

INTRODUCTION

THIS PAPER looks at the evolution of the relations established between the Brazilian university and the productive sector as stimulated, directly or indirectly, by government plans and policies from the 70's up to the present days.

The University of Campinas (henceforth UNICAMP) is a particularly privileged subject for a study such as this for a number of reasons. Firstly, it is a quite recent university which was thought of and established in the beginning of the 70's to be different from what existed in the country. The central idea we want to develop is that behind this project was the intention to build a research university which could anticipate the future and potential technological demands of the productive sector. Secondly, it came into being in the period when government plans stressed the overall objective of technological autonomy, and the prospects were favourable for the country to become a significant player in the international arena.

The paper argues that the nature and features of the relations between the university and the productive sector have changed dramatically in the last three decades as a consequence of the changes in the national environment under which UNICAMP was created.

The environment envisaged a particular role to be played by the university and thus not only influenced the choices concerning fields of science, specialties and qualification of researchers but also shaped its relations with the productive

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sector. The central idea developed here is that, due to the dramatic changes in the external and national —political and economic— contexts in this period, the evolution of the relationships between the university and the productive sector is in a «counter movement» to the trends observed in the advanced countries. In Brazil, we argue, such changes considerably downgraded the university role as a knowledge supplier to industrial technology development.

The paper first presents a rough sketch of the industrialization by import substitution model adopted in Latin America and highlights the role played by local R+D. It also points out specific features of the Brazilian case so that the context in which UNICAMP was created can be better understood. This is followed by two sections which attempt to characterize the evolution of UNICAMP's relationships with the productive sector as the country reoriented its development model.

The article finishes by setting up a desirable social scenario for the country in the near future and by suggesting ways in which the Brazilian university could restructure its decision-making processes and its research-priority-setting mechanisms in order to play a more significant role in the social and economic development of the nation.

INDUSTRIALIZATION BY IMPORT-SUBSTITUTION AND THE 'DEFAULT' ROLE TO BE PLAYED BY LOCAL R+D

Typical late development processes in Latin America are associated with import-substitution industrialization: internal production of goods demanded by the local middle and upper classes and formerly purchased from developed nations (Tavares, 1972). Given these countries' historical, cultural, social and economic features there was a prior and rigid specification of the goods to be substituted, considerably reducing the range of possible technological solutions (Morel, 1979).

Such functional relation between import substitution and technological dependence became particularly evident after the Second World War. On the one hand, Latin American infant industry was struggling to establish itself. On the other, advanced countries big corporations —which owned the desired technological know-how— envisaged the profit opportunities attached to Latin American markets and low-priced inputs (Wionczech, 1976; French-Davis, 1976). In these circumstances, technology transfer became the norm not only for the transnational companies which set foot in the region (as would be expected) but also for the local firms (Erber, 1979).

The experience of the so called NICs made clear that in order to be fully successful import substitution processes require other public policies besides the protection to infant industries. Such policies necessarily include distribution measures and government's systematic pursuit of social well being. The case of South Korea is exemplar in bringing up to light the main lapses of the Latin American development process. In the former, social public policies placed a limit to the import substitution phase which lasted as long as the internal market could be occupied by national industry. Contrarily, in Latin America economic growth reinforced income concentration and transformed the import substitution process in a «model» to be maintained, as opposed to a particular phase. A pact among elites was institutionalized by means of a set of public policies which aimed to protect the interests of the dominant groups at the expense of the larger population. Recent changes in the international context have forced the abandonment of this model before the demagogic promise made by the elites, concerning the inclusion of the majority of the population to the consumption market, was attained. As we will emphasize at the end of this article, we consider this as the main challenge facing present Latin American efforts to build an innovation policy. To incorporate the social problematique into the design of innovation policy, avoiding the *ex post* trap in which Latin American S+T policies have been caught, is the essence of the new approach we think appropriate.

Protectionism, a tool present in every national industrial and technology policies has been used in Latin America in a «frivolous» fashion¹ by the industrial elites to further their own interests. Latin American entrepreneurs kept operating at a low level of competitiveness instead of taking advantage of the low priced human and material inputs, and of the government subsidies available to insert themselves in an innovation trajectory. TNC also profited from these advantages, which led to artificially high internal prices. This also allowed them to use considerably less efficient technologies than the ones they were forced to use in more competitive markets (Dagnino, 1994).

The character of the industrialization model adopted —its reliance on technology transfer— does not require local R+D activities but only the accumulation of specific capabilities to operate technology developed elsewhere². Therefore, industrial technological innovation has been restricted to adapting imported technology to the specific features of local markets, workforce and raw

¹ The expression «proteccionismo frívolo» was coined by Fajnzylber, 1983.

² Few exceptions where local generation of scientific and technological knowledge was needed are restricted to the agricultural and health sectors, for obvious reasons.

materials (Sabato, 1975; Katz, 1973). As a consequence of demanded technology being supplied from abroad, local R+D is shut out or plays a strictly circumscribed role, unable to match the advantages of foreign technologies. With no demand of them made by the industrial productive sector, the scientific institutions are alienated or «marginalized» from production activities (Herrera, 1975). Furthermore, the lack of pressures on science from the local economy means that the main determinants of research orientation are the individual decisions of research workers, who take their lead from the international orientation of research (Varsavsky, 1969).

