

A 'House for Solomon' in the Caribbean: The Venezuelan Institute of Scientific Research

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The paper describes a sociological analysis of one of the most prestigious scientific institutions in Latin America in the light of its past achievements and in view of the challenges posed by the present and future trends which demand renewed quality, strength and competitiveness of national research. The core of the challenge facing the institute at present is seen to lie in the successful resolution of three different problems that divide and reduce its effective contribution to the national well-being. One of the problems is its very source of success, its collective culture of basic science. In conditions like the ones of the present transition where scientific practice, the organisation of that practice and the target of such activity have been experiencing profound changes in contemporary science, the 'pursuit' of academic culture prevailing in the institution may act as a break to more challenging pursuits. Another pressing problem is the excessive weight of labour issues compared to other issues that are related to its research mission, reflecting the overall 'malaise' of the public sector in the country. The last problem is connected with the new social demands upon an institution that set the traditional standards of scientific quality in a country that did not have them. This is another way of saying that the old 'social contract' is exhausted and a new one has to be agreed between the national society and IVIC.

Templo de claridad y hermosura,
El alma que a tu alteza
Nació, qué desventura
La tiene en esta cárcel, baja, oscura?
Fray Luis de León
Noche serena. *Poesias*

Temple of clarity and beauty,
The spirit that from your sublimity
Was born, what misfortune

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Keeps it in this low, dark, prison?

Fray Luis de León

Peaceful Night. *Poems*

'SOLOMON'S HOUSE' IN Bacon's *New Atlantis* was the first literary picture of a modern scientific academy, in the centre of an ideal society placed on an island in the South Atlantic. It was

. . . a place of all virtue, 'the virgin [as Bacon tells us] of the world'; a status preserved by a quasi-hermetic seal between the island and the rest of the planet . . . [It] contained mines, fisheries, farms, orchards, and other places for experiment with and improvement of the things of nature. It provided lesser spaces for trials of optical, acoustical, meteorological and astronomical phenomena. The house was home to 36 elegant and high-living philosophers, who sought information from books and observations, designed and carried out experiments, and derived general principles, or light, from the results of their labor. They were served by a large staff, both men and women, which supplied their every need . . . [including] the *sine qua non* of the research institute, postdocs. Like its parent island, Solomon's House was self-sufficient . . . The Solomons decided in their wisdom which of their results to make public or to impart to the state . . . They owed nothing since they needed nothing; they inhabited an ivory tower on a full-service kibbutz. The isolation and independence of Solomon's House were the condition of its virtue (Heilbron 1990: 331–33).

This is the realm of utopia. In real life, throughout the last 300 years Solomon's House has been extended, refurbished and brought into an ever closer relationship with the wider society. On the way, scientists have learnt to actively seek funds to investigate, compete against other scientific entrepreneurs like themselves, advise unsympathetic governments, and seek what used to be called the spiritual exchange with scientists from other countries. Is it possible to recognise any genealogical affinity between today's Houses of Science with regard to the one conceived by Bacon in 1627?

Although it is a worn-out image, the metaphor of the construction of a house is useful because it contains the notion that the extension, repair and demolition of old buildings and the design of new ones is part of the normal course of life; and it suggests that a particular

structure may either become too large, weak or costly or, on the contrary, be inhabitable for a long time. In this work, an analysis is made of one of Solomon's Houses in the contemporary geography of science, placed in an unusual context, the Caribbean tropics, in order to explore the social landscape in which it was built, its internal spaces and the probability of future habitability in new urban, legal, and social conditions. This is a study of the Venezuelan Institute of Scientific Research (henceforth IVIC).

Throughout its existence, the IVIC has played a paradigmatic role in the Venezuelan scientific community, representing the highest level of scientific excellence in the country. Since its inception, it assumed the role of the local custodian of international quality standards, a prime example of full-time research, having trained some of the best researchers in the domestic scientific domain. Its graduates and researchers have nurtured other institutions and spread the institute's standards and ideals. Although it was the dominant and almost exclusive basic science institution in the country since its inception in 1959 and for the next twenty years, by 1980 its relative share in the funding of the Science and Technology sector had decreased to 10.16 per cent, and by 1985 it had further declined to 7.12 per cent. Although in 1978 the IVIC still had a relative share of 20.74 per cent among the non-university institutions conducting R&D activities, by 1985 INTEVEP S.A. (the oil industry technology institute) absorbed 65.34 per cent, while the share of the IVIC had declined to 10.04 per cent of the group (CONICIT 1986).

Given the rather stable size of its researchers' population and of its organisational pattern, its publishing programme shows an equally stable output, with 278 publications between September 1994 and August 1995; about 150 publications have been registered annually by the Science Citation Index (SCI) from 1980 to 1993. As expected, its relative contribution to the total number of Venezuelan publications registered by the SCI decreased from 38 per cent in 1981 to 21 per cent in 1993 (FUNDACITE 1995).

A characteristic feature of the institutional profile is the adoption from the very beginning of values pertaining to international competition in basic science; thus the search for international recognition for its researchers' publishing endeavours. Research members of the staff have won considerable recognition abroad and have worked in foreign laboratories; the incoming visits of foreign scientists is part and parcel of the institutional culture. In the local

context, the IVIC's researchers have bagged 54 per cent of the national 'Lorenzo Mendoza Fleury' Prizes granted by the Polar Foundation since 1982 in recognition of excellence in research in basic science, and over the years they have won considerable international recognition and prizes in the different disciplines. The IVIC's participation in the most vital arms of decision-making in the national scientific sector has always been much higher than that of other institutions, which only confirms its importance as the leading institution in the domestic scientific arena.

But what is the IVIC really like, beyond this cursory characterisation? How did it come to be what it is? What generalisations can be made from this particular case? The emergence of islands of excellence in developing countries reflects local conditions of scarcity of science and technology resources as well as the will of the state or of key groups within it, for strategic and symbolic reasons, to leapfrog as fast as possible to the frontiers of science (Khelifaoui 1994). What was adopted was a view of science that to a large extent accepted the notion that if national science institutions modelled on those of the advanced countries were built, development results would follow, a view not peculiar to that group of scientists but common to international agencies like UNESCO and, in general, among international scientific experts at the time. The result, I argue, was that science was reified above its context, and the IVIC aimed to be a mirror image of institutions in advanced nations, removed from the real contexts in which both those institutions and itself actually functioned. The IVIC's project evolved oblivious of the fact that it had to operate in a knowledge context totally different from that in advanced countries. Sooner or later it had to face a relevance/legitimacy crisis in the public mind. It can be argued that this model of institution has been adopted in countries with similar historical experiences to Venezuela, where modern science lacks a past to which it can relate. The future of these institutions will depend on whether they manage to *target* their resources to have an impact on society. Targeting (Hill 1987: 72) implies assessing the contribution of national science within the *particular* techno-economic structure in which it is embedded before, after and during the research process. Of course, this cannot be done by the research institution alone. It also implies a role for the government in reaching beyond research into its application that extends far beyond that which is appropriate in

an advanced industrial nation. With the production sector unable to do so, it is the responsibility of the government to *build knowledge bridges* between research and economic development.

