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THE ARGENTINE CIGARETTE INDUSTRY:
TECHNOLOGICAL PROFILE AND BEHAVIOUR

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PROLOGUE

The IDB/ECLA Program on Research into Science and Technology has directed its principal efforts towards the analysis of technological innovative and adaptive activities within the framework of the development of branches of industry in various Latin American countries.

The present monograph is a preliminary study of the problems of the technological behavior of the cigarette industry. Carried out within the scope of the IDB/ECLA Program, this study uses a technico-economic approach which the authors are to employ later for their two research programs. One, concerning the consequences for regional income distribution of the industrialisation of tobacco, and another on the multinationals in the tobacco industries of Argentina, Colombia and Peru.

This paper does not claim to exhaust the subject of technological change and the role played by adaptive activity and innovation in the industry, but rather to demonstrate a particular behavior and suggest some explanations for it.

Finally, it should be emphasised that the work involved in this paper has been possible due to the contributions of the Consejo Latinoamericano de Ciencias Sociales (CLACSO) and the Social Science Research Council.

Buenos Aires, December 1976

I. INTRODUCTION

A peculiarity of this productive sector is that there are few studies which examine in depth its economic and technological characteristics. We must go back 25 years to find a paper which fully analyzed them. During this lapse of time great changes and technical progress have taken place.

The first thing that stands out when one speaks of the cigarette industry is the small number of firms in all countries which make this product. Usually there are no more than 5 or 6 firms. If we take only Latin America, the progressive penetration of corporations of three nationalities stands out: North American, English and German, the first being the most important. The 1960's marks the period of expansion of American subsidiaries and of their links with domestic firms through licences for the use of internationally recognised brands.

Another impressive characteristic is the rapid transformation of the taste of the region's smokers. This is shown by the adoption of norms of consumption which imitate those existing in countries with different customs and character. Smoking strong non-filter cigarettes of local brands is no longer the most natural thing to do; rather, the majority of the population prefers those products they began to know through the typical world-wide cultural diffusion media.

When we begin to go more deeply into aspects not obvious at first sight, we realise that the productive equipment and the technical capacity for production are not very complex. Even though the manufacturing establishments are of a considerable size and have large amounts of machinery, it is feasible to carry out the manufacture of cigarettes on a small scale with a limited capital investment and with few workers. Expenditure on advertising and the ability of the marketing team, that is, skill in persuading the consumer and increasing the number of purchasers, are some of the factors which prevent the existence of a larger number of firms.

When we see the cost of manufacturing a cigarette, we realise that the price of the tobacco is not the only relevant one and that all these costs which provide a better and more attractive presentation of the product itself have an important influence.

When we began to visit the factories (*), we were faced with a real situation which was in contrast with our preconceived ideas. We expected to find very modern and sophisticated plants, with a high degree of automation and little labour involved in the process. But the first glance told us that the machines were rather old, most of them had undergone adaptations and technical improvements generated in the plant itself, and the manual operations and skill of the workers and the technical staff stood out.

When we reached this point, innumerable questions were raised; the answers to some of them are to be found in the course of this paper. Others, however, still stand and we believe that they will gradually be elucidated to the extent that our research is able to continue (**).

(*) Due to problems of time we were not able to visit either the manufacturing plant of Manufactura de Tabacos Imparciales S.A., in Goya, Corrientes, or the Massalín & Celasco establishment which has recently come into production in Salta. For the reasons given, the technological profile and other data on machinery refer to the four plants situated in the Federal Capital, which can be considered representative of the sector, since they manufacture about 90% of total production.

(**) We thank the managers and technical staff of the following firms for their cooperation and the information supplied: Massalín & Celasco S.A.C.I., Manufactura de Tabacos "Particular" V.F. Grego S.A., Manufactura de Tabacos Piccardo y Cía Ltda. and Cía Nobleza de Tobacos S.A.

II. CHANGES IN THE PATTERN OF CONSUMPTION

Tobacco consumption has undergone significant changes in the last thirty or forty years, both on a world scale and in the Argentine context. Four important phenomena characterise this long-term development, the ultimate consequence of which has been the discarding of certain forms of tobacco consumption and the firm introduction of the cigarette as the end product.

The four structural characteristics referred to are:

- A) Of the products made from tobacco, cigarettes show the highest and increasing consumption, while that of others has declined. That is, there has been a shift from consumption of tobacco in the form of cigars, pipe tobacco, snuff, tobacco for chewing, etc. to its consumption as cigarettes.
- B) An important change in demand for types of tobacco, chiefly the shift from dark to light tobacco. This process is associated with the greater demand for cigarettes instead of other forms of tobacco.
- C) Within overall cigarette sales, a change from the consumption of non-filter to filter cigarettes.
- D) A similar change has occurred with the size of cigarettes consumed, that is, a shift from short to longer cigarettes.

As we shall see in the following section, all and every one of these new patterns of consumption were assimilated by the Argentine market, which shows both the change from other products to cigarettes, and the shift from short, non-filter cigarettes made of dark tobacco to long, filter cigarettes made of light tobacco.

We shall now look at each one of these changes in greater detail.

- A) Process of shift of consumption from other tobacco products to cigarettes.

World wide (Table II.1), the share of cigarettes in total tobacco consumption has grown from 35% in the five-year period 1935-39 to 75% in 1968. This process shows similar characteristics in the case of the United States market (Table II.2), since the consumption of other tobacco products has dropped between the five-year periods 1925-29 and 1965-69 from 63% to 18.4%.

The data referring to Argentina (Table II.3) show that the shift in consumption during the last three decades has been more marked than in the United States, and that, at the present time,

TABLE N° II.1

World Consumption of Tobacco in Cigarettes and other Forms
Average 1935-39, 1956 and 1968

(in thousand million pounds and percentages)

| YEAR | Cigarettes | | Other Products | | Total of Tobacco Consumption |
|-----------|------------|------------------|----------------|------------------|------------------------------|
| | Quantity | Percentage Share | Quantity | Percentage Share | |
| Average | | | | | |
| 1935-39 * | 1.19 | 35 | 2.21 | 65 | 3.40 |
| 1956 * | 2.94 | 70 | 1.26 | 30 | 4.20 |
| 1968 | 6.50 | 75 | 2.17 | 25 | 8.67 |

*/ Not including the Soviet Union and the People's Republic of China.

Source: Years 1935-39 and 1956: U.S. Department of Agriculture, Foreign Agricultural Service, World Tobacco Analysis-Consumer Marketing FAS Report N° 107, February 1958, pp. 16-17; Year 1968: Foreign Agricultural Tobacco Circular, FT 4-68, September 1968, p. 1.

