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1. Introduction

Despite the heated debate over the guns vs. butter issue, remarkably little empirical attention has been given to the socio-economic sources of national military-industrial capabilities. The boom in the growth of arms industries began in the 1960s. By the end of that decade, a total of 27 third-world countries produced some equipment for their armed forces, usually small arms and ammunition (Evans 1986, p. 99).

1980 some of the advanced weapons systems in these countries had reached the point where they were competing with the established arms suppliers. At present, arms production in the third World is a bimodal system. Argentina, Brazil, Israel, India and South Africa possess the most advanced and diversified defense industries, involving the production of a range of aircraft, armored vehicles, missiles and warships. A second emerging group includes Egypt, Indonesia, Mexico, North Korea, the Philippines, South Korea and Taiwan (Evans 1986, p. 99).

The motives for indigenous arms production in the third world have been traditionally dealt with in terms of political and or strategic considerations. As Michael Moodie (1979, p. 298) has observed: "Indigenous defense production is an expression of self-reliance, and thus it is a means of reducing a state's vulnerability to military and political pressures during times of crisis".

Increasingly, however, economic incentives (Wulf 1985, p. 329) have acquired an independent importance in motivating third world countries to establish their own defense production facilities.

Developing countries maintain that by manufacturing weapons systems indigenously, they can reduce the costs of these arms and save foreign exchange. Furthermore, if these products can be exported they are a potential source of foreign exchange earnings (Evans 1986, p. 100).

In fact Brazil is the classic example of a country which vigorously promotes arms exports and has a thriving indigenous military industry based partly on expanding exports. Other countries are following the trend and there is little doubt that developing countries will increasingly compete in world markets to sell their armaments. An interesting new feature is the entry of transnational corporations in this field. The recent decisions by firms in Italy and Brazil to pool resources to produce strike fighters may simply be an early signal for many more such developments (Deger and Sen 1985, p. 2).

While economic motives undoubtedly influence some third world countries to attempt arms production, it is just as clear that not all countries in the developing world are able to profitably begin producing their own armaments (Alexander, Butz, and Mihalka 1981; Ross 1981). Recently Stephanie Neuman (1984, p. 181) has raised the question as to "why, for example, do some states produce arms while others do not? What explains why some producing states support large and diversified military industries, while others do not?" Neuman is in fact one of the few researchers¹ who has attempted to determine the critical characteristics that set Third World arms producers² apart from those countries who have not developed domestic defense industries.

Neuman's (1984, p. 185) general hypothesis and results indicate that

What emerges within the Third World from these data is a hierarchically shaped arms production system based largely on factors of scale. In each region, the largest defense producers are generally also those countries with the biggest militaries and GNPs, which dwarf quantitatively, if not always qualitatively, the capabilities of their smaller, poorer neighbors.

It should be noted that Neuman's results apply only in a general sort of way, and that there are numer-

ous smaller countries - Ecuador, Fiji, Peru, Sri Lanka and the Dominican Republic whose arms industries clearly cannot be explained simply in terms of their economic size or population base.

In short, what seems to come out of the discussion by Neuman and others is the hypothesis that military producers can be categorized by either size variables - the overall gross national product, population, area, and so on - or military variables - armed forces, total military expenditures, or other measures of military allocation or some combination of size and military variables.

While the unique factors characterizing Third World arms producers may be somewhat hazy, there is no doubt that their numbers have been increasing rapidly in the post-World War II period; the number of Third World producers of at least one major weapons system has increased from 5 in 1950 to 14 in 1959-69 up to 21 in 1969-70 and 26 by 1979-80 (Neuman 1984, pp. 172-173).

Not surprisingly, a number of commentators have specifically cited the proliferation of arms production facilities in the developing countries as a major contributing factor to the disintegration of super power influence in the third world. For example:

The indigenous weapons production phenomenon is one small dimension of a much larger development, the diffusion of power throughout the international system. This has occurred in the economic and political realms as well as in the military. In each case, this has involved the erosion of the incredible concentrations of political, economic, and military power in the hands of a small number of large industrial states (Miller 1980, p. 25).

The implications for armaments developments and disarmament efforts are manifold. More nations and producers are offering arms on the world market. The structure of the supplier market has therefore been directly affected. Effective control of arms transfers is becoming increasingly difficult. Concerted supplier action to limit the transfer of arms seems ever more unlikely as the number of producers, and therefore potential exporters increases (Wulf 1985, p. 342).