Let us begin our analysis by considering first the local conditions in which the IVIC evolved.

The Setting: The Venezuelan Context for Research

In the last half a century several groups of researchers made efforts to both legitimate and reproduce the institutions of science in Venezuela. But they met with stiff resistance to get this project accepted in the local context. Research grew in a non-receptive society, one that at best, was indifferent to science, in a milieu with almost no scientific tradition. In practically every field, especially those that in the twentieth century were the engines of scientific culture and technological progress, modern science in Venezuela did not have a past to which it could relate; it did not inherit a school of thought or a value horizon upon which to base the construction of a scientific community.

In the first half of the twentieth century, the quality of university life was lacking in many aspects; the university suffered prolonged periods of closure and in general it had a precarious and stagnant development. In addition to the poverty of higher education, there was a very limited social base in the lower educational levels: by the middle of the century, 51 per cent of Venezuela's 5 million inhabitants were still illiterate. Technical knowledge was little diffused and the levels of expertise in urban and rural areas were low, as became evident in the numerous bottle-necks resulting from the lack of skilled human resources during the rapid years of industrial modernisation in the 1960s and 1970s. In the late 1930s and 1940s, in the aftermath of the long dictatorial regime of J.V. Gómez who remained in power for almost thirty years, there was an upsurge of scientific institutions. But it was only since 1958, after the authoritarian regime of Pérez Jiménez was deposed and a modern democratic government was established, that modern scientific activity became institutionalised. The new government approached the few distinguished members of the intellectual and scientific elites and entrusted them the task of modernisation of higher education and the rethinking of the institutionalisation of science (CNER 1994a and 1994b; Vessuri 1996).

A small group of scientific leaders had the opportunity to establish two public institutions of higher learning, with the expectation that these institutions would guarantee both the local delivery of scientific education and a research capability of international quality in the country. These institutions were the Science Faculty at the Central University of Venezuela (1958), and the Venezuelan Institute of Scientific Research (1959). In both cases, scientists were given a free rein by the state to establish policies that would guide the conduct of research and the training of high level human resources. The shared assumption was that politicians and public officials should leave to the scientists all matters pertaining to science. This autonomy conceded to science and higher education by the new democratic government established in 1958 has to be viewed as a reflection of the fact that scientific and technological research was a marginal activity, without a definite role being assigned to it by the state or by civil society. Research was assumed as a significant medium for the control of society by neither the government nor the different pressure groups. This is understandable, since at the time a well prepared base for the production of knowledge simply did not exist and what was available was a largely unskilled and uncomprehending production culture. In 1961 only 1.2 per cent of the population over 25 years of age had attained at least a year of study in a higher education institution, and 0.2 per cent of the population over 15 years of age had a diploma in technical education (Population General Census 1991). Only 2.9 per cent of the 137 researchers with postgraduate qualification identified in the 1966 researchers' census had pursued their education in Venezuela (Gasparini 1969: 95).

Although the rhetoric about science changed in the last forty years, beneath the surface the main institutional arrangements for the national support of research remained stable. In the late 1960s, the same group of leading scientists who had founded the IVIC, managed to obtain the approval of a legislation for the establishment of the National Council of Scientific and Technological Research (CONICIT, set up in 1969). The activities of this agency were largely concentrated on academic science and its clientele have been mainly university faculty, although it was initially conceived to influence and guide the scientific and technical activities of ministerial units and state companies.

To get an idea of the size and composition of the 'scientific community' in the early 1960s when the IVIC began to function, it may be useful to examine the results of the national survey of scientists and research institutions carried out in 1963 in preparation for the creation of CONICIT. A total of 76 institutions linked to research were identified in the country: 753 persons were contacted, and 520 questionnaires were filled out, yielding an average of 6.85 persons per institution. Of them, 222 (41.7) per cent were engaged in full-time research, 2 researchers out of 10 were foreigners (33.8 per cent of them Latin Americans and 23.4 per cent Spaniards). Most of them were young, with few years of professional experience, 42.9 per cent were engaged in biological sciences (including medicine), 33.1 per cent in physical and mathematical sciences (including engineering research), 15.6 per cent in social sciences and humanities. Total investment in research was estimated to be of the order of US \$9.8 million in 1963, which represented 0.56 per cent of the national budget, or 0.12 per cent of the GNP (Comisión Preparatoria 1965).

By then there was not a single public research centre on oil technology, although over 90 per cent of the national income depended on oil. An initiative to encourage technological and industrial research came from the Instituto Venezolano de Investigaciones Tecnológicas (INVESTI), created in 1959 with the sponsorship of domestic and foreign enterprises. Nonetheless, until 1967 its annual income had been on average less than US \$150,000, an amount hardly sufficient to embark on such type of research. It was the IVIC, as will be seen later, the institution that initiated systematic research linked to oil and petrochemistry, being the most significant antecedent to the National Institute for Oil Technology (INTEVEP), that would be created in 1976 in the event of the nationalisation of oil.

The massive growth of higher education in the third quarter of the century emerged to be one of the central knots of the science question in contemporary Venezuela. While in the government's modernising scheme of the 1960s it was thought that the new scientific capabilities extolled for the country would be developed within the universities, in practice the educational deficit persisted and resulted in a quality crisis. University enrolment exploded and institutions of higher education became large enterprises whose

products—diplomas, publications, extra-mural courses—invaded the new urban market, without systematic concern for quality, either relative to the training of human resources or with regard to the knowledge produced. In the absence of a significant intellectual tradition that could have served as a reference, the challenge within the framework of a mass higher education system was how to ensure the expansion of scientific–technical research capacities in the light of increasing deterioration of the academic quality of the system.