With this picture in mind, S+T policy analysts in Latin America have tried to break up such a «circular-causal» process. Firstly, by assuming the linear model of innovation, efforts were concentrated in the scientific end, the rationale being that high quality critical mass of researchers, well equipped labs and strong institutions would result in «good science» which would, sooner or later, find its application in technology development (Sagasti, 1980). This is what has been called by Latin American analysts an «ofertista» S+T policy (Avalos, 1991; Sagasti, 1989). Secondly, aware that science and production in the region were constantly working in parallel, with no interaction between them, official discourse and, in a certain sense, actual behaviour, has devised mechanisms to fill in the gap —the «vinculacionista» character of S+T policies.

Both «ofertismo» and «vinculacionismo» are important features of S+T policies in Latin America which were devised by government officials and policy-makers, segments of the scientific community who were eager to legitimate their social role, and entrepreneurs who, mistakenly, believed that public R+D could be a substitute for their own investments in in-house R+D.

The Brazilian case fits perfectly into the processes and outcomes roughly painted above. However, it also shows distinctive features, as compared to other Latin American countries, concerning initiatives towards endogenous technological development. These initiatives must be seen in the light of the political, economic and social context of the late 60's and early 70's, an authoritarian and centralized state which resulted from the military coup of 1964, abundant and easy flow of international financial credit, easy access to mature technologies, exceptional growth rate of the Brazilian economy, and a growing demand of well-trained professionals. These elements brought about an artificial «national consensus» around the idea that the country could become a significant player in the international arena and gave rise to the «Brazil great power» project of the military.

In order to attain these goals, it was assumed that the country had to foster a more sophisticated phase of import substitution industrialization while it was preparing its long term project of technological autonomy. In view of this, a number of government policies were designed: protective legislation of national infant industries (market reserve), creation of R+D labs attached to state enterprises in strategic sectors, reform of the higher education system. It is in the latter that we shall concentrate our attention.

The rationale behind the higher education reform followed two strands. Firstly, if local R+D were to play a role in endogenous technological development, efforts had to concentrate, at least at first, in the public universities, where the vast majority of the research workforce was located. Secondly, the universities had to be technically, politically and culturally adjusted to the new development objectives which included «the generation of technologies demanded by the accelerated modernization» (Romanelli, 1987).

The reform imposed to the universities³ included, among many other things, the establishment of graduate schools and full-time teaching/research faculty positions; the setting up of laboratories and libraries, the creation of special research funds and government agencies. The latter was a mechanism particularly designed to force the universities into the intended route: since universities' budget was drastically cut down by government, researchers were stimulated to apply for government S+T funds to do their work. These were primarily oriented to research in areas claimed as strategic by the military in power. Thus, it was believed that the research agenda of the universities could be directed through such research funds so that the technological demands of the national industry would be met (Dagnino, 1985).

The outcome of the above was a dramatic change in the quantity and quality of the research carried out in the country. Although heavily concentrated in a number of institutions in Sao Paulo and Rio de Janeiro, research was no longer a spasmodic activity, let by itself, on the hands of a small elite who found little stimuli besides its own scientific curiosity. It became fully institutionalized and its practitioners gained political and social clout. The process, however, was not without resistance, particularly from segments of the student and faculty bodies due to their scepticism towards the «Brazil great power» project and to their disagreement with the political and anti-social measures imposed by the military (Dagnino, 1989a).

³ The university reform of 1968 was possible through a concerted political action involving segments of the military and civil bureaucracies, the research community, and foreign organizations such as USAID.

THE PROJECT OF TECHNOLOGICAL AUTONOMY AND THE CREATION OF UNICAMP

UNICAMP was created in the late 60's, exactly when the national higher education system was under the reform process mentioned above. Despite the fact that its participation in the total national student enrolment is only 0.77%, the number of graduates at the doctoral level is almost 16% (Table 1). Thus, UNICAMP was conceived of, designed and implemented in the light of what we call the Brazilian project of technological autonomy. As such, UNICAMP may be considered a paradigmatic example of a Latin American university born out of the «second academic revolution».⁴ In the UNICAMP case, the «revolution» was made within the university, through a privileged arrangement with the state apparatus, aiming to satisfy productive demands. The difference concerning the U.S. experience was that, at least at that moment, «science parks», «incubators», etc., oriented to reinforce the links between academe and the private sector were not necessary. A point raised later in this paper is to ask whether to emulate this experience is adequate under the present Brazilian conditions.

TABLE 1
COMPARATIVE INDICATORS UNICAMP/BRAZILIAN UNIVERSITY SYSTEM

Student Indicators	PhD	MSc	TOTAL
Total Enroll.			0.77%
Graduate Enroll.	17.68%	7.24%	
Degrees Granted	15.70%	10.30%	
Faculty Indicators	Full Time	Part Time	TOTAL
Total Faculty			1.55%
Dedication	3.01%	0.44%	
	PhD	MSc	
Titulation	7.30%	2.67%	
Publications*			6.28%

* In foreign journals.

⁴ The concept of a «second academic revolution» was developed by Webster and Ertzkowitz, 1991, meaning a new social contract between academia and society whereby «large scale government support for academic research will be sustained so long as the research plays a key role in the new economy» (p.10).