In this conception, interdependence is a zero-sum pie in which the individual slices are becoming more equal in size. Indigenous production capabilities, specifically in the area of military-production, become a symbol, not just of the growing self-sufficiency of key Third World producers, but the erosion of the traditional suppliers' influence as well.

In short, the production of armaments for indigenous use is one symptom of the diffusion of power in the international system (Gilpin 1981, p. 180).

As technology becomes available to developing countries, traditional ties to the superpowers for military support have become weaker. The underlying impetus is part of a growing international movement for political-military autonomy on the part of the Third World and a striving for economic self-sufficiency. This principle of reducing dependence applies to regions as well as countries, as appears to be the case in most of Latin America as a number of countries in that part of the world seek out alternatives to their economic ties to the northern hemisphere. Many of the Latin American countries decided to produce some of their own military weapons, and have been doing so for over 25 years (Table 1).

Table 1. Latin American and Caribbean Producers of at Least One Major

C o u n t r y	1959 - 1960	1969 - 1970	1979 - 1980
Argentina	Light plane Submarine	Trainer	All types
Brazil	Light plane Trainers	Trainer Transport	All types
Chile	Light trainer	Tanker	
Colombia	Patrol boat	Light plane Submarine	Light plane
Dominican Republic	Light craft	Light craft Patrol boat	Light plane
Ecuador	-	-	Corvette
Mexico	Patrol boat	-	Patrol boat
Peru	Tanker	Patrol boat	Frigate tanker
Venezuela	-	-	Patrol boat

Source: Stephanie G. Neuman, "International Stratification and Third World Military Industries", *International Organization* (Winter 1984), Table 2, pp. 172-173.

The purpose of this article is to assess the likelihood that additional countries in Latin America will become arms producers in the foreseeable future. The present paper extends our earlier work (Looney and Frederiksen 1985, 1986a, 1986b, 1987; Looney 1987, 1988) which indicated that:

1. for a large group of developing countries, external public borrowing has been used to accommodate increased levels of military expenditures and arms imports;
2. given the external borrowing limits recently reached by a number of these countries, further military expenditures may result in lower rates of economic growth. Similarly debt constraints may serve to reduce the over-all levels of third world military expenditures;
3. it is possible to profile with a high degree of probability, arms and non-arms producers in Latin America;
4. the same appears to be the case for other parts of the world, although the factors setting the two

groups of countries apart may be somewhat different (Looney 1988);

5. in general the non-producing countries have high debt service ratios relative to the countries that produce arms. This fact together with the generally unproductive nature of military expenditures, make it unlikely that this group of countries as a whole will be in a position to significantly expand military expenditures in the near future.

2. Characteristics of Latin American Arms Producers

More specifically, the main factors characterizing military and non-military producers in Latin America (Table 2) appear to be with respect to size, military activity, and access to foreign exchange, with the military producers being larger in terms of GNP, population and overall armed forces. They also appear to have greater access to foreign exchange as indicated by the relative size of their external public debt and growth (since 1970) in exports and imports.

Table 2. Characteristics of Latin American Arms and Non Arms Producers

Variables	Variable Means		
	Total Sample	Producers of Arms	Non Arms Producers
Size Variables (1982)			
GNP Per Capita	1861.4	2092.2	1688.3
Gross National Product	33961.9	72663.3	4935.8
Population	17.1	34.9	3.7
Area	65.6	1964.2	185.5
Industrial Labor Force	401.8	838.2	74.4
Labor Force	945.9	1941.5	199.3
Military Variables (1981)			
Armed Forces	65.6	133.4	14.8
Total Military Expenditures	571.2	1138.3	107.2
Military Expenditures % GNP	2.1	2.1	2.1
Military Expenditures Per Capita	39.7	47.8	32.9
Economic Variables			
Public External Debt, 1980	743.5	1521.3	160.2
Public External Debt, 1982	8041.9	16619.8	1608.5
Public External Debt % GNP, 1970	14.7	12.9	16.1
Public External Debt % GNP, 1982	35.8	24.8	44.2
Growth in Exports, 1960-1970	5.2	2.1	7.6
Growth in Exports, 1970-1982	2.3	4.5	0.8
Growth in Imports, 1970-1982	2.1	4.5	0.1

Note: Economic and size variables from: The World Bank, *World Development Report, 1982*; Military variables from United States Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers, 1972-1982*, (April 1984).