To palliate the critical situation of research within the academic context, in 1990, following a long decade of discussions and pressures by the small community of academic researchers who were overpowered by the corporatist behaviour of the bulk of university teachers unconcerned with the fate of research, CONICIT launched the national Programme for the Promotion of the Researchers (PPI is the local acronym for it), conceived as a mechanism for the social recognition of active researchers and the grant of a supplementary amount to their salary in the form of a special scholarship according to academic merit and performance during a given period. Since this programme was meant for academic researchers, it assumed several of the research performance evaluation criteria that have been common in the IVIC. It is interesting to observe how it has become an object of contention in the national academic community. The current issue regarding science in the country today has to do with taking sides for one of the two poles of a dichotomy variously defined as:

'local social relevance'	vs	'international visibility',
'usefulness'	vs	'excellence',
'national science'	vs	'international science'.

At a time of economic and political crisis and renewed collective soul-searching for national identity, the IVIC's quality standards tend to be identified in the public eye with the right-hand 'cosmopolitan' column of the dichotomy, that at present no longer carries the social legitimacy that it held in the past.

The IVIC and the Construction of a Scientific Tradition

The IVIC is a classic example of a scientific research *locus* in Latin America and one of the 'white elephants' of science in the developing world. Founded by the Venezuelan National Government in 1959, it is the main research centre in the country devoted to the basic sciences. Located on the grounds of the former Venezuelan Institute of Neurology and Brain Research (IVNIC), its organisation meant a substantial change with regard to the ephemeral preceding institution created a few years earlier (1954) by the authoritarian government of General Marcos Pérez Jiménez. The IVIC was conceived in isomorphic terms with some research centres in the international domain, for the transmission and advancement of the basic sciences. Its mission was to pursue 'fundamental and applied research in the several fields of biological, medical, physical, mathematical and chemical sciences and [to serve] as advanced training and consulting centre in those fields, particularly for the National State' . . . consecrating 'freedom of research and scientific communication'.

A central defining principle was the notion of 'excellence'; the science that would be pursued at the IVIC would be 'state of the art science'. This implied adopting the criteria and values of 'international' science: refereed scientific publications and the impact measurements common in the *mainstream* scientific community. Thus, there has always been a conscious search for congruence of the research done in the institution with that of the international domain. No serious attention was devoted to the surrounding knowledge and production environment, which was very different from the typical one beyond the walls of well-known institutions in advanced countries which it adopted as models. In the delusion of having an institute that had many similarities with those in the advanced countries, its prestige in the national society grew in the 1960s and 1970s, becoming embedded in the collective imagination of this developing society, for it served as a symbol of the achievement of universal values to which its élite aspired in the process of modernisation.

Despite its broader disciplinary scope it came under the Ministry of Health and not under the Ministry of Energy or Industry. This was due to the fact that the founding group was constituted by physicians, the Ministry of Health was one of the most modern

ones, and obviously there was a greater affinity between that Ministry's officials and the founding group of IVIC's researchers. On the other hand, the Ministry of Industry had always shown little concern for the construction of endogenous capabilities of science and technology, and until the nationalisation of oil in 1976 the Ministry of Energy dealt mostly with the financial dimensions of the oil business rather than with its technical or scientific aspects. It was, then, quite natural that the new basic science institution whose initial membership had a disproportionate number of medical scientists, should come under the Ministry of Health.

The geographical location and space organisation inherited by the IVIC, conditioned the new institution much more than expected. Its location on the top of a mountain—Altos de Pipe—in a rural area near Caracas, allowed the creation of a social climate favourable to research, but involved huge investments to build the necessary infrastructure of buildings, water, energy, roads, and other services. Like Solomon's House in the *New Atlantis*, it is largely self-sufficient, with a restaurant, a pharmacy, a post office, banking facilities, a carpentry workshop, a scientific instruments repair shop and other facilities meant to make life easier in this mountainous 'island'. For its maintenance and operation, it had to rely on labour, technicians and administrative staff in larger numbers than would have been the case in urban conditions. The gradual growth in absolute numbers of such support staff is seen, by some, as one of the main sources of institutional difficulty in the present time. Indeed, it has translated into an excessive weight of the labour problem, which assumes priority over the institutional mission and the assigned budget to satisfy it. But more will be said about this later.

The Institution as a Bureaucratic Organisation

The IVIC belongs to the decentralised public administration, and has historically enjoyed a great deal of functional autonomy, offering several features conducive to research that are not matched by any other institution in the country. Its leaders have always cared to safeguard the institutional mission: the production of scientific knowledge. They succeeded because the institute was surrounded by a protective belt of political prestige that allowed it to self-govern throughout its existence, to a large extent according to the rules of the game of scientific merit. Work conditions ensuring a

full-time regime for research and advanced teaching activities in a favourable physical environment, the provision of funds for the basic expenditures required to run the laboratories, the construction of an excellent scientific library and the availability of general services to cater for the many different needs of the staff, made the IVIC a favourable habitat for the development of science and its researchers the most approximate local representative of those 'elegant and high-living philosophers' of the Solomon's House utopia.

The structure of institution is hierarchical. The Directive Council is formally the highest authority of the institution, comprising the Director, the Deputy Director and three representatives of external institutions. Executive authority is delegated to the Director, appointed for four years by the President of the Republic through the Minister of Health, after taking into consideration the recommendation of the IVIC's Researchers' Council. The Director enjoys the highest power, because he controls not only the information but also the form in which it is disseminated to other members of the Directive Council. He appoints the Deputy Director, who acts in his absence and shares functions, generally on the basis of complementarity. The Researchers' Council is in theory the sovereign organ of the institution, where the values and interests of the researchers are expressed. It is expected to advise the Director besides being entrusted with the task of approving the Director's annual report as well as changes to the institute's statutes and by-laws. Although in it we find expressions of various conflicting interests it does not function as a true negotiating arena but rather as a catalyst of personal and group feelings, which may reach high peaks of intensity sometimes suffocating 'island' climate. Although the authorities' regular business meetings with the heads of centres and the management committee serve to filter and disseminate information from the Director's office to the researchers and administrative staff, the actual negotiation about matters concerning the running of the laboratories takes place directly between the researchers concerned and the Director, who historically enjoyed a considerable amount of institutional power.

The collective instance that constitutes the sensitive heart of the institution is what is called the 'Classificatory Commission' (henceforth CC) or Evaluation and Planning Commission, for the evaluation of scientific staff. Comprising eight researchers chosen by the Researchers' Council, the CC looks into all the scientific work

the evaluation of performance and promotion of the scientific staff, including post-doctoral fellows and scientific support staff, and it advises authorities in these matters. The CC is accepted and defended by researchers as the custodian of scientific legitimacy and the guarantee of the institutional mission's fulfilment.