Even if UNICAMP maintained the already anachronistic idea of a university system organized in disciplinary departments and professional schools, it meant to inaugurate a new model for research activities. This may be translated by basically two directives, a research policy oriented to hard sciences and engineering and guided by productive sector demands (Dagnino, 1990). The distinctive feature of UNICAMP's orientation to industrial demands was that instead of focusing in problem-solving, trouble-shooting type of demands, its research policy was designed to match what was believed to be potential future demands for new technologies, particularly those of the large state-owned enterprises in strategic sectors (cf. Sabato, 1975).

Evidence of this are many: from the speeches of UNICAMP's officials, to the consultation with entrepreneurs and engineers working in industry about the research agenda to be set out and, moreover, to the choice of researchers enlisted by the university (Meneghel, 1994). The latter were typically young hard scientists and engineers, trained in the best Brazilian universities (the University of São Paulo and the Institute of Aerospace Technology), most of whom had spent periods working or doing graduate studies in foreign institutions. This new brand of researchers, besides inaugurating innovative research practices in the Brazilian university, shared the assumptions underlying both UNICAMP's project and the national one aimed at technological autonomy.⁵

Moreover, they brought with them a cosmopolitan perspective about local opportunities and potential impacts of global S+T trends. In addition, they had a clear perception of the research priorities to be implemented in order to foster technological autonomy. Such features made possible the selection of the research directions that could maximize, in the long run, the economic impacts of the academic activities. In doing so, many times the research choices made were contrary to the mainstream. For example, instead of trying to develop at UNICAMP the prestigious, expensive and «basic» field of particle physics, it was decided, in the early 70's, to concentrate efforts in solid state physics -the scientific basis for the newly born information revolution (Dagnino, 1982; Brisolla & Pinto, 1995).

Government decisions concerning the technological autonomy project were soon implemented: research funds to Brazilian universities, which were steadily growing since the late 60's, increased threefold between 1974 and 1979. UNICAMP was particularly successful in getting research contracts. See, for example, data on 1974: extra mural research funds made up one fourth of its

⁵ These developments could be understood in reference to the concept of «subversive elites» formulated by Adler, 1987.

total budget, the fields of physics and engineering received together 85% of UNICAMP's total research budget»,⁶ the Physics Institute got three dollars from external sources for each dollar of its internal budget (Dagnino, 1982).

The investment of government research funds at UNICAMP and other universities of «excellence» was thought to be a step towards the next phase of the technological autonomy project. In this, the central role was to be played by state-owned companies operating in infrastructure technology intensive sectors such as telecommunications, oil production, power supply etc. As these companies matured, the capabilities developed at the universities would be transferred to them helping them establish their R+D departments. The results were very positive for a while. The best example of this virtuous type of relationship was the role played by UNICAMP in the local development of technology for telecommunication. One ought to be cautious to attribute rationality to past behaviour of political actors. This notwithstanding, the process described is in accordance to Sabato's normative scheme known as «the Sabato Triangle» (Sabato, 1975). His policy recommendation —concerning the reinforcement of the links between government, S+T structure and enterprises— envisaged the state enterprises as a privileged actor. The only actor capable of implementing university/productive sector relationships in a peripheral environment.

THE «LOST DECADE» AND THE ABANDONMENT OF THE TECHNOLOGICAL AUTONOMY PROJECT

Technological spin-offs of university research could only have been achieved if the second phase of the import substitution model had been fully implemented. This second phase was to be based on the strengthening of technologically intensive sectors where TNC affiliates had been kept aside.

Things, however, did not go as planned. Since the other public policies were not tuned in with S+T policies, the broad economic and social context did not experience much change. More specifically, the transnationalization of the productive sector, fostered by government aiming at rapid economic growth through foreign savings and technology inflow, considerably reduced the opportunities for the utilization of local R+D capabilities. Few industrial sectors —particularly those directly linked to military interests— were able to escape such perverse and paradoxical «logic» (Dagnino, 1980a), being kept aside of the

⁶ This figure is an evidence of the already mentioned concentration of research funds in few alleged strategic fields.

transnationalization process. Thus, these sectors oriented themselves towards a complete technological development strategy whereby disjointed «innovation systems» (Stefanuto, 1993) implemented policies ranging from S+T accumulation to the creation of a «business environment» favourable to the application of the newly installed R+D capabilities.

A correct appraisal of the Brazilian experience could minimize the university's «scarce obligation with reality» or its «incapacity to develop technology that could be used by the productive sector». Firstly because the role that was expected of university research was, inherently, unrealistic. Secondly because even the meagre research results produced found no utilization opportunities. As the atypical successful cases show, when there were effective economic demands for locally developed technology, university was ready to respond. In other words, when state initiatives, mediated by public enterprises succeeded in breaking up the «frivolous protectionism», universities were able to participate in technological development.

Structural factors were aggravated by the fact that the anticipated economic growth, letting alone social development, assumed by the technological autonomy project did not materialize. Reasons were not only the public sector financial crisis which considerably reduced the S+T budget in the 80's, but mainly the fact that the designed great infrastructure projects —for which the whole research strategy was conceived— were postponed and finally abandoned.

The 80's however were more than a «lost decade» for UNICAMP. Despite its expansion, and the noteworthy changes in its context, the university maintained the research structure established in the 70's: the relative weight of the different disciplines —estimated by internal budget, number of students and professors— was kept still (Table 2). The policy-making process has been clearly incremental as opposed to rational (Table 3).⁷ Apparent exceptions to the university «statu quo» could also be explained by this incremental attitude and should be understood as having been provoked by external stimuli —opportunities or pressures in general provided by governmental stance. Evidences of this are:

(a) the expansion of the medical field: between 1985 and 1990 the faculty in the School of Medicine increased much more than the number of students. This was possible due to an initiative of State government in trying to counteract the crisis of the public health system by expanding university hospitals which became increasingly involved with primary health services.