An examination of the evolution and development of arms industries in developing countries is suggestive of the type of economic variables that might be used to differentiate arms from non arms producers. In general the build up of domestic arms production capacities can be considered in terms of seven stages (Ayres 1983, pp. 255-259):

1. arms are imported, but are serviced and maintained domestically;
2. a license to produce arms is acquired and production facilities are built requiring huge technical and personnel assistance from the supplier;
3. production starts and to begin with involves local assembly of imported sub-assemblies;
4. the sub-assemblies are assembled locally from imported components and sometimes re-exported to the licensor;
5. components are manufactured locally from imported raw materials;
6. local production of raw materials;
7. complete indigenous production including design, raw materials and manufacturing.

Since military-industrial development appears to proceed through a series of evolutionary states, developing nations will remain dependent on the industrial nations for research and development, materials and production technology throughout the early stages of armament development. In fact, an examination of current arms producers indicates that the great majority are still in the early stages of development where the ability to finance high levels of imported technology and components are critical to the survival of the industry.

Structural difficulties and bottlenecks in the economies of the developing countries hamstring a policy of self-sufficiency. As long as domestic arms production is based on a weak industrial base, very large investments are required to initiate the design and production of the numerous components of modern weapon systems. Sub-optimal utilization of production capacity characterizes both the late-comer civil industries and arms production. Technological specialization leads to investments in highly diverse and only partly integrated production capacities; the limited demand of the armed forces results in over-sized factories and eventually substantial cost overruns. While foreign exchange requirements might be eased by producing a particular weapon system rather than import it, it seems likely that import of production technology for setting up industrial plants involves a drain on the balance of payments, which might be higher than the original savings (Wulf 1985, p. 341).

Of the Latin American countries, it appears that only Brazil has reached the stage of industrial arms

production where large scale imports are no longer necessary to sustain indigenous production (Evans 1986, pp. 103-108; Lock 1986, pp. 70-108; and Perry and Weiss 1986, pp. 103-118).

The nature and evolution of the arms industry, therefore suggests that for the vast majority of Latin American countries the ability to earn foreign exchange (or borrow external funds) may be of prime importance in assuring not only adequate resources for the initial establishment of the industry but also its continued operation through the importation of parts, components and raw materials, many of which may not be domestically produced.

Based on these considerations a number of economic variables depicting foreign exchange availability were selected for the discriminant analysis. From the discussion above, it would appear that arms producing countries would have to have large and sustained increases in their import capacity to maintain and or increase over time their level of indigenous arms production.

The results of the discriminant analysis of our sample of Latin American countries³ using different measures of size, military and economic variables confirm the importance of import capacity in differentiating arms from non arms producers. In fact it is apparent that economic variables related to foreign exchange availability were necessary and sufficient for the correct profiling (Looney and Frederiksen 1986a) of arms and non arms producers. That is, variables relating to size and military related measures were redundant and did not contribute to the profiling of the two groups of countries. In descending order (Table 3) the variables that were necessary and sufficient to differentiate arms from non arms producers in Latin America were: 1) growth in exports 1960-70, b) public external debt 1970, c) growth in imports 1960-70, d) gross international reserves 1982, and e) the current account balance 1970.

Table 3. Discriminant Analysis Latin American Arms, Non-Arms Producers

(probability of correct classification)

Arms Producer	Discriminating Variables					Non Producer	Discriminating Variables				
	I	II	III	IV	I		II	III	IV		
	EGA	EGA	EGA	EGA	GIRB		EGA	EGA	EGA	EGA	GIRB
	EGA	PDA	ZA	ZA	CAA		EGA	PDA	ZA	ZA	CAA
Venezuela	96.1	98.7	99.4	100.0		Nicaragua	98.5	100.0	100.0	100.0	
Mexico	78.1	100.0	100.0	100.0		Honduras	99.4	100.0	100.0	100.0	
Brazil	41.8*	100.0	100.0	100.0		Costa Rica	98.1	100.0	100.0	100.0	
Ecuador	85.4	57.5	97.9	99.1		Bolivia	98.3	99.9	100.0	100.0	
Colombia	87.4	99.0	98.3	100.0		Guatemala	97.6	100.0	100.0	100.0	
Dominican Republic	00.7	99.8	100.0	100.0		El Salvador	74.8	98.9	99.8	100.0	
Chile	97.2	100.0	100.0	100.0		Paraguay	60.2	96.7	98.3	100.0	
Argentina	71.8	99.5	97.4	100.0		Panama	99.0	100.0	100.0	100.0	
Peru	91.4	97.3	96.9	100.0		Uruguay	14.5*	37.8*	99.3	100.0	
						Jamaica	49.8*	94.2	99.7	100.0	
						Trinidad	49.8*	92.7	98.9	100.0	
Average	83.2	85.3	98.9	99.9		Average	76.2	92.7	98.9	100.0	