Recently, other actors have joined the negotiation arena (scientific support staff, the employees and labour unions), pressing for greater participation in decisions that may decisively affect the future of the institution, not only in connection with the labour problem but also and most crucially with regard to the IVIC's mission: scientific research. It is still to be seen how a new social contract will be reached. The ways and motives to do science are many and varied. Competitiveness, the establishment of specialised fields, internationalism, more direct national relevance, higher income levels are valid ideas sustained by different groups of institutional actors, and it is no longer possible to focus attention on only one or two groups as the true or legitimate institutional representatives to the exclusion of the others.

The House Taken Over?

The staff that justifies the IVIC's existence, the one entrusted with the responsibility of carrying out the fundamental mission of the institution—research and advanced training—are the researchers. Like some other professions, but probably with more eagerness, scientific researchers constitute a markedly stratified community. Recognition of technical expertise or of higher scientific knowledge of any kind, is full of political significance. From a sociological point of view, cognitive authority is institutionally expressed in contingent factors such as the indicators of curricular advancement in a scientist's career: administrative steps which result from 'measuring' his professional progress and thus signal *rites de passage* in the life of a researcher. In the IVIC, merit and authority evolve in an upward direction in the following manner: at the bottom of the scale is the Associate I or post-doctoral fellow, followed by Associate II, Associate III, Full Associate and, finally, the Full Researcher (*titular*) who historically was the only one with the *Investigador* status in the institute.

A crucial segment of the research body, the 'promise' of the future, are the *post-doctoral fellows*, whose formal position is

equivalent to the initial stage of the researcher's career corresponding to Associate I. The post-doc is an institutional figure that emerged at the IVIC in the 1980s, as an administrative solution to mitigate a conjunctural problem: the government imposed restriction to incorporating new staff in the institution. Since 1991 it became an institutional strategy to attract younger research staff. Through this, the IVIC hires young scientists holding a doctoral degree for a period of up to three years, without having to assume the final responsibility of employment. In addition to those post-docs, and also as a strategy of attracting younger staff are the scholarship holders that the IVIC sends abroad and whose entrance to the institute is deemed desirable. In recent years a special portion of the budget has been earmarked for the funding of post-doctoral contracts, with an absorption rate by the institute of around ten to fifteen new post-docs or researchers per year.

In the house of science in Altos de Pipe there are researchers as well as post-docs, and it is assumed that scientific research is a life project for them. Due to the research dynamic followed in the institution, they have increasingly shared the scientific space with others, some having features similar to theirs, while others are quite different. They constitute the *scientific support personnel*. They are categorised as Professionals Associated to Research (PAIs) and Specialists Associated to Research (EAs).

The PAIs occupy a space in the institution that involves, really or potentially, a series of tensions derived from status problems, responsibilities and real functions. Because qualifications, incentives and work modality of the different laboratories differ significantly, as also the forms of evaluation and recognition given to them by their immediate supervisor, an individual researcher is the PAI's direct 'boss'. Such tensions acquire importance because the PAIs constitute 27.3 per cent of the institute's staff, while researchers and post-docs comprise only 12.6 per cent. Among other things, it may be noticed that a part of this category is engaged in services rendered by the laboratories and other units. It is necessary, therefore, to clarify their situation by subdividing the category into two classes: professionals linked to research and professionals associated to the services—PASs (this involves remuneration that sometimes is quite differentiated, benefiting out of proportion those who work in the provision of external services and who thus earn a 'surplus' income). Besides, some of the PAIs have nothing

to do with research. At different times and in individual cases, in order to compensate for low salaries, irregularities were made when administrative and general service personnel were appointed as scientific support staff so as to ensure them a better remuneration.

Thus, the work category became too heterogeneous and its current form of assessment results ambiguous and in some cases even contradictory. Although initially the IVIC envisaged the *graduate student* as part of the IVIC staff who would work in the laboratory while being trained as a researcher alongside a senior researcher, in the course of time it was the PAI rather than the graduate student who became consolidated as the scientific support to the laboratories' experimental research.

Until recently, the other co-inhabitants of the institute—*administrative staff and manual workers*—did not participate in decisions pertaining to the fate of the institution. This situation seems to be undergoing change, in view of the growing role of unions in the institution. It is as if science had come to be seen as the 'life project' of these other institutional groups as well, although very clearly in ways that are different from those of scientists. In their pressure for control of this 'house of science', means become the ends: job stability, higher salaries, collective agreements are the targets aspired for. For the moment, the argument of the inhabitants of this 'House of Solomon' may be summarised as a structure of personnel made up of three groups: scientific rank, technical-administrative staff, and labour. For some time the three parties accepted the traditional right of the researchers' group to direct the affairs of the institution, but of late voices have been raised questioning such an arrangement and demanding a share and an equal share in this House of Solomon in the Caribbean.

The Difficult Transit from Individual Researchers to Research Groups

The transition from the individual researcher to the research group is a common feature of twentieth century science. As it became increasingly necessary to compress the duration of research programmes, partly for achieving priority of discovery, partly in view of the relatively brief deadlines of public subsidies, or owing to the urgency to reach scientifically significant results in relation to practical issues, the research group became accepted as the appropriate institutional unit because it came to be considered the most

efficient way to work on scientific problems. The differentiation of specialities deepened this division of labour to account for increasingly complex problems, which included broader fields of knowledge that necessitated a joint attack to resolve the scientific problems at hand. The increment in the size and complexity of groups led to a qualitative change of scale, with the emergence of 'big science' megaprojects, inaugurated by the Manhattan Project.

However, 'small' science, carried out by small academic groups continues to constitute a very large proportion of research not only in developing countries but also in industrialised ones. It has some crucial advantage such as the direct control of the equipment 24 hours a day. In the opinion of some scholars this allows a rapid alternation between data collection and analysis, comparing favourably with regard to the *modus operandi* of 'big science', where these functions are normally carried out in different stages, sometimes with several months interval before being able to return to the research site (Etzkowitz 1992). Besides, bureaucratic problems are avoided as well as the risks of the sudden obsolescence of a large research 'facility' or the unexpected loss of funding by a centre, as the increase of scale in 'big science' becomes irreparable, as was recently the case with the particle physics programme in the United States.