TABLE N° II.2

Per Capita Tobacco Consumption (18 years and over)
of Cigarettes and other Products, in the United States
Five-Year Averages 1925-29 to 1970-74

(in number of cigarettes, pounds and percentages)

| Five-Year Averages | N° per Capita | Cigarettes | | Other Products | | Total Tobacco Consumed (in pounds per capita) |
|--------------------|---------------|-------------------|------------------|-------------------|------------------|-----------------------------------------------|
| | | Pounds per Capita | Percentage Share | Pounds per capita | Percentage Share | |
| 1925-29 | 1,285 | 3.56 | 36.8 | 6.12 | 63.2 | 9.68 |
| 1930-34 | 1,389 | 3.82 | 43.4 | 4.98 | 56.6 | 8.80 |
| 1935-39 | 1,779 | 4.81 | 52.2 | 4.41 | 47.8 | 9.22 |
| 1940-44 | 2,558 | 6.97 | 64.1 | 3.91 | 35.9 | 10.88 |
| 1945-49 | 3,459 | 9.38 | 75.3 | 3.08 | 24.7 | 12.46 |
| 1950-54 | 3,695 | 9.98 | 79.1 | 2.63 | 20.9 | 12.61 |
| 1955-59 | 3,806 | 9.39 | 80.2 | 2.32 | 19.8 | 11.71 |
| 1960-64 | 4,248 | 9.62 | 81.6 | 2.17 | 18.4 | 11.79 |
| 1965-69 | 4,201 | 8.82 | 81.6 | 1.99 | 18.4 | 10.81 |
| 1970-74 | 4.071 | 7.86 | 82.2 | 1.70 | 17.8 | 9.56* |

Source: U.S. Department of Agriculture, Economic Research Service, Tobacco Situation TS-133, September 1970, Table 2, p.7 and TS-159, March 1977, p.5.

*/ The drop in per capita consumption (both in the quantity of cigarettes and in the total amount of tobacco) is not the result of a lower demand for tobacco products, although there has been a slight reduction in the number of cigarettes consumed up to 1974. The reason for the large fall in tobacco consumption in pounds per capita has been the use of certain raw material-saving technologies. Manufacturing processes such as "puffing", tobacco "sheet", etc, have reduced the amount of tobacco required for manufacture, and the increase in consumption of filter cigarettes involves a lower fibre content.

TABLE Nº II.3

Estimated Annual Tobacco Consumption in Cigarettes
and other Products, in Argentina

Period 1945-1974
(in tons of processed tobacco and percentages)

| Year | Cigarettes * | | Other Products | | Total Tobacco Consumed (in tons) |
|------|--------------|------------------|----------------|------------------|-------------------------------------|
| | Tons | Percentage Share | Tons | Percentage Share | |
| 1945 | 15,288 | 71.5 | 6,100 | 28.5 | 21,388 |
| 1946 | 16,559 | 73.3 | 6,040 | 26.7 | 22,599 |
| 1947 | 18,438 | 75.5 | 5,980 | 24.5 | 24,418 |
| 1948 | 19,365 | 76.6 | 5,920 | 23.4 | 25,285 |
| 1949 | 20,473 | 77.9 | 5,813 | 22.1 | 26,286 |
| 1950 | 19,864 | 77.7 | 5,700 | 22.3 | 25,564 |
| 1951 | 19,996 | 78.2 | 5,590 | 21.8 | 25,584 |
| 1952 | 21,713 | 79.9 | 5,470 | 20.1 | 27,183 |
| 1953 | 21,955 | 80.3 | 5,382 | 19.7 | 27,337 |
| 1954 | 21,819 | 80.6 | 5,238 | 19.4 | 27,057 |
| 1955 | 23,242 | 82.0 | 5,098 | 18.0 | 28,346 |
| 1956 | 23,711 | 82.7 | 4,958 | 17.3 | 28,669 |
| 1957 | 23,875 | 83.2 | 4,819 | 16.8 | 28,694 |
| 1958 | 24,900 | 84.2 | 4,678 | 15.8 | 29,578 |
| 1959 | 24,795 | 84.7 | 4,488 | 15.3 | 29,283 |
| 1960 | 26,020 | 84.5 | 4,771 | 15.5 | 30,791 |
| 1961 | 27,522 | 85.5 | 4,668 | 14.5 | 32,190 |
| 1962 | 26,717 | 85.1 | 4,677 | 14.9 | 31,394 |
| 1963 | 26,721 | 85.5 | 4,544 | 14.5 | 31,265 |
| 1964 | 29,067 | 86.6 | 4,495 | 13.4 | 33,562 |
| 1965 | 27,641 | 86.1 | 4,453 | 13.9 | 32,094 |
| 1966 | 29,253 | 85.7 | 4,879 | 14.3 | 34,132 |
| 1967 | 28,776 | 85.1 | 5,035 | 14.9 | 33,811 |
| 1968 | 30,932 | 86.6 | 4,774 | 13.4 | 35,706 |
| 1969 | 32,568 | 86.9 | 4,928 | 13.1 | 37,496 |
| 1970 | 33,330 | 88.0 | 4,558 | 12.0 | 37,888 |
| 1971 | 32,336 | 89.2 | 3,934 | 10.8 | 36,270 |
| 1972 | 33,808 | 88.8 | 4,269 | 11.2 | 38,077 |
| 1973 | 35,500 | 89.9 | 4,004 | 10.1 | 39,504 |
| 1974 | 39,336 | 90.7 | 4,017 | 9.3 | 43,353 |

*/ Includes home-produced light and dark tobacco cigarettes and an estimate of imported light tobacco cigarettes, at 20 grams per packet.

Source: Calculated from data from the Departamento de Tabaco de la Secretaría de Estado de Agricultura y Ganadería y el Instituto Nacional de Estadística y Censos (INDEC).

TABLE N° II.4

World Production of Light and Dark Tobaccos
(in millions of tons and percentages)

| PERIOD | LIGHT TOBACCOES | | DARK TOBACCOES | | TOTAL PRODUCTION |
|--------------------|-----------------|------------------|----------------|------------------|------------------|
| | Quantity | Percentage Share | Quantity | Percentage Share | |
| Average 1935-39 | 1,489 | 49.6 | 1,512 | 50.4 | 3,001 |
| Average 1955-59 | 2,504 | 64.9 | 1,357 | 35.1 | 3,861 |
| 1966 | 3,167 | 69.9 | 1,367 | 30.1 | 4,534 |
| Average 1969-73 | 3,327 | 72.4 | 1,266 | 27.6 | 4,593 |
| 1974 | 3,837 | 74.3 | 1,325 | 25.7 | 5,162 |
| 1975 | 4,029 | 76.0 | 1,274 | 24.0 | 5,303 |

Source: B.C. Akehurst, Tobacco, London: Longmans, Green, 1968, p.29 and United States Department of Agriculture, Foreign Agriculture Circular, FT 6-75, December, 1975, p.5.

more than 90% of processed tobacco goes into the manufacture of cigarettes.