⁷ About the conceptualization of incremental and rational styles of policy-making, see, for instance, Ham and Hill, 1993.

TABLE 2: Enrollment (1980 = Base 100)

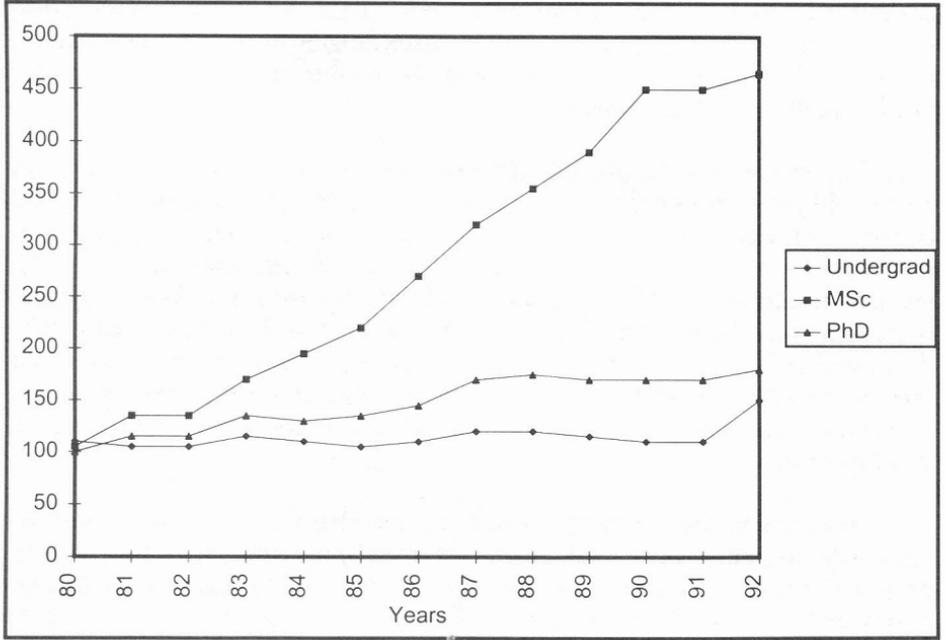
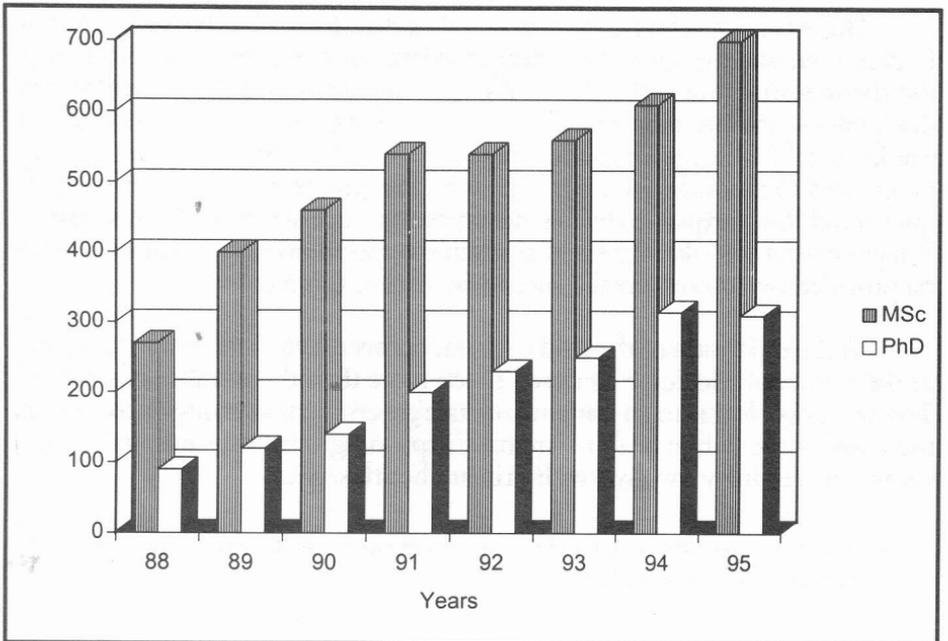


TABLE 3: Graduate Degrees Granted UNICAMP



(b) the expansion of the economics faculty: between 1984 and 1989, the number of faculty in the Institute of Economics increased twice, which raised the teacher/student ratio of the Institute to a level more than two times greater than the University's average. Financial resources were provided by the State specifically for this end.⁸

(c) the increase in building area: between 1983 and 1989 the constructed area of UNICAMP increased by more than two times. This was possible thanks to international funds.

(d) the pretence adoption, in 1985, of the «five modernization banners» in research—informatics, biotechnology, new materials, fine chemistry and precision mechanics—all of them stimulated by government who promised specific resources to be allocated to these fields of research.

(e) the creation of an interdisciplinary research centre in biology, chemistry and agriculture: the closing down of a Monsanto research lab in Campinas and the selling of it to UNICAMP, in 1986, by 3 million dollars (total budget of UNICAMP was 133 million dollars in 1985) triggered the establishment of this centre (Mercado, 1995).