The research activity carried out in Latin America corresponds almost exclusively to 'little' science. This is also the kind of science carried out at the IVIC. The organisational principle of research in the institute has been that a trained researcher has the right to establish his own research group, in his own independent laboratory. This kind of organisation served well the purposes of growth of an institute in a country just beginning to develop scientific research. Its statutes reflect the notion of research and researcher that prevailed in the IVIC's early years and determined the institutional culture. They identified what is today called the Full Researcher (*investigador titular*) as Researcher with capital 'R', reflecting his independence, authority and power.

New laboratories could not be established endlessly. As the number of trained scientists grew, it became obvious that the IVIC could not grow indefinitely. The stability in the number of laboratories indicates the existence of limits to institutional growth. In 1979 there were fifty-eight laboratories (Antonorsi 1979). In 1995 the organisation for research continued to be practically the same,

with fifty-nine laboratories distributed in seven centres and three departments (IVIC 1995: 2). Apart from the Departments of Mathematics and Science Studies, which are organised around projects without internal differentiation in laboratories, the basic research unit is the research laboratory, commonly identified with the figure of an individual researcher who has one or more related research lines. Laboratory work is usually organised in a hierarchical fashion, with the head responsible for setting objectives and assigning tasks. Intellectual leadership is needed to articulate consensus within and outside the group and the academic institution. The typical composition of an IVIC laboratory includes a researcher and a research associate (PAI or *profesional asociado a la investigación*); in a smaller number of laboratories it constitutes a researcher and students and one or more technicians, although the ideal would seem to be to have both students and PAIs or technicians. More recently, in some centres more than one researcher is found to belong to the same laboratory, leading to the inference of a greater division of labour.

If all the laboratories that constitute the IVIC and not only some open their doors to graduate students, the institute could double or even treble the number of students. One may argue that this would enhance its role as a prestigious Latin American graduate school and would have positive effects upon the overall organisation of research. However, in the past there was stiff resistance from a sufficiently large proportion of its research staff to the idea of enlarging the scope of its teaching activities. The IVIC Researchers' Council explicitly rejected the idea of joining the National Universities Council as an advanced teaching institution (Comisión Ministerial 1986). Thus, in the absence of a significant graduate school in the institution, an alternative strategy often adopted in the IVIC has been that of the researcher who, instead of inducting students into his research work, relies on a permanent salaried auxiliary scientific staff (the PAIs). Supporters of this arrangement argue that there is an obvious advantage because of the continuity resulting from the tacit knowledge acquired in the joint long-term work by a team. The inevitable drawback, however, is that there may not be sufficient motivation among the auxiliary scientific staff because there are no scientific competitive challenges facing them in the institution except in terms of job stability. Given the lack of frequent renewal of research technical routines in some

laboratories, their attitude to laboratory work risks becoming bureaucratic. Many routine tasks in a research laboratory could be carried out by personnel with lesser qualifications than those of the PAIs, with savings for the institution and a more rational and better use of the qualified human resources who could be assigned to more challenging tasks.

As the perception of institutional authorities is that the researchers/scientific support staff ratio should not be more than 1 : 1 or at the most 1 : 2, it is obvious that by way of appointing auxiliary scientific staff, laboratories cannot grow much. On the other hand, as the majority of researchers have only a moderate level of external support, even in cases where external funds are forthcoming, they are not in a position to hire more than one or a few temporary support staff on the basis of the extra budgetary fund. This also helps to explain the stability (some would prefer to speak of 'stagnation') of the IVIC's productivity. Since it is based on the work of a single researcher or at best of the researcher and his PAI, the per capita productivity of 2.1 or 2.2 papers per year is perfectly reasonable (more about this will be discussed later). However, if a different group work strategy were adopted throughout the institution, this productivity could be increased considerably.

The natural way to grow, then, would appear to be through the number of graduate students a researcher or a laboratory may attract, of course, always within the limits of 'small science'. Given the need to grow and, particularly in the present situation, in view of the impending generational renewal of the researchers' population, an increasing predisposition among them to focus more attention on graduate teaching is observable. Traditionally, it has been argued that the rapid student turnover has both advantages and disadvantages for research groups. The new recruits have to be trained before they can make any contribution, but the new members constantly bring new ideas to the group and the possibility of having a number of students allows to train them in a broader range of techniques, which adds to their skills as well as to the advantage of the laboratory and the research group as a whole. The process of constant formation and dissolution of research groups is a basic feature of the academic context. The aim of the young researcher is to become independent as soon as possible, forming his own group. There is a tendency for few to remain

under the wing of established researchers once they get their doctoral degree. Even so, a certain level of endogamy is observable in some units at the IVIC; given the small size of the institution, this is not necessarily a healthy sign.

Basic or Applied Research?

At an early stage, the institute concentrated its research activity in biomedical specialties such as biophysics, biochemistry, microbiology and physiology. It also hosted groups in fields having minimal tradition in the country, such as chemistry, physics, mathematics, ecology and anthropology. Since then, it has added a few other fields of knowledge, such as materials science, science studies, nuclear technology and agricultural biotechnology. Although results for immediate application have been forthcoming in specific laboratories, they have not been considered systematically for promotion. The basic production of the institute is scientific papers and a constant effort has been made to check the impact factor of the journals in which papers are published as well as the papers themselves. As a result, the IVIC has developed an institutional culture that has persisted remarkably unchanged for the last thirty years, mostly based on the publication of papers in mainstream journals, at the cost of applied research and teaching. As may be expected, the criteria used are not infallible and a range of research profiles with regard to productivity and quality are present. Thus, although the institute has a good number of very prolific authors, it is possible that an older researcher who is not very productive and who has managed to survive the earliest assessment in his career is tolerated in the institution. Even though the productivity profile of such older researchers is not very high and impressive, this does not seem to influence the evaluation of younger scientists. Younger scientists are, however, evaluated with higher standards and norms.

Perhaps, the main challenge facing the institution today, from the point of view of its organisation for the continued production of knowledge, has to do with the need to adapt its culture or philosophy to changes in the social demand that have taken place both at the national and international levels. The IVIC was and continues to be a case of the classical 'basic science or academic research institution' that has been a type of problem generator

constantly creating new intellectual puzzles. It has been argued already that its organisational design principle is not the most efficacious and efficient in developing nations, where the social, economic and technological environments differ markedly from those characteristic of advanced nations. In recent decades an alternative social arrangement to the classic pattern on which the IVIC was modelled has become increasingly common in the research area as well; it is the 'interdisciplinary task network' that skips over the disciplinary puzzles and often places itself ahead of the theoretical front (Bohme et al. 1983). The solution sought in this kind of arrangement is not so much of the scientific problems implicit in the task, but of social (or in any case socio-technical) problems. Researchers who advocate this alternative institutional arrangement do not usually perceive their activities as being differentiated in terms of the contrast between applied or close-to-market and basic research, nor their collaboration as symbolically bridging the gap between basic and applied science. As far as they are concerned, they are engaged in scientific research. The change has much more to do with negotiations that respect the language, expert knowledge and professional orientation of each group to the task at hand (Webster 1989).