B) Marked tendency towards the consumption of light instead of dark tobaccos, as can be seen in Table II.4.

This change in the type of tobacco consumed is closely related to the shift from consumption of other products to cigarettes, since the former are always made of dark tobaccos. This link is clear from a comparison of Tables II.1 and II.4.

Since their introduction in the last century, the first cigarettes were almost always made of light tobaccos, chiefly from the East (Turkish tobacco) and later on Virginia and Burley tobaccos were incorporated 1/.

1/ The first cigarettes introduced into Europe and the United States about 1860 came from the Middle East (Egypt), Turkey and Greece. They were made from Oriental tobacco and for many years were considered the best in almost all countries in the world. On the origin of the cigarette and the development of Virginia tobacco see N. M. Tilley, The Bright Tobacco Industry, 1860-1929, University of North Carolina Press, Chapel Hill, 1948, pp.501-10.

Higher consumption of tobacco in the form of cigarettes is not only a result of the greater ease involved for the smoker, but it also depends on their milder taste 2/. Taking into consideration that light tobaccos are, in general, milder, it is logical to deduce that the change from other products to cigarettes is connected with that from dark to light tobaccos.

Given the identification of cigarettes with light, mild tobaccos 3/, consumption of cigarettes made from dark tobaccos has always been a minority taste throughout the world, although it has enjoyed importance locally in Latin countries such as Spain, Portugal, France and their ex-colonies in Latin America and Africa. Nevertheless, these countries have not escaped the changes mentioned and, although it was resisted for many years, the change to light tobaccos has been evident during approximately the last 3 or 4 decades 4/. In many Latin American countries the economic

2/ See Richard B. Tennant, The American Cigarette Industry, Yale University Press, New Haven, 1950. Especially "Factors Responsible for the Growth in Cigarette Consumption", pp.136-42.

3/ The three most internationally known blends are of light tobaccos:

- "Turkish Blend". The oldest of the blends, it is based on tobaccos from Turkey and Greece, such as Xanth, Kavalla, Izmir. It is the third most important in world production.
- "English Blend". At the moment, this is the second in importance in the world. Usually the blend contains only Virginia tobacco (flue-cured), with very little moisture or essences.
- "American Bland". This is the blend which sells most in the world, partly because of the high consumption in the United States and Canada. It contains approximately 50% to 60% Virginia tobacco, 30% to 40% Burley tobacco, 2% to 3% Maryland tobacco and 5% to 10% Turkish tobacco, blended with essences and molasses. See Phil Shepherd, A Primer on Tobacco Types and Cigarette Blends, Mimeo, July, 1975.

4/ See, for example, the comments by J. Barnard Gibbs, Tobacco Trade with Latin America, U.S. Dept. of Agriculture, Office of Foreign Agricultural Relations, FS-82, June, 1940 and George W. Van Dyne, Trends in Latin America Affecting United States Trade in Tobacco, U.S. Dept. of Agriculture, Office of Foreign Agricultural Relations, FS Report N° 38, August, 1949.

policy of import substitution encouraged the development of a domestic cigarette industry using dark tobaccos and, in some cases, state monopolies ^{5/}. In those countries where there were very high tariff barriers and/or state monopolies (such as Peru, Colombia and Chile), consumption of dark tobacco cigarettes remained predominant till the 1960's, when a rapid change in taste to light tobaccos occurred.

In Argentina, the process of change to these new patterns of consumption dates from an earlier period, since light tobacco (mostly imported, however) cigarettes had begun to be manufactured in this country in the 1920's. The presence of a foreign firm, the British-American Tobacco Co. Ltd. (Compañía Nobleza de Tabacos S.A.), meant that the introduction here of cigarettes made of light tobaccos occurred prior to many other Latin American countries.

As appears in Table II.5, domestically-produced mild cigarettes already had a 27.4% share of the market in 1945 ^{6/}. As can be seen in that Table, the consumption of mild cigarettes continued to grow steadily till it reached the 75.4% shown in 1975. This last percentage does not take into consideration the increasing share of mixed tobaccos with about 50% dark and 50% light tobacco content.

Without further analysis for the moment, it is interesting to note that, despite the fact that it began more than fifty years ago, the change from dark to light tobaccos has been somewhat slower in Argentina. Two kinds of observations arise from this fact: on the one hand, the continued preference for strong cigarettes which, up to the mid-sixties, accounted for 50% of total

^{5/} State monopolies were very important in the colonial period and in the economic history of the last century, especially in Colombia, Mexico, Brazil and Peru. See Stanley J. Stein and Barbara H. Stein, The Colonial Heritage of Latin America: Essays on Economic Dependence in Perspective, Oxford University Press, New York, 1970, pp.100-101 and William P. McGreevey, An Economic History of Colombia 1845-1930, Cambridge University Press, Cambridge, 1971, pp.23-40 and 98-118.

^{6/} Mild home-produced cigarettes held 27.4% of the market in physical volume. Given that these have always been sold at higher average prices than strong cigarettes, their percentage share in value should be even greater. Furthermore, in 1945, 15.7 million packets were imported (almost all mild), which would give a consumption of 29.2% of the market.

TABLE Nº II. 5
Argentina: Annual Sales of Domestically-Produced Cigarettes
Grouped by Type of Tobacco

(In thousands of packets of 20 cigarettes)