(f) the creation of night-courses: after unsuccessful attempts by the university community to create night-courses to be attended by lower income students, they were compulsorily created by the State Constitution of 1988.

The policy-making style of UNICAMP in this period is not surprising given the general context. Evidence of this are the difficulties faced by the S+T system to respond to the changing environment by internally reorganizing itself.

The year of 1983 may be considered a divide in the evolution of the national system of S+T, as the military saw their regime coming to an end (Dagnino, 1993). The stagnation of the country's S&T policy reinforced disciplinary internal dynamics as well as the relative influence of research groups (Biato, 1994). In these circumstances, the research community preferred to adopt a self-defensive

⁸ These two events should be stressed since they show how the absence of a collectively formulated policy can leave space to corporatist interests. Alliances between the two main forces within the faculty—the physicians, who were able to appoint two of the four University's presidents since 1980, and the nationwide increasingly influential economists, who succeeded in nominating the most successful university president during the same period—have to be regarded as the primary cause of these events.

TABLE 4: PhD Holders (percentage of total faculty).

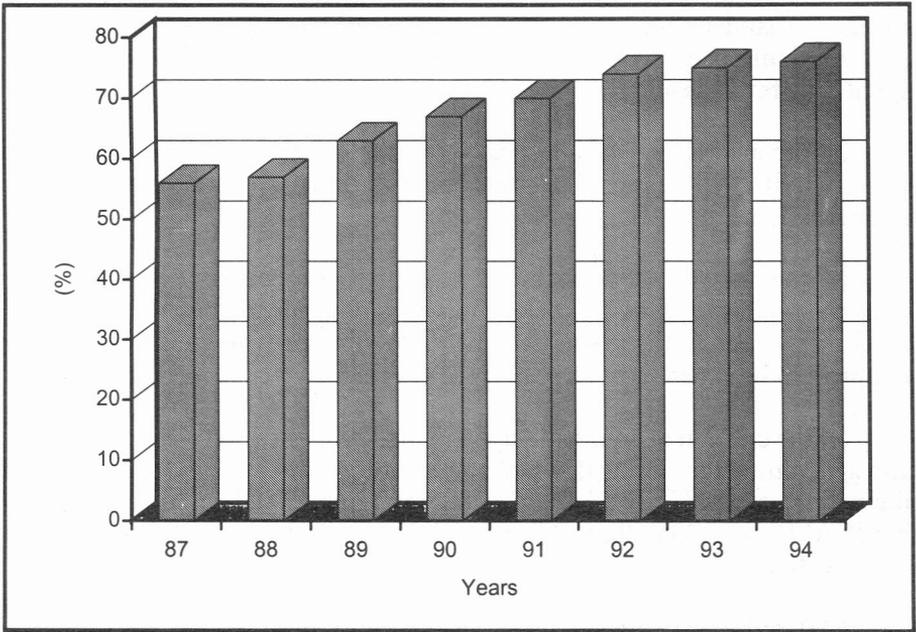
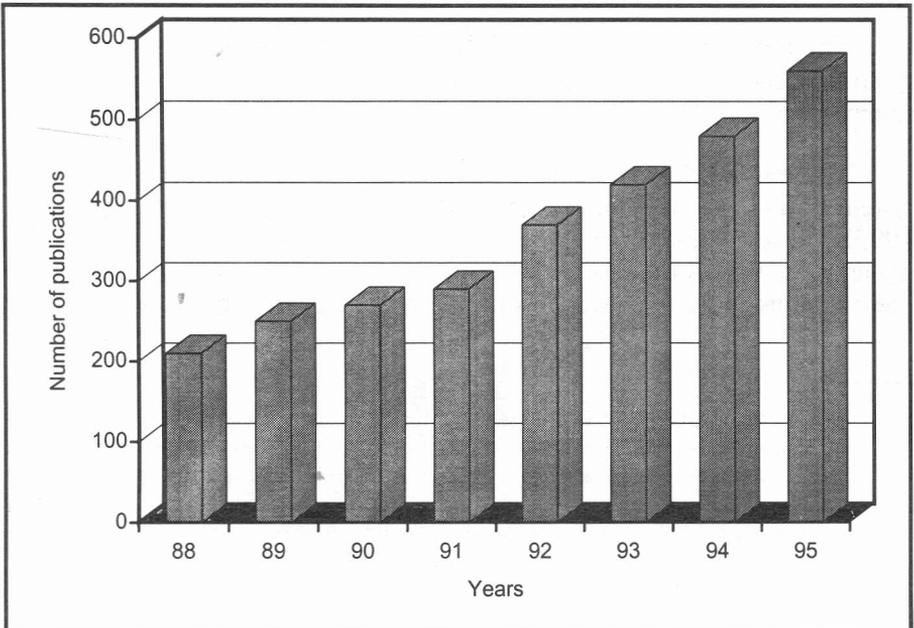


TABLE 5: Impact of UNICAMP Research



strategy, hanging on the old social contract of the linear innovation model which was even more inappropriate than before (Table 4). Thus, it may be said that UNICAMP adopted a non decision-making posture⁹ concerning its research policy. In doing so, the University has ignored the dramatic changes in the country's institutional environment which began in the 80's and are even more clear today (Table 5).