Order	Symbol	F statistic	Wilks' Lambda	Variable
1	EGA	19.7	0.46	Growth in exports 1960-1970
2	PDA	14.5	0.24	Public external debt 1970
3	ZA	3.5	0.20	Growth in imports 1960-1970
4	GIRB	3.9	0.15	Gross international reserves 1982
5	CAA	4.4	0.11	Current account balance 1970

Means

	Producer	Non Producer
Growth exports 1960-1970	2.2	7.4
Growth imports 1960-1970	5.4	7.0
Growth exports 1970-1982	4.2	0.7
Growth inputs 1970-1982	4.6	0.3
Public external debt 1970	1521.3	172.7
Public external debt 1982	16619.8	1608.7
Public external debt % GDP 1970	12.9	16.2
Public external debt % GDP 1982	24.8	40.5
Gross international reserves 1982	3896.2	793.4
Current account balance 1970	-285.4	-50.6

Note: *Represents incorrect classification.

To summarize, the results from the discriminant analysis suggest that (at least for Latin America):

1. while size and military expenditures are important in determining whether a country produces arms or not, these variables are not necessary and sufficient conditions for the establishment of a domestic arms industry;
2. the nature of the arms industry must dictate that a

certain economic environment be present for the initial profitability of an arms industry and its continued survival;

3. continued access to foreign exchange, given the nature of the import substitution process characterizing arms industries seems to be the most important factor in determining whether or not a country will produce arms.

It follows that whether or not arms production will significantly expand or not or whether new arms producers are established in the near future will depend largely on the individual country's ability to generate fairly high levels of foreign exchange needed to support this type of activity.

One may argue that this quantitative economic burden on the balance of payments (i.e., the amount of foreign exchange earnings used by the military) is minor when compared with the foreign exchange need to support higher levels of domestic investment and consumption, and that, in any case, indigenous defense production would reduce the overall amounts of foreign exchange used for military purposes.

As a basis of comparison, a recent study (Tehral 1982, pp. 255-259) on the foreign exchange costs of the Indian military indicated that, despite the explicit long term goal of minimizing the defense claim upon foreign exchange earnings in order to further economic growth, military claims on foreign exchange were certainly not negligible. It appears, for example, that total foreign exchange requirements for defense were equivalent in value to nearly half of the Indian imports of machinery and equipment. During the 1960-1970 decade, the level of these foreign exchange requirements oscillated between 8 per cent and 42 per cent of the deficit on the balance of payments with an average of about 20 per cent (Tehral 1982, p. 156). Similarly, Brzoska (1983, pp. 271-278) has estimated that 20-30 % of external public debt of developing countries in the late 1970s was due to military related imports.

From the analysis and discussion above it appears that the policy goals of:

1. reducing foreign political dependence through non-alignment;
2. building up a strong defense apparatus; and
3. minimizing the defense claim upon foreign exchange earnings to further economic growth prove to be incompatible for third world countries in general and Latin America in particular.

3. Prospects for Future Defense Production in Latin America

The discriminant analysis results discussed above indicated that existing Latin American defense producers could be largely characterized as countries capable of earning or attracting fairly large amounts of

foreign exchange, some of which could presumably be made available for financing and servicing a fairly foreign-input-intensive defense industry. Given the nature of the defense industry, there is little reason to believe that it will become less foreign exchange intensive in the near future. It follows, therefore, that potential producers of military equipment must be those countries who also have the ability to finance a large volume of imports for a fairly long and sustained time interval.

Based on the following brief survey of the debt/export potential of the region, it appears very unlikely that any new significant arms producer will be established in the region in the foreseeable future.