| Year | Sales of Cigarettes | | | Percentage Share | | | |
|------|---------------------|-----------|-------------|------------------|-------|-------------|------|
| | Total | Light | Mixed Blend | Dark | Light | Mixed Blend | Dark |
| 1945 | 644,649 | 176,826 | | 467,823 | 27.4 | | 72.6 |
| 1946 | 696,048 | 193,078 | | 502,970 | 27.7 | | 72.3 |
| 1947 | 762,451 | 207,442 | | 555,009 | 27.2 | | 72.8 |
| 1948 | 819,460 | 241,378 | | 578,082 | 29.5 | | 70.5 |
| 1949 | 889,854 | 282,020 | | 607,834 | 31.7 | | 68.3 |
| 1950 | 875,990 | 318,664 | | 557,326 | 36.4 | | 63.6 |
| 1951 | 889,582 | 349,100 | | 540,482 | 39.2 | | 60.8 |
| 1952 | 968,003 | 404,340 | | 563,663 | 41.8 | | 58.2 |
| 1953 | 992,011 | 477,349 | | 519,162 | 48.1 | | 51.9 |
| 1954 | 974,917 | 496,506 | | 478,411 | 50.9 | | 49.1 |
| 1955 | 1,047,091 | 527,058 | | 520,032 | 50.3 | | 49.7 |
| 1956 | 1,068,342 | 523,948 | | 544,394 | 49.0 | | 51.0 |
| 1957 | 1,096,677 | 544,887 | | 551,790 | 49.7 | | 50.3 |
| 1958 | 1,118,435 | 559,138 | | 559,297 | 50.0 | | 50.0 |
| 1959 | 1,166,611 | 528,898 | | 637,713 | 45.3 | | 54.7 |
| 1960 | 1,081,755 | 500,436 | | 581,319 | 46.3 | | 53.7 |
| 1961 | 1,161,176 | 587,310 | | 573,866 | 50.6 | | 49.4 |
| 1962 | 1,174,474 | 557,013 | | 617,461 | 47.4 | | 52.6 |
| 1963 | 1,188,909 | 589,091 | | 595,818 | 49.7 | | 50.3 |
| 1964 | 1,256,243 | 631,958 | | 624,285 | 50.3 | | 49.7 |
| 1965 | 1,247,717 | 652,974 | | 594,743 | 52.3 | | 47.7 |
| 1966 | 1,206,538 | 668,477 | | 538,061 | 55.4 | | 44.6 |
| 1967 | 1,241,295 | 743,536 | | 497,759 | 59.9 | | 40.1 |
| 1968 | 1,306,588 | 878,900 | | 427,688 | 67.3 | | 32.7 |
| 1969 | 1,376,201 | 973,109 | 39,108 | 363,984 | 70.7 | 2.9 | 26.4 |
| 1970 | 1,467,382 | 1,051,345 | 64,380 | 351,657 | 71.6 | 4.4 | 24.0 |
| 1971 | 1,509,249 | 1,081,121 | 84,084 | 344,044 | 71.6 | 5.6 | 22.8 |
| 1972 | 1,595,092 | 1,146,852 | 113,328 | 334,912 | 71.9 | 7.1 | 21.0 |
| 1973 | 1,675,514 | 1,193,750 | 167,316 | 314,448 | 71.2 | 10.0 | 18.8 |
| 1974 | 1,890,670 | 1,367,781 | 229,740 | 293,149 | 72.3 | 12.2 | 15.5 |
| 1975 | 1,907,852 | 1,438,388 | 225,876 | 243,588 | 75.4 | 11.8 | 12.8 |

Source: Drawn up from data from the Departamento de Tabaco de la Secretaría de Estado de Agricultura y Ganadería.

sales. On the other hand, it is important to understand that the acceleration in change of taste which takes place in the period 1964-66 coincides with the entry of several international firms into the industry. This confirms these firms' capacity to manipulate demand by means of advertising or other strategies which will be analyzed later on in this monograph.

There are two other changes in cigarette consumption which have also appeared in the Argentine case.

C) Change from non-filter to filter cigarette consumption.

As can be seen from Table II.6, world expansion of filter cigarette production has been very significant from 1955 onwards. While in that year in only two countries did filter cigarettes account for more than 50% of sales and/or production, in 1971 this was the case in 53 countries.

TABLE Nº II.6

Growth of the Share of Filter Cigarettes in World Production, 1955-1975
(in number of countries)

| YEAR | PERCENTAGE SHARE | | | |
|------|------------------|-----------|-----------|---------------|
| | 10 to 25% | 26 to 50% | 51 to 75% | more than 75% |
| 1955 | 4 | 0 | 2 | 0 |
| 1956 | 4 | 2 | 2 | 0 |
| 1957 | 4 | 4 | 2 | 0 |
| 1958 | 3 | 7 | 1 | 1 |
| 1959 | 8 | 6 | 4 | 1 |
| 1960 | 11 | 4 | 6 | 2 |
| 1961 | 16 | 7 | 6 | 4 |
| 1962 | 18 | 10 | 4 | 7 |
| 1963 | 17 | 13 | 6 | 7 |
| 1964 | 17 | 19 | 6 | 8 |
| 1965 | 17 | 20 | 9 | 8 |
| 1966 | 10 | 22 | 14 | 11 |
| 1967 | 7 | 22 | 16 | 15 |
| 1968 | 6 | 18 | 21 | 17 |
| 1969 | 4 | 13 | 27 | 20 |
| 1970 | 6 | 10 | 26 | 25 |
| 1971 | 8 | 8 | 26 | 27 |
| 1972 | 9 | 10 | 20 | 32 |
| 1973 | 9 | 9 | 16 | 37 |
| 1974 | 4 | 9 | 16 | 42 |
| 1975 | 4 | 8 | 15 | 44 |

Source: U.S. Department of Agriculture, Foreign Agricultural Service, Foreign Agriculture Circular Tobacco, FT-15-63, July, 1963; FT-4-67, September, 1967; FT-5-72, October, 1972 and FT-3-76, July, 1976.

Like all the previously mentioned changes, this one also occurred in Argentina, as can be deduced from Table II.7. When the first acetate filter cigarette was introduced in 1960, it held only 5% of the market, while 15 years later this type of cigarette had achieved more than 98% of the market.

TABLE N° II.7

Growth of the Percentage Share of Filter Cigarettes in the Argentine Market.
1960 - 1975
 (in percentages)

| YEAR | % |
|------|------|
| 1960 | 5.0* |
| 1961 | 8.1 |
| 1962 | 16.7 |
| 1963 | 27.0 |
| 1964 | 36.1 |
| 1965 | 48.8 |
| 1966 | 59.5 |
| 1967 | 67.9 |
| 1968 | 76.4 |
| 1969 | 83.0 |
| 1970 | 87.3 |
| 1971 | 90.4 |
| 1972 | 92.8 |
| 1973 | 94.5 |
| 1974 | 96.7 |
| 1975 | 98.1 |

*/ Estimated by Foreign Agricultural Service

Source: 1960-62: U.S. Dept. of Agriculture, Foreign Agricultural Service, Foreign Agriculture Circular, FT-6-65, September, 1965; 1963-1975: Cámara de la Industria del Cigarrillo.

D) Shift from short (70 mm) to longer (85, 100 and 120 mm) cigarettes.

Although there are no precise data on this shift world wide, the United States' experience is a good example. As can be seen in Table II.8, in 1954 70mm cigarettes (mainly non-filter) made up 64.7% of the country's total consumption, and the longest (80-85 mm) made up only 35.3%. Ten years later this ratio had changed completely, the respective percentages of the market being 21 and

