on the productive structure of these countries, an alternative source of demand is needed, strong in quantitative terms as well as in the complexity of the intellectual endeavor it entails. Precisely this is why an innovation policy conceived as a social policy, that is, aimed directly at social inclusion, can be expected to take root in places where “classical” innovation policies have shown so far dismal outcomes.

It is striking the clarity with which forty years ago the authors of the Sussex Manifesto described the problem of weak knowledge demand in underdevelopment and hinted from where a way-out could be expected to come: “...the structural and

organizational characteristics of developing economies are antithetical to the application of science and technology and, by the same token, prevent the development of what might be termed a ‘realized demand’ for scientific and technical knowledge. ...This is a particular aspect of the ‘vicious-circle of under-development’: the resolution of many of the problems of the developing countries requires the application of science and technology to production, yet the conditions of under-development itself tend to limit the possibilities for their application.” (Singer et al, 1970: 9) Moreover: “... the ‘need’ for science and technology in the developing countries is unlikely to take the form of a commercial demand coming from individual producers.” (Ibid: 20) This quotation is not made as a complain for the long time that important ideas need to make their road, but to stress the opportunity that present times seems to be given us to put into practice the direct implications of such ideas.

One example can be given of the kind of opportunities we are referring to. In the International Seminar “Innovation Policies and Structural Change in a Context of Growth and Crisis” where a very preliminary sketch of this chapter was presented, Dr. José Maldonado, from FioCruz, highlighted a remarkable fact: the health policy of the Brazilian government, that is struggling to include a population of almost 200 million people, led to a huge commercial deficit in 2010, 21% of which was generated by imports of equipments and materials. It seems clear that given the amount of such deficit, either the policy will not be sustainable at a very short term, leaving outside the reach of the health policy millions of people, or good quality alternatives to imports, that is, innovations leading to affordable equipment and materials, will be achieved. Under the umbrella of the APL concept, for Arranjos Produtivos Locais in Portuguese, or Local Productive Arrangements in English, developed by the Redesist under the leadership of Jose Cassiolato and Helena Lastres (for a review see Lastres and Cassiolato 2005), a project is being developed to help building Health APL in several Brazilian States. The idea is to foster the emergence of localized innovation networks able to deliver local solutions in tune with the national health policy. Asymmetries of power have been taken into account in the design of the project: insisting in the importance of the local aspects of the health APLs, the project aims at avoiding the “Matthew Effect” of poor States buying innovations from already rich and highly industrialized States (Maria Clara Couto, personal communication). The project is in its early stages, but optimism is backed by the legitimacy of public policies based on APLs, “even among international financial organizations”, qualified, as industrial policies, as “possibly the most important of the (Latin American) region” (Peres, 2009: 180 and 186).

Innovation systems and organizational power

“Basically, the theory underlying innovation systems analysis is about learning processes involving skillful but imperfectly rational agents and organizations. It assumes that organizations and agents have a capability to enhance their competence through searching and learning and that they do so in interaction with other agents and that this is reflected in innovation processes and outcomes in the form of innovations and new competences.” (Lundvall 2010: 331).

Such outcomes are highly dependent on the relative power of the agents and organizations that interact in innovation processes. Thus, particularly when the theory of National Systems of Innovation (NSI) is analyzed from the perspective of underdevelopment, one of its relevant features appears to be the following:

“NSI describe situations in which conflict is present. Conflict can be found along two dimensions, one within the national system of innovation and the other at a more general, or macro-social, level. “Internal” conflicts have to do mainly with institutional competence and with inter-institutional problems. For instance: what is the relative weight that entrepreneurial organizations, political power and the academia have regarding the setting of the research agendas?; to what extent are the impacts upon national innovation capabilities taken into account in decision making undertaken in ministries, public enterprises and other public spheres? “External” conflicts, on the other side, can be found in different scenarios. Education is one of such scenarios; workers participation on technological decisions at shop floor level is another. NSI are not socially neutral: its configurations affect unequally different social groups, allowing better possibilities for some of them and threatening others, which underlines that conflict is indeed one of its dimensions.” (Arocena and Sutz, 2002)

The NSI can be considered as a set of (real or potential) actors and their (more or less strong) interactions that expand national collective power by means of innovations and capabilities accumulation. When such interactions are relatively diverse and strong, to speak of a NSI is an “ex post” characterization of reality; when rather the contrary happens, the NSI is an “ex ante” notion (Arocena and Sutz, 2000).

Which are the “sources of social power” of Mann’s IEMP model that foster the consolidation of the organized power networks which give its consistency to a NSI? First of all, the economic source of course: a NSI exists if relevant economic networks are benefited by the generation of “innovations and new competences” within the nation and consequently foster them.

The historical experiences of industrialization and structural change, especially after the Industrial Revolution started, suggest that economic dynamics have not been capable of fostering just by themselves the effective building of a NSI. In the relatively successful cases, strong but highly context-dependent influences can be registered that stem from political, ideological and even military sources.

Consequently, a sensible question to ask in order to evaluate the situation of a NSI (real or potential) concerns the “stakeholders”. Which are the groups that could objectively see their material and spiritual interests benefited by the expansion of the NSI? Which are the existing or potentially “interstitially emergent” networks that can have organizational power in such a measure that their interactions of cooperation and conflict foster and shape the NSI?