In fact, since 1981, Latin America as a whole, has been facing its worst economic and financial crisis since the depression of the 1930s. This crisis is marked by reduced production, exacerbated by the overall slowdown in the world economy in the first part of the 1980s, increased unemployment and the consequent waste of the economic potential of the countries of the region. In addition domestic inflation has accelerated in most of the Latin American countries, reaching its highest rate in the last three decades. In general the balance of payments position for most countries in the region are moving toward surplus simply because of lack of finance to increase imports, rather than any dramatic increase in over-all export earnings.

In fact the consensus based on the analysis of the leading international agencies (United Nations Economic Commission for Latin America, 1982; Inter-American Development Bank, 1984; and The International Monetary Fund, 1985) appears to be that the most burdensome aspect and, at the same time the primary cause of the current economic crisis, is the foreign debt problem. In many countries of the region, the growing costs of interest and amortization of foreign debt absorb a high proportion of the external payments capacity, virtually eliminating the possibility of development. In some cases, domestic adjustment measures have had to be taken, and special external resources have had to be mobilized to deal with the emergency situation (Kuczynski 1982/83, 1983).

But it is not the growth in the volume of the debt by itself that has brought on external problems; it is rather the deterioration in the debt structure and in the terms of interest and maturities which, in certain circumstances may place an excessive burden on the economies of the debtor countries (Cline 1982/83, p. 111).

In as much as external credit-worthiness is one of the principal factors limiting economic growth, two critical aspects of this process are the ability of the debtor countries to earn foreign exchange – through expansion of exports and or substitution of imports and the evolution of the world economy and international trade. From that point of view, external borrowing policy will have to be based on strict compliance of conditions of efficiency and financial compatibility in the use of external credit. Any diversion of resources to unproductive purposes or an excessive dose of short and medium term credit on the part of these countries will intensify the vulnerability of the balance of payments to an eventual liquidity crisis, participated by for example a drop in exports, a contraction in capital flows, or a deterioration in the terms of trade.

To understand the current situation and future prospects for the region, it is useful to break recent Latin American growth-debt patterns down into three significantly different phases of economic development (Inter-American Development Bank, 1984). In the first phase, from 1960-1974, a deliberate policy of accelerated economic growth prevailed, based on the dynamic expansion of private and public investment, increased domestic savings and the contribution of a modest, but significant amount of external savings.

The region's total gross domestic product experienced accelerated growth, with the average rate moving from 5.5 per cent in 1961-69 to 7.3 per cent in 1970-74. During this period, the external financing received showed a relatively balanced structure, with 42 per cent coming from official credits, 27 per cent from private credits and 31 per cent contributed by private capital in the form of direct investments. The financing terms for external credits were in general appropriate to the external payments capacity of the countries and the nature of the investment programs supported. This made it possible to maintain the foreign debt service at a relatively stable level of about 15 per cent of current export earnings.

The situation changed dramatically in 1974, when a slower economic growth trend – but still significantly than in the industrialized countries, became evident. The reduction in growth was combined with increasing balance of payments deficits and an elastic and unconditional supply of international private credit. This second stage of the Latin American economic experience, which extended to about 1980 was characterized by an expansionist policy of public and private consumption expenditures, moderate and irregular growth in fixed capital formation and an

increase in exports. The surplus of domestic demand over gross domestic product and its counterpart, the current account deficit of the balance of payments was sustained by easy access to international credit.

In the third phase, which began between 1981 and 1982, most Latin American countries adopted adjustment and stabilization policies designed to reduce domestic spending and curb the balance of payments deficit (Williamson 1983). Data presented by the Inter-American Development Bank (1984) show that the reduction in investment expenditures in 1982 and 1983 exceeded the drop in consumption and was a major factor in bringing about the decline of gross domestic product in those two years. The reduction in imports resulting from the adjustment policies generated a growing trade surplus, and substantially reduced the current account deficit in the balance of payments in 1982 and 1983. However, serious reservations (Balogh 1982; Girvan, Bernal and Hughes 1980) have been expressed about the significance and effectiveness of these adjustment policies, particularly regarding their effects on the incipient economic recovery of the industrialized countries. In general, such reservations emphasize the practical impossibility of all countries successfully attaining the objective of increasing their exports and at the same time reducing their imports.

With this background and in terms of the future, a series of detailed forecasts for the region up to 1990 have been undertaken by the Inter American Development Bank (1984b).

Under alternative economic growth scenarios produced by the Bank, it would appear that interest on foreign debt will continue to be a heavy burden on export income and the main determinant of the current account deficit in the balance of payments.