TABLE N° II.8

Growth of Percentage Share by Size of Cigarette in the United States
1954 - 1976

(physical volume)

| YEAR | 70 mm ("Regular") | 85 mm* ("Long and King") | 100 mm ("Extra Long") | 120 mm |
|------|----------------------|--------------------------------|-----------------------------|--------|
| 1954 | 64.7 | 35.3 | | |
| 1955 | 56.6 | 43.4 | | |
| 1956 | 49.8 | 50.2 | | |
| 1957 | 42.6 | 57.4 | | |
| 1958 | 37.4 | 62.6 | | |
| 1959 | 33.6 | 66.4 | | |
| 1960 | 30.7 | 69.3 | | |
| 1961 | 28.7 | 71.3 | | |
| 1962 | 26.5 | 73.5 | | |
| 1963 | 23.7 | 76.3 | | |
| 1964 | 21.0 | 78.9 | 0.1 | |
| 1965 | 18.6 | 81.0 | 0.4 | |
| 1966 | 16.3 | 81.8 | 1.9 | |
| 1967 | 13.9 | 76.5 | 9.6 | |
| 1968 | 12.1 | 74.7 | 13.2 | |
| 1969 | 11.0 | 73.5 | 15.5 | |
| 1970 | 9.3 | 72.7 | 18.0 | |
| 1971 | 8.3 | 72.1 | 19.6 | |
| 1972 | 7.6 | 71.4 | 21.0 | |
| 1973 | 7.1 | 71.8 | 21.1 | |
| 1974 | 6.1 | 70.1 | 23.8 | |
| 1975 | 5.5 | 68.9 | 24.2 | 1.4 |
| 1976 | 5.0 | 69.8 | 23.3 | 1.9 |

*/ Includes 80 mm with and without filter, which achieved 12% of the market in 1958, but which recently have been much less significant.

Source: United States Department of Agriculture, Economic Research Service, Tobacco Situation, TS-119, March, 1967; TS-135, March 1971; TS-147, March, 1974; TS-155, March 1976 and TS-159, March 1977.

78.9. In 1964, the 100 mm size appeared and, although in that year it held only a 0.1% share, its subsequent growth was very significant, reaching 24.2% of the market in 1975 1/. Meanwhile, short cigarettes continued to decline and reached 5.0% in 1978.

These changes have also occurred in the cigarette market in Argentina, although some years later. Unfortunately, full information does not exist to make a detailed comparison of this process possible. However, Table II.9 shows an Argentine market behavior rather similar to that of the United States. The shift from short to long cigarettes has been even more marked in Argentina.

To sum up: the historical behavior of tobacco consumption in Argentina reflects similar tendencies to those observed in the world context. Thus, while in 1945 cigarettes held 71.5% of the market, today the proportion exceeds 90%. In 1945 cigarettes made from dark tobaccos made up 72.6% of sales, thirty years later light tobacco cigarettes made up 75.4% and those made from dark tobaccos only 12.8%. The same thing happened with consumption of filter cigarettes: in 1960, when they were first introduced, they made up approximately 5%, while in 1975 they already showed 98.1% of sales. Finally, with regard to size, in 1963 70 mm cigarettes constituted 71.3% of the market, while in 1976 they have accounted for only 1.1% of consumption.

It is not only feasible to see that Argentina has assimilated all and every one of the changes which have appeared on the world scene, but also a relative acceleration in the process of spread and adoption of these changes can be observed in Table II.10.

At the beginning of the century, there was a lag of about 25 years between the introduction of mechanical technology into cigarette manufacture in the United States and the same kind of production in Argentina. Recently there was only one year between the production of 120 mm cigarettes in the United States and their manufacture in this country.

1/ The drop in sales of 100 mm cigarettes observed in 1975, may have been the result of various factors. In the first place, it may be the result of an insignificant temporary trend or of the launching of even longer cigarettes (120 mm). But perhaps the most relevant fact is the higher consumption of low nicotine and tar content cigarettes, which were almost all 85 mm. This may indicate a new medium-term trend, with a consequent improvement in sales of 85 mm and even short (70 mm) filter cigarettes, in spite of the fact that in 1975 some brands of low nicotine/tar 100 mm cigarettes appeared.

TABLE N° II. 9

Argentina. Calculation of the Percentage Share of Different Sizes
of Cigarettes in Total Sales. 1963 - 1976
(physical volume)

| Year | 70 mm (Standard) | 85 mm (a) (Long) | 100 mm (Extra Long) | 120 mm |
|---------|---------------------|---------------------|------------------------|--------|
| 1963 | 71.3 | 28.7 | | |
| 1964 | 62.3 | 37.7 | | |
| 1965 | 49.5 | 50.5 | | |
| 1966 | 38.5 | 61.4 | | |
| 1967 | 30.0 | 70.0 | | |
| 1968 | 21.5 | 61.5 | 17.0 | |
| 1969(b) | 15.3 | 67.8 | 16.9 | |
| 1970(b) | 11.3 | 77.7 | 11.0 | |
| 1971(c) | 8.5 | 79.4 | 12.1 | |
| 1972 | 6.2 | 73.1 | 20.7 | |
| 1973 | 4.7 | 68.7 | 26.7 | |
| 1974 | 3.0 | 62.3 | 34.7 | |
| 1975 | 1.8 | 57.8 | 40.4 | |
| 1976(d) | 1.1 | 68.5 | 29.8 | 0.6 |

Notes: (a) Includes 80 mm and 90 mm cigarettes.

(b) Cigarette sales during June of the year shown.

(c) Cigarette sales during December.

(d) Cigarette sales during July.

Source: Authors' calculations from data from the Cámara de Industria del Cigarillo and from the Gaceta Financiera.

As we shall see later on, in the chapter on the analysis of the structure of production, it is necessary to examine the lag involved in the incorporation of new products separately from that implicit in the utilization of new productive processes. Thanks to domestic adaptive capacity in relation to the latter, it cannot be assumed that in this branch of industry there is a necessary one-to-one relationship between process innovation and product innovation.

TABLE N° II.10

Time taken for Spread to Argentina by Cigarette Type

| Cigarette Type | Date of Introduction into United States | Date of Domestic Production in Argentina | Time Taken for Spread |
|-----------------------------------------------------------|-----------------------------------------|------------------------------------------|-----------------------|
| Machine manufactured cigarette (Bonsack) | 1875 | 1900 | 25 years |
| "American Blend" (Virginia, Burley and Turkish) cigarette | 1913 | 1928-30* | 15-17 years |
| Acetate filter cigarette | 1952 | 1960 | 8 years |
| 100 mm cigarette | 1964 | 1968 | 4 years |
| 120 mm cigarette | 1975 | 1976 | 1 year |

*/ "American Blend" type cigarettes existed previously, but they were made entirely of imported mild tobaccos (Virginia and Burely). 1928-30 are taken as the years when cigarettes with an appreciable amount of domestic-produced tobacco were introduced.

Source: Drawn up by Authors'.

III. STRUCTURE OF THE INDUSTRY

Having already analyzed some aspects of demand, it is now necessary to describe the basic elements of the industry which will help us to later outline the behavior of the firms in the sector. This will then enable us to understand the reasons behind the technological behavior of the industry, which is the basic aim of this monograph.

In this chapter, we propose to describe the main characteristics of the structure of production in the Argentine cigarette industry. We consider that to be able to understand the way it works, we must not only analyze certain structural traits, but also bear in mind the changes produced by foreign influence in the industry, since this makes itself apparent in a new kind of behavior on the part of the firms in the sector.