Concerning the “(slow) return of industrial policies in Latin America and the Caribbean” a similar question is posed: “Even if policies to diversify the productive structure can technically demonstrate their capacity to generate positive impacts, it is by no means clear which social stakeholders would be interested in generalizing them in the region’s countries.” (Peres, 2009: 194)

In order to exemplify what we are trying to say, we pause to refer to a paper by Khan and Blankenburg (2009), although they work with a quite different approach. Their core argument is that technological upgrading “is not just constrained by state capacities, but also and often primarily by political constraints”. (Op. cit.: 348) The authors analyze different sets of relations between organized interests and industrial policies. The last can be seen as first steps in a road to structural change. We summarize some conclusions of such analysis.

In South Korea, from 1960 to 1980 technological change was led by the chaebol protected in the learning process by a “classic infant industry strategy”. Its success “was based on rather unusual conditions”, including “an internal distribution of factional power”, especially the weakness of landed elites, that “denied the chaebol the

opportunity of offering to share rents with powerful social forces in exchange for their support in protecting inefficient rents” (Op. cit.: 350). In Malaysia, from the 1970s to the 1990s, the state could ensure that multinational companies brought in advanced technology because it had enough bargaining power to provide adequate infrastructure and, especially, a stable political situation. The dominant political party had enough power to credibly establish that “Malaysia’s internal redistributive needs were entirely met by taxing domestic capitalists” (mainly “ethnic Chinese capitalists”) and also to prevent “the construction of alliances between particular multinationals and factions between the state whose support could be purchased to protect low-technology investments” (Op. cit.: 351). Several other examples are considered. Perhaps the above brief quotations concerning two of them are enough to illustrate the general approach that “suggests that the success or failure of rent-management strategies for industrialization is largely determined by the *compatibility* of technological and institutional strategies for late development with political constraints arising from inner-societal power constellations as from transnational – external – influences. The East Asian NICs succeeded because their various rent-management strategies to promote industrialization did not lead to political destabilization. In the South Asian subcontinent, a political configuration favorable to highly fragmented clientelist alliances between industrialists and the organizationally powerful middle classes led to the breakdown of more or less classic infant industry strategies. In Latin America, less fragmented, but not less powerful alliances between strong landed elites and emerging industrialists led to a similar breakdown.” (Op. cit.: 359)

The paper we have been quoting shows, theoretically and empirically, how the “strategy that is most likely to be effectively implemented and enforced in a country can depend amongst other things on its internal distribution of organizational power.” (Op. cit.: 337)

Studying innovation systems from the organizational power approach may help to understand both the level of “innovations and new competences” generated by each NIS, their prevailing types and their main beneficiaries. That leads to consider not only the collective power of a given NIS but also the distribution of power within the NIS. The last seems relevant when trying to build “Inclusive NIS”. In this case previously stated questions could be rephrased as follows: Which is the power configuration concerning existing or potentially emergent networks such that their material and spiritual interests point to inclusive innovations and capabilities accumulation? Actual outcomes of knowledge politics are highly dependent on country-specific answers to such questions.

Preliminary conclusions

The feasibility of democratic knowledge policies in the context of actual structural change is one of the major issues of our time. An important step in that direction may be the emergence of a new gamut of innovation policies that can be seen as part of social policies. When they are considered in the context of the theory of organizational power and its social sources, some minor facts and big problems are highlighted.

Ideologically, those “new policies” have strong normative foundations and they mobilize (embryonic networks of) policy makers, academics and NGOs. Will such networks expand? A more important question is if those policies will become ideologically linked with significant “popular actors”, political parties and social

movements. This seems to require a feed-back between specific cases of “democratic knowledge policies”, as those “new innovation policies”, and a more general ideological conception of knowledge democratization. Such conception needs to include, among other issues, features concerning learning by studying, by researching, by innovating, and by working in knowledge demanding contexts.

Politically, the issue should be considered from the NSI theory, even more than innovation in general. In fact, innovation related with social inclusion needs to be interactive and systemic in a maximum degree. It requires specifically “connections”, dialogues and collaborations between quite different actors (from research teams to persons from deprived groups that can state their specific problems). The articulating role of the State becomes especially relevant. Can (some sectors of) the State foster forcefully innovation policies as part of social policies? The question takes us from policies to politics: which are the (potential) stakeholders, the organized networks that may be interested in such issue. Answers will surely be difficult, highly context-dependent and related both with ideological and economic aspects.

Economically, an analogy can be suggested with the protection of infant industries. It would point to a pattern of specialization in producing goods and (moreover) services with high added-value of knowledge and capabilities that are related with social inclusion. Measuring the results of this “protection for learning” would be related with indicators of success in social policies, of amount and quality of related R&D, of backward and forward linkages induced by such activities, of the volume and level of related job-creation.

In part because they are directed to diminish some aspects of inequality, in part because from their very conception they need to be interactive and take deeply into account a diversity of voices, “innovation policies as social policies” belong to the species “democratic knowledge policies”. If they can start growing in the interstices of the dominant trends, the kind of structural change we are talking about in this paper, characterized as the transition to a knowledge-based and innovation-driven economy, may have an original chance in developing countries.

Acknowledgement

The authors want to thanks the Redesist for the opportunity to present, even in a preliminary way, ideas that we have developed along a common journey since the first days of this truly Latin American endeavor.

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