The new institutional research structures combine disciplinary expertise, and provide a favourable context for useful 'negotiations' among different specialists. In such institutional settings, any 'basic' research may be considered as having an 'applied' nature, not only because of the spin-offs of techniques and technologies, but also because the very experimental questions that are sought to be examined tend to push in both directions at the same time. As Freeman (1987) has suggested the knowledge base of the new technologies may perhaps only be expanded in the context of institutions that overcome the basic/applied dichotomy.

Thus, either because the socio-economic and technical context is different, or because a new organisational pattern has also been adopted in the advanced centres of the world, the fact is that this is a period of profound organisational changes for the production of knowledge. The implication, however, is not that a developing country should give up conducting research in areas of high technology, nor that it should avoid basic research. Because of the technologically sophisticated world economy of the present, research resources must exist in developing nations if only to enable them

to make the right choices concerning technology purchases from abroad. But

... where basic research is supported, the level of effort needs to be significant, and needs to be oriented towards building a small number of highly concentrated, internationally competitive research units so as to maximize the power of a limited capability. In addition, wider government policy cannot just leave it at that and expect results in a knowledge-poor environment; policy needs to encompass the wider situation and to extend into adequate support for the whole transfer and capitalization process via the provision of venture capital and highly competent management expertise. This will ensure that the products of research do not flow beyond national boundaries at poor bargaining prices (Hill 1987: 68, italics mine).

So far, the IVIC community has resisted an indepth examination of a possible redefinition of its institutional profile along these lines and thus it has been unable to rally the essential social support for basic research needed to tackle research challenges relevant to the 'leading sectors' of the economy. May be the present crisis gives way to a more creative collective response.

Society: Source of Support and Legitimation

The relationship between the IVIC and its surrounding environment can be analysed at least in connection with three main aspects.

Social Legitimacy

The IVIC is an institute which gained national and international prestige due to its adherence to a particular institutional ideology, a certain demarcation of roles and functions and standards of quality and international visibility sustained through time. Once in place, these features assumed a life of their own, with important practical consequences. Thus, to the extent that a common institutional ideology became the collective consciousness of the group of researchers, it helped to select (discriminate) the aims and means for social action and also contributed to produce the means. In this

sense, the institution became a 'vector' for a particular collective understanding. The mechanisms of selection and induction into the institutional culture that the scientists themselves instaurated, afforded it not only the 'know how' and the 'know what' but also the 'know where', in other words, gave the institution the beliefs, expectations and objectives that defined the direction that it would follow (Adler 1987: 15).

In the same way as the institution managed to build up an ideology that was reflected in its concrete image and presence, it achieved legitimacy when certain elite groups became identified with the idea of science as progress that it embodied. The IVIC perceived as the symbol of modernity and rationality, the main filter through which ideas, models, theories and scientific ideologies from foreign to the local culture, mainly from the United States and Europe, were received and translated. Thus, its researchers helped to establish objectives for science in the country, raised public consciousness, and influenced public decision makers well beyond experimental science of which they were the standard-bearers in the national context.

An expression used by the IVIC to project its achievements and therefore its claim to legitimacy has been through its publications. Despite financial crises and uncertainties in the 1980s, which affected productivity (in 1988 the institutional scientific production reached its lowest level in the decade, with a total of 186 papers published and 168 in press), since 1989 the institute's publications have increased, surpassing 300 publications in 1991, and recovering its historical curve of about 2 papers per capita. Between 1989 and 1992 the average annual publication rate was 2.3 publications per researcher. In 1993 the index was somewhat lower: 1.9 papers per researcher. This decline could be attributed to conditions in the institute, or could be interpreted as an effect of new researchers and post-doctoral fellows in the early 1990s, whose production could only be reflected some time later. Indeed, in 1994-95 it had recovered its historical average of 2.1 papers per year.

In any case, it may be said that in the IVIC no 'PPI (Programme of Researcher's Promotion) effect' can be observed, contrary to what seems to be the case in the national scientific community at large, where an increase of about 20-25 per cent of the productivity rate in the first five years of operation of the new programme can be observed. A possible explanation is that the IVIC was already

applying the criteria that are characteristic of the PPI, and therefore there were no significant changes despite the fact that a much larger percentage of the IVIC personnel participated in the PPI than is the case of any other Venezuelan institution. In 1993, the IVIC had 146 publications registered in the source journals of the Institute of Scientific Information in Philadelphia, that is, 68 per cent of the papers published by the IVIC staff were published in journals of the greatest international visibility. This is an indirect indicator of the quality of research at the institute, which leaves it well positioned by comparison with similar institutions in the international domain, that is, where the individual researcher still prevails over the research teams. However, the idiom of scientific publishing was always alien to the culture of the general public and this most valued product for the IVIC's researchers did not have much meaning for the public at large, or for many decision makers in the public domain. Of late, public criticism and internal and external demands of social relevance have emerged stronger than in the past.

The Demand

Despite a growing diversification of the demand, the IVIC continues to occupy the segment of the knowledge market corresponding to the most advanced research capabilities in the country. Given the specificity of its functions, it has been slower than other institutions in absorbing new audiences, although it remains to be seen whether it fulfils new functions and becomes internally differentiated, such differentiation being willed or not. Earlier proposals for a scientific *and* technological IVIC were not viewed favourably and instead the IVIC was distanced from the clearly technological activities that were initiated in it: the first to leave the institution were groups of petrochemical and oil fields, which were integrated into the new INTEVEP in 1976. Later, it was the turn of the engineering groups who formed the core of the Fundación Instituto de Ingeniería in 1980 and of those who were the seed of the development of biotechnology at the new IDEA research centre.