For example, under a low growth scenario, with a gross domestic product increase of about 2.7 per cent per year (equivalent to population growth) and expansion of the region's exports at a rate of about 11 per cent a year – the prospects are relatively favorable. In this scenario, the drain on export earnings caused by the debt interest payments tends to decline. The projected economic picture assumes the continuation of disciplined public and private expenditure policies that will make it possible to maintain a moderate import growth which, together with a vigorous expansion in exports, would lead to an increased foreign trade surplus. The Bank's simulation exercise shows, however, that the growing trade surplus would reach the level of interest payments only at the end of this decade. If, in addition, a low foreign debt growth rate

of 4 per cent annually is attained, the net transfer of foreign savings received by the region would continue to be negative and growing in the upcoming years. Certainly, the rate of growth of real imports would in no way approach the levels reached by the arms producers in the 1970-82 period.

Under the alternative scenario of a 5.4 per cent annual economic growth rate and with the same conditions of export expansion assumed in the previous scenario, imports would rise faster, and the trade surplus would decline. The viability of this growth scenario depends, among other things on the unlikely possibility of the Latin American countries being able to attract a growing net external financing estimated at \$73 billion toward the end of the decade (which would be more than double the net disbursement of foreign loans in 1982).

Again given the fact that the non-military producing countries already have a higher debt burden (Table 1) in terms of external debt/GNP, it seems highly unlikely that major inflows of external funds will be directed to any of the members of this group of countries, especially if one of the intended uses of the additional inflow of funds was to establish a domestic armament industry.

In summary, analysis of the process by which foreign debt has accumulated in Latin America indicates clearly the constraints imposed by foreign debt on the prospects for the region's economic development. Even under conditions of low economic growth assumed in the first scenario, the foreign exchange earnings generated by exports would only cover interest payments and imports of consumer goods and intermediate inputs. The cost of merchandise and capital imports would have to be supported by the new inflow of external savings. All of this also assumes that the international financial community will respond favorably to the need for long time refinancing of debts maturing in the coming years, a rather heroic assumption given the existing near default position of most of the countries in the region.

4. Conclusions - Implications

The main conclusions together with their implications of the analysis above is that:

1. whether a country in Latin America is or is not a producer of at least one major weapons system can be explained largely by the economic environment of that country;

2. access for foreign exchange to finance a relatively high rate of growth of imports appears to be a major determinant of whether or not a country will be a military producer;
3. based on the evolution of the current debt situation and the export prospects for the region, it is highly unlikely that any individual country (either an existing producer or non-producer of armaments) will be able to finance imports on the scale experienced in the 1970-82 period, at least for the rest of this decade;
4. reinforcing this general trend towards austerity and reduced import capacity is the fact that the non-military producer countries in Latin America are also those countries who appear to have less access to foreign exchange due to poor export prospects and or higher debt service burdens;
5. it follows that we can anticipate no new Latin American arms producers, at least for the period up to 1990, and most likely for some years later.

Notes

1. Others are: Wilfetal (1980), Harkavy (1975), and Peleg (1980). Recently, a number of excellent case studies and country analyses have appeared. See for example the essays in: Tuomi and Väyrynen (1983), Ball and Leitenberg (1983), Brzoska and Ohlson (1986), and Katz (1984 and 1986).
2. Here producers are defined as those countries producing at least one major weapons system (Neuman 1984, p. 175). Obviously this is somewhat arbitrary, but this definition is essentially the same as that used by Wulf (1985, pp. 332-335).
3. Country economic data were taken from the World Bank (1984, 1985 and 1986); Military variables were taken from the United States Arms Control and Disarmament Agency (1987).

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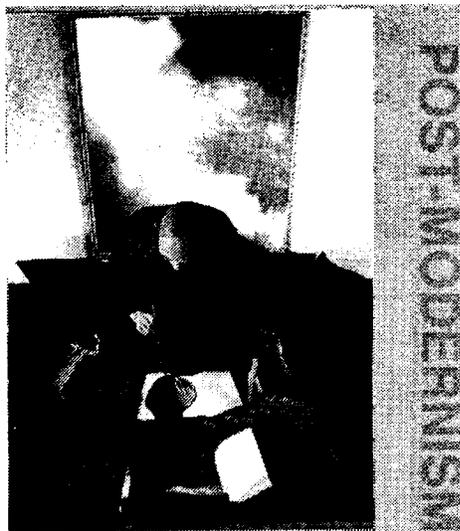
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