THE NEOLIBERAL CHALLENGE AND BEYOND: THE NEED FOR A NEW RESEARCH POLICY

From 1985 three civilian presidents have succeeded in the federal government and have consistently abandoned the industrialization by import substitution model. The new model is based on the attraction of external capital and technology and on the exploitation of developed countries' market niches with a view to national growth (Dagnino, 1994). As a consequence, industrial and technology policies are under considerable reorientation, including incentives to technology import and foreign capital in the few technology-intensive sectors (traditionally under state control), cutback of protectionism to infant industries, reduction of import duties, changes in intellectual property legislation. All this points to a passive adaptation of the country to a new global order, to a capitulation to long standing requests of the international power centers instead of to a policy sovereignly designed. On their side, international power centers are concerned with setting up the conditions for the expansion of TNCs and for promoting the diffusion of their own technologies.

In such a context, it is not surprising that S+T policy has been increasingly disoriented. As the technological autonomy project was abandoned together with the import substitution model the role expected from university research has significantly changed. A new arrangement of university/productive sector relations is now under way: one in which the university would be responsible for adapting the imported technologies to the local environment, for making routine and trouble-shooting type of activities and for some consultancy work. These indeed characterize the dominant type of links established between universities and the productive sector in Brazil today, UNICAMP included, as a number of recent studies have indicated (Velho, 1993; Stefanuto, 1992; Gomes, 1995; Pinto de Almeida, 1995).

⁹ About the concept of non decision-making see, for instance, Hogwood and Gunn, 1985.

What we want to argue here is that the above is not the only possible—and certainly not the most desirable—role we see for university research in Brazil. We recognize that the rationale behind the neoliberal industrial and economic policies does not allow much room for a participation of local R+D in industrial technology development. The latter is clearly «locked-in» or irreversible given the configuration of the collectives forming the prevalent networks. This notwithstanding, we believe it is possible to incorporate in the research policy framework of the university, new intermediaries so as to conform heterogeneous collectives leading to varied reconfigurations of networks.¹⁰ Using the codified language, we stress that the only way out for the university to do challenging research work and at the same time produce socially relevant results is by linking itself up with «social problems». Private industrial actors should not be seen as the only significant partners. The Brazilian state has a significant role to play in the integration of at least 50% of the country's population -so far excluded- to the consumption market.

The need to put science and technology to work favourably towards the solution of social problems has been recently stressed by actors located at both ends of the policy process continuum: the decision-makers and the «users». The former have argued in government plans and studies that «a most serious problem facing the development of Brazil is the low level of literacy, numeracy and sciency. The improvement of this situation must be a priority of PADCT III (a S+T Program sponsored by the World Bank and the Brazilian government), of all the involved agencies, and of the President's Council for Science and Technology, with full participation of the Brazilian scientific community. There are basic societal problems (as in the area of public health, education, sanitation, nutrition and sustainable exploitation of natural resources) where local research is needed as the key to solving the problems and improving the quality of life» (PADCT, 1995:69). Statements very much in similar lines can be found in the Pluriannual Plan for Science and Technology issued in 1995 by the Ministry of Science and Technology.

Concerning the «users», members of the scientific community, including a group at UNICAMP, have insisted on the urgency to discuss and design a research policy for the university. The faculty Association of UNICAMP, for example, has been trying to motivate a reflection of the matter by promoting seminars and workshops (ADUNICAMP, 1991; 1995).

¹⁰ On the concepts of collectives, configuration, intermediaries and networks in science and technology, see Callon, 1994.

Contrary to what many believe, the focus on socially relevant research does not imply routine, unchallenging research which would render no internationally publishable papers. Much to the contrary, socially relevant research implies a mapping of problems to be solved and of the S+T component of the problems, the development of new theories and methods, equipment, data bases and information services; the adoption of a multidisciplinary research perspective and, consequently, the introduction of innovative research practices; the incorporation of representatives of existing but excluded social groups to have a say in research priority setting. Such a process, we strongly believe, is much more stimulating and challenging than simply responding to demands of the productive sector which seem to be farther away from a socially just development project. Moreover, taking social problems as an input in setting up research priorities and choosing research problems is certainly an ethical decision. As such, it can be better defended than the Sisifo's task carried out by the Latin American scientific community in its quest for a place in mainstream international science (Dagnino and Davyt, 1995).

To implement this process, Brazilian universities in general, and UNICAMP in particular, have to seriously discuss their research policy in the light of a socially desirable scenario. Obviously, all the effort, if ever made, may not be enough if government agencies continue to allocate research money on the basis of the traditional disciplinary criteria of «scientific excellence». This, however, is a long and complex enough topic for a different article.

FINAL REMARKS

Far from facing the discussion referred to above, current research policy at UNICAMP seems to be at a crossroads between discourse and practice. As such, it is the resultant of two opposing vectors. According to the former, UNICAMP has to engage in partnerships with the productive sector and direct its research effort to meet economic needs. Such orientation is seen as a progressive change inasmuch as it entails an increasing commitment of the university to society. In order to accomplish this, a whole set of new mechanisms have been conceived of and implemented by university officials.¹¹ Although the success of these in strenghtening national technological capabilities is often mentioned, there is no evidence that they have done so.

¹¹ Ranging from science parks to technology transfer offices, a whole set of mechanisms have been created since the beginning of the 90's.