Among the antecedents of the Technological IVIC 'which never was', the 1972 UNESCO Mission is worth mentioning for the establishment and development of a Centre of Technological Research (CIT) at the IVIC. In the 1970s, among the viable

alternatives considered by the expert mission to launch a consistent technological research effort at the national level, the IVIC appeared as the most appropriate one, for it had already made considerable headway in technological research and had the organisation, resources, personnel and experience afforded by previous achievements. The mission proposed an alternative organisational scheme to the existing one, this included a Director of Technology, with the status of Deputy Director of the institute and as such member of the Directive Council; an Executive Secretary responsible for administrative management as well as the establishment of congenial relations with industry, the diffusion and exploitation of the institute's research results. The proposed reorganisation implied a radical change in the Evaluation Committee (CC) which has been central in the life and philosophy of the institution, being in charge of recruiting, evaluating and promoting the scientific staff. Among the changes envisaged in the CC was its subdivision into two subcommissions, one for the scientific branch and the other for the technological one, for it was believed that technological researchers could not be evaluated according to the same criteria as basic researchers and their evaluation had to be done by experienced technological researchers.

Evidently, neither the project of the UNESCO 1972 Mission nor later proposals were successful and what happened instead was the crystallisation of the IVIC as a predominantly basic research institution. The existing Technological Centre (CT), that since 1973 was oriented as a centre for the promotion, planning and coordination of technological activity at the institute, never gained momentum. In its current small size, it offers a range of specialised services of analysis, consulting and work to hospitals, firms, universities, other institutions, private individuals, etc. The funds earned through these services are distributed among the participants in the execution of the service: 70 per cent to the laboratory involved, 15 per cent to the CT and 15 per cent to the IVIC, intended for the creation of a special fund to be used for the support of institutional activities and the funding of development projects. Despite the expectations of recent years, the volume of funds coming from the CT has not increased. Two former IVIC authorities said in their final report that until 1988, the number of services went up from 400 to 1600 per year, which has been maintained until now [1991] *and seems to represent IVIC's maximum*

capacity to render services without disregarding research and teaching' (Vanegas and Sanchez 1991).

It is evident that in the IVIC, this current stagnant ceiling for service activity is the maximum that can be attained. But this does not mean that the institution does not have the potential to expand considerably without compromising on its quality. It would need, of course, to make the necessary transformations to aspire to more ambitious realisation targets. Rapid technological change demands high levels of specialisation and efficiency of research. The application of the technology developed in the laboratories demands greater effort in terms of transfer and commercialisation. More than that, the institutional research management, no less than the national scientific management, needs to pay attention to what more commercial (chiefly international) interests are likely to disregard, that is, the construction and reconstruction of linkages that will articulate the leading, secondary and traditional sectors into an integrated economic whole. Current technological developments require relatively less by way of traditional disciplines and more of novel interdisciplinary efforts. The IVIC has valuable laboratories that represent capacities in a number of fields of knowledge. It is necessary to have a better understanding of how scientific specialties interact, both formally and informally in the institution and how researchers can translate their 'interests' into concrete results. Variation in the R&D activity is not easily classifiable as 'basic', 'applied', 'marketable', etc. What is observed is a range of different types of language, expertise and professional disposition that may be much more interactive than its users and research, and within the economy itself. The IVIC cannot be divorced from this.

Social demand is expressed through the training of human resources for research. Advanced teaching has been an enduring concern of the institute, defined in the statutes as part of its specific mission, although not necessarily recognised by the research community as having any strategic significance. In the early years of institutional life there was an Education Committee; in 1965 a Studies Commission and the position of a Dean of Studies were created although the emphasis remained for a while on sending fellowship holders abroad. In 1971 there was progress in the formalisation of *in-house* graduate studies when the Centre of Advanced Studies (CEA) was established with three specific programmes: graduate, undergraduate and out-reach.

The graduate programme is the most important one. The CEA grants degrees at the Master's and doctoral levels, in the first case the *Magister Scientiarum* and in the second the *Philosophus Scientiarum*. In 1993, the National Universities Council approved the first accreditations to graduate programmes, sixteen to graduate courses taught by the IVIC at the Master's and doctoral levels in eight specialties. This accreditation culminates in a long-term process and is a recognition of the role of the institution in the science graduate programmes in the country. In practice, legal technicalities have not prevented the diplomas granted by the IVIC to be considered prestigious both nationally and internationally. In the 1994-95 academic year, 108 graduate students were enrolled at the CEA and 4 *Philosophus Scientiarum* and 15 *Magister* degrees were granted. The fields of study were biology, human genetics and microbiology, chemistry, physics, mathematics, environmental engineering, electrical engineering and metallurgy and materials science. Until 1994 512 *Magisters* and 92 *Philosophy Scientiarum* had graduated from the IVIC.

The out-reach programme has as its aim to disseminate the advances of scientific knowledge through special courses conducted by individuals of recognised scientific trajectory in a given speciality and to give support to the publication of materials of scientific interest. The undergraduate programme allows a considerable number of undergraduate students to do their *licenciatura* thesis in some of the IVIC's laboratories under the supervision of a researcher from the institute.

Finally, the IVIC has a small number of graduate scholarships for the best students. Besides, students may apply individually to FUNDAYACUCHO, CONICIT, INTEVEP and other local foundations for scholarships or educational loans, although in general, domestic scholarships have not been raised in relation to the rising cost of living. The logical consequence of this is a reduction in the number of students enrolled in the graduate programme. A complementary explanation is the general decline in student enrolment at the undergraduate level in scientific and engineering fields in universities that has occurred in recent years.

Funding

The IVIC falls under the Ministry of Health and its annual budget is approved by that Ministry. Its main source of support for

individual research projects is CONICIT, both through its regular programmes as well as from the New Technologies IDB-CONICIT and Privatisation programmes. INTEVEP, too, funds particular projects as do Fundación Polar, the Ministry of Health and other national donors and research contractors. Among the foreign agencies are the European Union, the National Science Foundation and the National Institutes of Health. Every researcher seeks his/her own financial support beyond the basic resources provided by the institution to be able to maintain his/her laboratory work.

Since the 1980s, uncertainty with regard to institutional funding has been a crucial factor in the gradual decline in the number of researchers, precisely at the time when the national scientific community had reached its maximum size. However, in the early 1990s efforts were on to reverse that trend with the entrance of a substantial number of post-doctoral fellows and new researchers, recovering its historical size of around 140 researchers (Vessuri 1995). Despite this institutional strategy, that appears to be correct because it seeks to ensure the continued dynamism of the institution, the budget reduction has meant that in the last three years this increase in the research staff has not been matched by a corresponding increase in operational research funds, with an increasing incidence of personnel expenditures relative to operational ones. The average expenditure incurred on salaries over time has been around 70 to 75 per cent of the institution's budget. Current estimates situate it close to 90 per cent. Among other things, this is linked to a general government policy that for social reasons seeks to minimise work dismissals in circumstances when it has to reduce public expenses.