On the other hand, being a branch of industry which produces a mass consumer product, with a great need for differentiation between one kind and another, this gives it special characteristics which influence its behavior, the number of firms which operate in the sector, and also the particular form of competition between firms.

1. Product Differentiation and Barriers to Entry

The cigarette is a mass consumption product. The 1,900 million packets sold in 1975 reflect a market of approximately 9.000.000 consumers. However, postulating the existence of a market of such magnitude obliges us to analyze the homogeneity of the product in question and, consequently, the existence or not of sub-markets.

Any market is made up of several forms of the product, within a general type, and with different brands ^{8/}. In the case of the cigarette, this can be summed up as follows:

- Kind of Product: Cigarettes (all of them)
- Forms of the Product: 70 mm with and without filter
85 mm with and without filter

^{8/} Roland Polli and Victor Cook, "Validity of the Product Cycle", Journal of Business, Vol. 42, N° 4, October, 1969, pp.388-89

100 mm with filter
120 mm with filter
Light or dark tobaccos
Mentholated or not
Low tar or not

- Product Brands:

Jockey Club, Parliament, Benson & Hedges, Particulares, L & M, etc.

A look at the different forms of the product presents us with an apparent duality. The cigarette as a product in itself is a relatively homogeneous good; however, a number of variations have been introduced which do not modify it substantially, but which try to give it new forms by means of different kinds of presentation. To this is added the great variety of brands for each form.

This brings us to a very controversial topic in economic theory, which is competition and market forms. The perfect competition theory does not only assume a large number of suppliers, but also the existence of a perfectly homogeneous product, so that the consumer experiences no preference whatever for the goods of one supplier or another.

Following the arguments of Sylos Labini, the situation to be considered characteristic of the production of manufactured goods is that in which the goods are differentiated with respect to the consumer; specific markets exist and we can only speak of a general market which covers the most directly interchangeable products. In the final analysis, imperfect competition is the most common situation observed in reality ^{9/}.

The cigarette industry, in this respect, is a sector in which product differentiation plays a predominant role. In August, 1976, a total of 60 brands were offered on the Argentine market, covering all the forms of the product previously indicated. To give us an idea, there were 13 brands of 85 mm mild filter cigarettes. The same number could be found for 100 mm mild filter cigarettes.

That is, the differentiation between products in this industry is achieved not only by giving them different forms, but also by brand competition. In this way, different options within the same

^{9/} The bibliography on this problem is very extensive. The reference to P. Sylos Labini is given because his book synthesises the most important opinions on this subject. See P. Sylos Labini, Oligopolio y progreso técnico, Ediciones Oikos-Tau, Barcelona, 1966.

kind of product.

This need for differentiation - as a way of making sure of a specific market - comes up against the very limited possibilities offered by cigarettes for creating new forms of the product. On the other hand, the fact that their production technology is not complex and that improvements are spread immediately, prevents the monopoly of certain forms of the product in question by a few firms.

According to Scherer, there are four ways in which sellers can differentiate their products:

- a) by choice of location of the plants or sales outlets;
- b) by offering exceptionally good service;
- c) by physical differences in the product supplied; and
- d) by the creation of a subjective image in the mind of the consumers 10/.

In the case of cigarettes, forms c) and d) are the relevant ones and of the two, the creation of a subjective image in the mind of the consumers plays a fundamental role. We do not wish to deny the importance of the presentation of products which are physically different (for example, the 120 mm cigarette), but to the extent that all firms can make exactly the same form of product, differentiation by brands and, therefore, the creation of an image in the consumer, becomes the most suitable method.

In this way, advertising becomes one of the principal elements in understanding the behavior of this industry. But, although the aim of the firms' advertising strategy is to ensure a specific market for their products, this aim has a number of other consequences. In fact, a brand promotion campaign requires a minimum initial expenditure to introduce the brand on to the market, and a further subsequent expenditure to maintain the image created.

Scale economies in sales promotion - as a result of the indivisibility of advertising costs - gives us one of the keys for understanding the degree of competition in the industry 11/. In

10/ F. M. Scherer, Industrial Market Structure and Economic Performance, Rand McNally & Company, Chicago, 1971, p.324.

11/ It has long been recognized that these scale economies and their consequences are of considerable importance for the concentrated structure of the industry. See, for example, Reavis Cox, Competition in the American Tobacco Industry, 1911-1932, Columbia University Press, New York, 1933, pp.100-115.

this case, the costs of promotion can be assimilated by the technological indivisibility, to the extent that both are fixed costs, which decrease per product unit as the volume of production increases.

Bain, Sylos Labini and Scherer, for industry in general, and Telser, for the specific case of the cigarette industry, conclude that in an industry that differentiates products, the costs of advertising become barriers to the entry of other competitors. Sylos Labini advertising costs: "introduction costs", and includes them with fixed costs 12/.

Therefore, in an industry which differentiates products, the existence of technological indivisibility will not be necessary to promote a concentrated market; rather, high advertising costs are sufficient to achieve the same result. We must add to this a further point. While technological barriers are usually of a relatively fixed magnitude (the initial cost of the equipment, for example), barriers arising from sales promotion costs may be variable, since an agreement between firms to increase advertising costs would result in a rise in the level of initial costs for a firm wishing to enter the market.

To conclude the topics developed so far, we can say that the outstanding characteristic of the operation of the cigarette industry is product differentiation. But the need to differentiate products by advertising also involves elements of concentration, to the extent that there are scale economies in sales promotion costs.

2. Economic Concentration

About 1961 the Argentine cigarette industry was coming to the end of a process of concentration begun several decades before. That year only five firms were involved in supplying cigarettes: Compañía Nobleza de Tabacos S.A. (subsidiary of the British American Tobacco Co.), Manufactura de Tabacos "Particular" V.F.G.S.A., Massalín & Celasco S.A., Manufactura de Tabacos Piccardo y Cía Ltda. S.A. and Manufactura de Tabacos "Imparciales" SAIC.

12/ J. S. Bain, Barriers to New Competition, Harvard University Press, Cambridge, 1956, pp.142-143; P. Sylos Labini, op. cit., p.70; L. G. Telser, "Advertising and Cigarettes", Journal of Political Economy, October, 1962, pp.473-483 and F. M. Scherer, op. cit., pp.95-100.

It is not an inherently concentrated industry. Quite the contrary. Around the 1940's there were a number of minor firms, which were later bought by some of the firms which made up the industry in 1961. In this respect, a process similar to that which occurred in the North American industry at the beginning of the century took place. A large number of small factories were rapidly absorbed by the American Tobacco Co., then subdivided into three firms according to the Sherman Anti-trust Law 13/.

The reasons for the high degree of concentration in the industry must be sought in the points developed in the previous section. In this respect there are no technological reasons to justify the few firms in the sector. The equipment the industry uses is extremely divisible, and the technology widely known, which prevents the existence of technological barriers to the entry of new firms.