In practice, however, all reward mechanisms at UNICAMP -from promotion, to research grants allocation, to honorific prizes- put a premium on academic quality and disregard research work which did not result in publication, citation, patent, process or product development. Since the last three types of research output are very rare indeed at UNICAMP,¹² publications and citations are «the» measure of academic excellence (Brito, 1995).

In view of this practice and in the absence of challenging scientific and technological demands from the productive sector, UNICAMP's research policy tends to be increasingly guided by «academic quality». This, at least, is the position of university officials. Reinforcing this directive is the ever increasing competition between universities for government agencies research funds which, again, are allocated on the basis of academic excellence.

The picture described above is one of confrontation of two criteria shaping UNICAMP's research agenda: demands from the productive sector and academic quality. These, of course in theory, need not be contradictory, but are made so in the light of the current (and former) development path.

The way out of this conflict is what we believe to be our main contribution to the current discussion about university/industry/government relations. We propose two additional criteria for setting up UNICAMP's research policy framework: multidisciplinary and social relevance from a prospective viewpoint. This, as argued above, implies the construction of an alternative socially desirable scenario.

On a more general vein, it may be interesting to look at the case of UNICAMP in the light of some of the worldwide trends concerning university/industry/government relations contained in the theme of this chair. Concerning the assumption that a new social contract is being drawn up between the university and the larger society, in which public funding for the university is made contingent upon a more direct contribution to the economy, our analysis of UNICAMP seems to indicate this not to be the case. Much to the contrary, we have found that being conceived of and implemented in the late 60's and early 70's according to the above directive, as time went by and the government technological autonomy project was abandoned, links between UNICAMP and the productive sector have considerably weakened. They increasingly resemble more those in place prior to what has been called in the literature as the «second academic

¹² They are not the norm of university research output worldwide. In peripheral countries they are even more rare for structural reasons, as argued throughout this article.

revolution», that is: consultancy work and small scale trouble shooting type of projects. In other words, we see an increasing «degradation» of the university role as far as the knowledge content involved in the relationship with the productive sector is concerned.

The explanation to this, we claim, may be found in the decline of the import substitution type of policies in Latin America within a context marked by neoliberal thought. Such development model, as is well known, does not stimulate local R+D. However, as it was conceived in Brazil in its more «sophisticated» phase -a step for the technological autonomy project- it entailed a role to be played by local universities. With the abandonment of this model and the blind engagement of the country elites in neoliberalism, even less than in the import substitution model is asked of the universities. In these circumstances, we believe, no interface mechanisms or policies to be fostered by either government or universities can be expected to succeed in linking up university research to industry needs. This because, on the one hand, now more than before, local industry does not need local technological development. On the other hand, because national firms do not seem very likely to create their own R+D departments—a necessary condition¹³ for successful university/ productive sector partnerships.

In view of the above, we see the desirable future as UNICAMP entering a «third academic revolution»—a new social contract between the university and the larger society in which public funding is made contingent upon a more direct contribution to the solution of basic social problems.

To end this article a last cautionary remark seems appropriate: it is important to stress that our position is not dominant among the Brazilian community of S+T analysts. For the majority of them, as well as for S+T government officials, the new context is conducive to strengthening the links between academic and productive sectors.

¹³. Recognizing this as a necessary condition is a first step towards a more realistic perspective of the normative analyses of some Brazilian colleagues (Plonsky, 1995; Medeiros, 1993). The same in relation to wishful-thinking-type of policies now being formulated by Latin American governments.

BIBLIOGRAPHY

- ADLER, E. *The Power of Ideology, the Quest for Technological Autonomy in Argentina and Brazil*. University of California Press, 1987.
- ADUNICAMP *Cadernos da ADUNICAMP* No.4, UNICAMP, Campinas, 1991.
- ADUNICAMP *Cadernos da ADUNICAMP* No.8, UNICAMP, Campinas, 1995.
- AVALOS, I. "La política tecnológica venezolana: De la economía protegida a la economía abierta". *Espacios* 12(2), Caracas, 1991.
- BIATO, F. *et.al. Projeto estudos analíticos do setor de C&T no Brasil*, 1993.
- BRISOLLA, S. AND PINTO, L. El Instituto de Física de la UNICAMP y el desarrollo de la telefonía en Brasil: Un caso de articulación eficaz de intereses. In: H.Vessuri *La academia va al mercado*. Fondo Editorial Fintec, Caracas, 1995.
- BRITO, C. "Política de pesquisa: A qualidade em primeiro lugar". *Cadernos da ADUNICAMP*, No.8, ADUNICAMP, Campinas, 1995.
- CALLON, M. Is Science a Public Good? *Science, Technology and Human Values*, 19(4): 395-424, 1994.
- DAGNINO, R. A universidade e a pesquisa científica e tecnológica. In: C. Bori (Org.) *Universidade Brasileira: Organização e problemas*. Suplemento Ciência e Cultura SBPC. Pp.133-154. Sao Paulo, julho 1985.
- DAGNINO, R. (Coord.) *O financiamento da pesquisa científica e tecnológica na universidade: O caso da UNICAMP*. NPCT/UNICAMP, 322 p., 1982.
- DAGNINO, R. A política científica e tecnológica do governo militar e seu impacto na universidade. In: Magalhaes, M. and Habert, A. *Política de ciência e tecnologia para a década de 90*. Pp.38-39, UnB, Brasília, 1989.
- DAGNINO, R. To the barracks or into the labs? Military programs and the Brazilian S&T policy. *Science and Public Policy*, 20(6): 389-395, dezembro de 1993.
- DAGNINO, R. *A indústria de armamentos Brasileira: Uma tentativa de avaliação*. Doctoral Dissertation. Institute of Economics, University of Campinas, 1989.