Only in 1991 did the IVIC's budget recover the 1978 levels, with almost \$20 million, after having witnessed a serious cutback in the 1980s. Having reached the lowest point in 1986, the IVIC's budget began to grow until it was 7.62 times higher in 1991 compared to that in 1987. Since then, however, a new retraction regrettably typical of the policies applied in the sector has taken place. The 1992 budget, which was repeated for 1993 and 1994, in conditions of an annual inflation rate of more than 40 per cent, reduction of the buying power of the national currency in the foreign markets of equipments, research inputs, books, journals, etc., has lowered its buying power once again to less than US \$13 million. This

includes a marked decline in the income of the research staff that is noticeably below that of their colleagues at the national universities.

It would seem that besides the amount fixed for scientific activity, what is important for a scientific research institution, as for other activities that take place in medium and long-term time horizons, is the maintenance or the increase of funding over time. Oscillations in budget assignments obstruct the strategic planning of institutional development and negatively affect the individual researchers' initiatives because they cannot make medium-term estimates and sometimes not even short-term estimates for buying the necessary equipment for new projects. It is obvious that basic research institutions are highly sensitive to funding problems. Because of funding instability it is difficult to retain persons of whom an international productivity profile is demanded.

Conclusion

Past achievement offers the advantage of prestige, contacts and influence. But it may become a ballast, precluding adjustment to new situations. In the light of the challenges facing scientific disciplines, it is obvious that given the reduced size of its institutional research community, the IVIC will only be able to attend to a small part of the growth of new research fields and of new positions for researchers in the country. Therefore, the decisions to be made in view of the current cutbacks in public spending as a consequence of the critical fiscal situation are crucial. In a developing country, where the main bottle-necks to economic and social growth continue to be the absence of a 'critical mass' of educated people, strategic scientific decisions should continue to be based fundamentally on trying to select the best talent and provide them favourable working conditions so as to retain them and allow them to express their creativity while trying to make their work broadly attuned to the general national strategies of development through the targeting of R&D.

In a 'catastrophic scenario' which cannot be totally replaced, one would assist to a gradual liquidation of existing capacities, and the loss of the experience of those researchers and technicians who are not being replaced on time. In view of the multiplicity and

dispersion of laboratories and research lines, if their interaction in the culture of institutional research is not ensured, it would be difficult to find the necessary means on time to have them reach a fruitful balance. To avoid the 'catastrophic scenario' from becoming real, as some indicators seem to predict, among the most important internal problems facing the IVIC today is the need of revising its general and specific personnel policies. But even more important is the necessity to rethink its research profile in connection with the reorganisation of techno-scientific disciplines and techno-scientific horizons that has occurred at the international level, defining lines of action to make more efficient and efficacious the interaction of the different disciplinary groups and thus allow them to embark on more ambitious programmes (Vessuri 1994).

From this point of view, institutional policy today is at the crossroads: either to approach R&D in a more integral fashion, with the challenges and problems involved in targeted research, or to run the risk of becoming a less relevant institution in the national domain. This does not mean not doing basic research. On the contrary, today more than ever before the country needs to increase the stock of public knowledge accessible to the actors in the innovation process and thus it needs to fund the activities of institutions like the IVIC, devoted to long-term research. Institutions such as this as well as research units in some universities, may provide the qualified staff to an economy based on specialised professional knowledge, and guarantee the necessary basic research to R&D. Through an institutional policy that concentrates on managing the change and adjusting to it, the institution could better prepare itself to carry through the necessary transition. Maybe the time has come for the IVIC to revise its traditional normative objective of first defining an optimum and then establishing the institutional structure to achieve it and accept instead more diversified objectives such as identifying strategic problems and possible improvements or solutions through the active effort of its laboratories in concert with other institutions.

Domestic scientific and technological activity would benefit from more intense inter-institutional agreements for the efficacious development of R&D. It would seem that universities, due to their sheer size, will have a greater capacity for absorption of researchers in the future, if and when they enact the necessary changes to create a favourable environment for research at the institutional

level, something that has not happened so far despite the good intentions expressed in university politics and rhetoric since 1958. In the definition and provision of large national programmes, the IVIC, having a significant proportion of the most experienced researchers in the country, may play a dynamic role in joint action with eminent figures of other higher education and research and development public institutions.

Recent social and historical research has contributed to remove science from the 'pedestal' and to reveal some of its 'seams'. What happens behind the walls of Houses of Solomon today is quite different from the traditional idealised vision of science. The outstanding feature of the Baconian structure is the complete coordination of the scientists' efforts, that follow a collective common direction. This is utopia and it has not been observed in the actual experience of science through the centuries. In reality, the separation of science from the state rarely took place, although violent confrontations were normally avoided. Permeating the *New Atlantis* is the notion that science must be governed by superior values and that not all its works are spontaneously in harmony with *caritas*; however, from the Baconian testament the part that received the widest recognition was the one concerned with the implementation of the discoveries.

Today, it is admitted that the IVIC's establishment was an outcome of negotiation and power struggle, influenced by contemporary images of science. Probably, it was never the peaceful place of pure scientific calling without internal strife, as the memory of some indulges with nostalgia. The social actors involved do not like to see the myth of harmony and rationality being shattered, because it is part of the modern ideology of science and often of the self-image of its practitioners. Despite its unreality, the power of the utopian vision was always an idea-force and indispensable material for realist action. 'If you have built castles in the air', said Thoreau (1854), 'your work need not have been lost; that is where it should be. Now put the foundations under them'. What happens in practice is that we often concentrate on the foundations forgetting the castles that are their only *raison d'être*. We become so 'realistic', that we get exhausted in the works of earth rotation and laying out of foundations without raising our eyes to the structures above them. We tend to be engrossed in 'fragmentary engineering' without being concerned about the final shape of the structure we so

eagerly try to erect. It is no surprise therefore that the result is often a forest without meaning or purpose. The elimination of the power of dreams, of utopia, would leave us without ideals, it would take away the impulse, we would experience dismay and doubt about the adequacy of our works. The IVIC, the 'House of Solomon' in the Caribbean, must go on expanding itself in the enriching tension between utopia and reality.

NOTE

- * Mariana Farias, PAI in the Department, assisted in the data collection.

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