The barriers to entry which cause a high concentration in the industry derive from sales promotion costs. This would also explain the process of concentration in the Argentine industry, since the small establishments were not able to compete with the big firms, and were thus forced to sell their enterprises to them 14/.

Between 1961 and 1966, the division of the market between the five firms mentioned underwent no significant change. In this respect, the stability of the market during this period must be mentioned. Nobleza, with about 40% of total sales was the undisputed leader of the industry, supported - basically - because it was the only foreign firm in the group and belonged to one of the leading firms in the world cigarette market 15/.

13/ R. B. Tennant, The American Cigarette Industry, Yale University Press, New Haven, 1950.

14/ The firms bought were closed down and, in many cases, the principal assets taken over by the large firms were the brand names, which they then used. See E. Pastrana, La desnacionalización de la industria del cigarrillo, Buenos Aires, 1975 (unpublished).

15/ British American Tobacco has 134 factories making tobacco-based products in 53 different countries. See E. Favier and E. Pastrana, Países productores, países manufactureros y empresas multinacionales en América Latina, Ce. D.E.L.-Suera, Buenos Aires, 1976.

TABLE III.1

Firms' Share of Cigarette Sales
(In % of the Total Value of Sales)

| | <u>1961</u> | <u>1966</u> |
|--------------------|-------------|-------------|
| Nobleza | 40.8 | 43.2 |
| Particular | 18.4 | 17.7 |
| Massalín & Celasco | 12.3 | 11.0 |
| Piccardo | 15.3 | 13.9 |
| Imparciales | 13.2 | 14.2 |

Source: Authors' estimates from information in the Revista Panorama de la Economía Argentina

This situation is modified from 1967 with the entry of foreign firms into the Argentine market. This is the result of two facts: in the first place, the new firms set up seek to increase their share of the market, which upsets the previous market stability. Nobleza's leadership begins to be challenged by the foreign firms, especially by Philip Morris, which acquires the assets of Massalín & Celasco.

Secondly, given that the market expansion observed during the period was based on light tobacco cigarettes, the firms which produced a high proportion of dark tobacco cigarettes lost their share (Imparciales and Particular).

As a result of this process, the market structure changes. Although Nobleza continues to keep its lead and a similar share of sales, there is marked progress by Massalín & Celasco, along with the consequent slump in Imparciales and Particular.

In this way, the modification in the property structure of the industry alters the firms' position in sales ranking, but does not change the original market structure. One firm continues to lead in the sales ranking, two firms follow with about 20% of the market each, and the other two share a little more than 20%.

TABLE III.2

Firms' Share in Cigarette Sales 1975 16/
(In % of Total Packets)

| | |
|--------------------|------|
| Nobleza | 41.7 |
| Particular | 10.6 |
| Massalín & Celasco | 17.8 |
| Piccardo | 18.2 |
| Imparciales | 11.7 |

Source: Cámara de la Industrial del Cigarillo.

3. Foreign Takeover of the Industry and the Strategy of the Multinational Corporations 17/

Up to 1966 only one of the firms in the sector was a branch of a foreign firm. The Compañía Nobleza de Tabacos has belonged to British American Tobacco since approximately the second decade of this century. As was said before, this firm is one of the chief cigarette producers in the world. However, until very few years ago Compañía Nobleza only offered the market brands created in Argentina. Its main brand - Jockey Club - in its various forms of light tobacco cigarette, covers more than a third of total consumption.

Manufactura de Tabacos Piccardo y Cía Ltda. was the first firm in the 1960's to begin to make a brand under license. In 1966, it launches L & M. Subsequently, the American firm Liggett & Myers acquires part of the shares of the Argentine firm, although apparently a minority share.

Massalín & Celasco S.A. is acquired by Philip Morris International in September 1966, with the United States firm controlling the whole of the share capital. It produces exclusively light tobacco cigarettes and more than half the brands it has belong to the parent company.

16/ If share by value of sales is measured, Nobleza would have 40.3; Particular 9.3; Massalín & Celaseo 19.4; Piccardo 19.2 and Imparciales 11.7.

17/ The information on the foreign takeover of the industry has been taken from E. N. Favier and E. Pastrana, op. cit., pp.23-24.

TABLE N° III.3

Cigarette Firms in Argentina

| Firm's Position in Argentina according to 1975 Sales | Name of Firm | Main Foreign Shareholder | Nationality | Shareholder's Percentage | World Position of Group to which it belongs, in 1971 |
|---------------------------------------------------------------|------------------------------------------------------|---------------------------------|---------------|-----------------------------|------------------------------------------------------------------|
| 16 | Compañía Nobleza de Tabacos S.A. | British American Tobacco | Great Britain | 85 | 69 |
| 32 | Massalín & Celasco S.A. | Philip Morris | United States | 100 | 176 |
| 75 | S.A. Manuf. de Tabacos Piccardo | Liggett & Myers | United States | <50 | 368 |
| 77 | Manuf. de Tabacos Imparciales S.A. | Reemtsma Cigaretten Fabriken | West Germany | >50 | 479 |
| 84 | Manuf. de Tabacos "Particular" V.F. Grego S.A. | Reemtsma Cigaretten Fabriken | West Germany | 30 | 479 |

Source: Mercado Magazine N° 363, 19th. August, 1976 and Cuestionario N° 8, December 1973 (from information from the North American Congress on Latin America-NACLA).

Manufactura de Tabacos Imparciales and Manufactura de Tabacos "Particular" were partly acquired by the German firm Reemtsma Cigaretten Fabriken in 1966 and 1968 respectively. While Particular continues to specialise in the production of dark tobacco cigarettes, Imparciales have ventured into light tobacco cigarettes, having launched Kent under license from Lorillard, United States, and other domestic brands of light tobacco cigarettes.

The points made so far require a number of explanations. In the first place, the entry of foreign firms into the Argentine cigarette market occurs by share transfers and in no case are new plants installed. As will be seen in a later chapter, the existing equipment is not completely renewed either.

This behavior might appear rather strange, especially if compared with what has happened in other Latin American countries, where one of the firms which enters the Argentine market exhibits a totally different behavior 18/.

Secondly, the situation of many firms in the sector was far from flourishing. Imparciales and Particular were suffering the consequences of the drop in sales of dark tobacco cigarettes and Piccardo and Massalin & Celasco the competition from light tobacco cigarettes which had entered the market illegally since the beginning of the 1960's.

Finally, and this will be developed more extensively in the chapters referring to the technology of the industry, the technological state of the existing plants did not constitute an insoluble restriction since the engineering capacity of the technical staff of the firms permitted the manufacturing establishments to be brought up to date.

The discussion so far offers us a partial explanation for the development previously described. However, we must ask why the international cigarette firms direct their investments to Argentina. This question is closely related to the possibilities for expansion that the Argentine market was able to offer.