- DAGNINO, R. ¿Cómo ven a América Latina los investigadores de política científica europeos? *REDES. Revista de Estudios Sociales de la Ciencia*, 1(1), Buenos Aires, 1994.
- DAGNINO, R. and Davyt, A. *Siete equívocos sobre calidad y relevancia en la investigación universitaria*. IG/UNICAMP, 1995.
- DAGNINO, R. Condicionantes de desempenho da UNICAMP em pesquisa científica e tecnológica: Um modelo a ser emulado? *Cadernos de IG/UNICAMP*, 1(1): 101-129, dezembro de 1990.
- ERBER, F. Política científica e tecnológica no Brasil: Uma revisão da literatura. In: *Resenhas de Economia Brasileira*. Saraiva, São Paulo, 1979.
- FAJNZYLBER, F. *La industrialización trunca de América Latina*. Editorial Nueva Imagen, México, 1983.
- FRENCH-DAVIS, R. "La inversión extranjera en América Latina: Tendencias recientes y perspectivas". In: V. Urquidí and R. Thorp (Eds.) *América Latina en la economía internacional*. Fondo de Cultura Económica, México, 1976.
- GOMES, E. *A experiência Brasileira de polos tecnológicos: Uma abordagem político institucional*. Dissertação de Mestrado em Política Científica e Tecnológica. Instituto de Geociências, UNICAMP, 1995.
- HAM. C. and HILL, M. *The policy process in the modern capitalist state*. Harvester Wheatsheaf, 1993.
- HERRERA, A. Los determinantes sociales de la política científica en América Latina. In: J. Sabato (Ed.) *El pensamiento latinoamericano en la problemática ciencia-tecnología-desarrollo-dependencia*. Pp.98-112, Paidós, 1975.
- HOGWOOD, B. and GUNN, L. *Policy Analysis for the Real World*. Oxford University Press, 1984.
- KATZ, J. (Ed.) *The Technology Generation in Latin American Manufacturing Industries*. MacMillan, Londres, 1973.
- MEDEIROS, J. "Pólos tecnológicos e competitividade". *Estudos Avançados Série Política Científica e Tecnológica*. 12, São Paulo, 1993.

- MENEGHEL, S. *Zeferino Vaz e a UNICAMP - Uma trajetória e um modelo de universidade*. MSc Dissertation, UNICAMP, 1994.
- MERCADO, A. La constitución del Centro de Investigaciones Químicas, Biológicas y Agrícolas de la UNICAMP - El CPQBA. In: H.Vessuri *La academia va al mercado*. Fondo Editorial Fintec, Caracas, 1995.
- MOREL, R. *Ciência e Estado, a política científica no Brasil*. Biblioteca Básica de Ciências Sociais, T.A. Queiroz Editor, São Paulo, 1979.
- PADCT *Report of the GEA meeting*. Brasília, January 1995.
- PINTO DE ALMEIDA, M. *A relação UNICAMP- Empresa: a questão do repasse tecnológico em uma perspectiva histórica (1970-1992)*. Dissertação de Mestrado, Faculdade de Educação, UNICAMP, 1995.
- PLONSKI, A. "Cooperação empresa-universidade: antigos dilemas, novos desafios". *Revista USP*, (25): 32-41, São Paulo, 1995.
- ROMANELLI, O. *Historia da educação no Brasil 1930-1973*. Petrópolis, Vozes, 1987.
- SABATO, J. and BOTANA, N. "La ciencia y la tecnología en el desarrollo futuro de América Latina". In: J.Sábato (Ed.) *El pensamiento latinoamericano en la problemática ciencia-tecnología-desarrollo-dependencia*. Pp.143-154, Paidós, 1975.
- SAGASTI, F. *Science and Technology for Development. A Review of Schools of Thought on Science, Technology, Development and Technical Change*. International Development Research Centre, Ottawa, 1980.
- SAGASTI, F. "Science and Technology Policy Research for Development: An Overview and Some Priorities from a Latin American Perspective". *Bulletin of Science, Technology and Society*, 8:50-60, 1989.
- STEFANUTO, G. *As empresas de base tecnológica de Campinas*. Dissertação de Mestrado em Política Científica e Tecnológica, Instituto de Geociências, UNICAMP, 1992.
- TAVARES, M.DA C. *Substituição de importações ao capitalismo financeiro. Ensaio sobre economia Brasileira*. Zahar Editores, Rio de Janeiro, 1972.

- VARSAVSKY, O. *Ciencia, política y cientificismo*. Centro Editor de América Latina, Buenos Aires, 1969.
- VELHO, S. *Relação universidade-setor produtivo, mitos e realidade*. Departamento de Sociología, Tese de Doutorado, UnB, 1993.
- WEBSTER, A. and ETZKOWITZ, H. *Academic-Industry Relations: The Second Academic Revolution*. A framework paper for the proposed research workshop on Academic-Industry Relations, 1991 (mimeo).
- WIONCZECK, M. El crecimiento latinoamericano y las estrategias de comercio internacional en la posguerra. In: C. Díaz *et al.* *Política económica en centro y periferia*. Fondo de Cultura Económica, México, 1976.

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