Although we do not attempt to discuss the causes of the firms' expansion, it is interesting to analyze the criteria which determine where they direct their investments. It is to be expected that the multinational corporations move to those countries which

18/ This is the case, for example of Philip Morris in Brazil. This firm installs a new plant and very advanced technology.

have markets with certain characteristics. Thus, the decisive variables will be level and distribution of income, and already existing consumption levels.

It is important to emphasise this last factor. To start from very low consumption levels implies creating a new market, that is, generating a particular consumption habit. This entails a much greater effort than that of expansion, extending already existing markets with medium levels of consumption. In short, the first situation implies the introduction of a new product, while the second involves the spread of new forms and/or brands.

The expansion of United States tobacco firms in the period 1960-1975 can be seen in Table III.4. Between 1960 and 1965, more than half the licenses granted and subsidiaries installed were established in Europe and Canada. In the following period, the chosen area is Latin America and the Caribbean, which absorb 50% of subsidiaries and almost 30% of licenses, adding other geographic regions to the group. In the period 1971-1975, the earlier distribution is more or less maintained, with licensing in the socialist countries acquiring importance.

According to what can be concluded from the analysis, the expansion was carried out gradually, first of all covering these regions with high income levels as well as a high cigarette consumption 19/.

However, this is not the only explanation for the establishment of subsidiaries and the granting of licenses. Other countries are chosen not for their markets, but for their advantageous conditions of supply, for which reason they are used as export centres. These economies offer incentives related to the cost of labor and tax regulations, which make them natural suppliers of American brands to other countries or surrounding zones. This is the case with Hong Kong, Panama, The West Indies, Malaysia, Singapore, the Philippines, etc.

According to the previous argument, Argentina was an attractive market for international cigarette firms and, of course, one of the main ones in Latin America.

19/ The ten main cigarette-consuming countries per inhabitant were, in 1966: United States, Canada, United Kingdom, Ireland, Australia, New Zealand, Japan, Switzerland, German Federal Republic and Belgium. See Centre for International Trade, Main Markets for Non-processed Tobacco, UNCTAD-GATT, Geneva, 1968.

TABLE N° III.4

Development of Establishment of Subsidiaries
and Granting of Licenses by United States Firms,
1960-1975, By Geographical Regions

| Geographical Region | Link | 1960-65 | 1966-70 | 1971-75 | Accumulated Total |
|---------------------------------|------|---------|---------|---------|----------------------|
| Europe and Canada | Lic | 11 | 8 | 8 | 27 |
| | Subs | 6 | 5 | 6 | 17 |
| Latin America and Caribbean | Lic | 1 | 8 | 6 | 15 |
| | Subs | 3 | 10 | 8 | 21 |
| Asia and Pacific Area | Lic | 4 | 6 | 5 | 15 |
| | Subs | 2 | 4 | 3 | 9 |
| Africa | Lic | 0 | 3 | 1 | 4 |
| | Subs | 0 | 1 | 0 | 1 |
| Middle East and Central Asia | Lic | 0 | 1 | 1 | 2 |
| | Subs | 0 | 0 | 0 | 0 |
| Socialist Countries | Lic | 0 | 1 | 6 | 7 |
| | Subs | 0 | 0 | 0 | 0 |
| TOTAL | Lic | 16 | 27 | 27 | 70 |
| | Subs | 11 | 20 | 17 | 48 |

Source: Memoirs and Balance Sheets 1960-1975 of R.J. Reynolds Industries, Inc.; Philip Morris Inc.; American Tobacco Co., Inc. (now American Brands Inc.); P Lorillard, Inc. (now Loews Corp., Inc.); Liggett "Interconnecting Interests of Major Tobacco Manufacturers", Tobacco Reporter. December, 1969-1975.

In the first place, per capita income in Argentina in 1965 was US\$1.061, while the average for the region was US\$554 20/. However, it not only had one of the highest incomes, but its distribution showed a relatively lower degree of concentration than that of other countries in the area.

With respect to cigarette consumption per inhabitant, Argentina offered a number of further advantages. Besides having the highest level in the area, it offered considerable possibilities for expansion if compared with European countries and the United States.

TABLE III.5

Cigarette Consumption per Inhabitant
in Latin America
(in units)

| | |
|-----------|-------|
| Argentina | 1.130 |
| Brazil | 589 |
| Colombia | 966 |
| Mexico | 801 |
| Peru | 198 |
| Venezuela | 1.049 |

Source: United Nations, Statistical Yearbook, 1974.

As can be seen in Table III.6, Argentine consumption was less than half that of the United States in 1966, and 20% less than that of Belgium.

As we have explained, the variables analyzed allow us to assume a growth in demand for cigarettes as long as an appropriate sales policy was worked out. In the Argentine case, it was based fundamentally on the incorporation into the market of new sectors of the population, such as women and young people.

It is not the aim of this paper to analyze the causes of the quantitative variations in cigarette demand, but the change shown in the sales trend from 1967 is significant. In the period 1957-67, sales increased at an average annual rate of 2.1% whereas, between 1967 and 1973, they grew at a rate of 3.7%. This was reflected, of

20/ CEPAL, Indicadores del desarrollo económico y social en América Latina, Santiago de Chile, 1976.

TABLE III.6

Estimates of Cigarette Consumption per Inhabitant
in Certain Countries, 1966
(in units)

| | |
|-------------------------|-------|
| U.S.A. | 3,830 |
| Canada | 3,450 |
| United Kingdom | 2,810 |
| Ireland | 2,770 |
| Australia | 2,760 |
| New Zealand | 2,530 |
| Japan | 2,440 |
| Switzerland | 2,400 |
| German Federal Republic | 2,200 |
| Belgium | 2,070 |
| Argentina | 1,668 |

Over 15 years
Including contraband

Source: Centre for International Trade, op. cit. and authors' estimates.

course, in per capita consumption. While, for 1957, consumption per inhabitant over 15 years old was 1,595 cigarettes, 10 years later it was 1,681 and in 1973 it reached the figure of 1,923. That is to say, that between 1957 and 1967, consumption by that sector of the population grew at a rate of 0.5%, whereas during the following period was at a rate of 2.3%.

This change in sales behavior is closely linked to the entry of foreign firms into the cigarette market. Thus, the prospects of expansion offered by the Argentine market confirmed.

4. Some Considerations Concerning Sales Promotion Policy

At this point, we think it appropriate to take up again the topic analyzed in Section 1. What has happened in the industry during these last 10 to 15 years clarifies many aspects connected with product differentiation. In this respect, the entry of foreign firms into the industry, with the consequent change in firms' behavior, allows us to draw a number of conclusions.

Although the manufacture of light tobacco cigarettes had already begun in Argentina in the 1920's, around 1960 this type

represented less than 50% of the market and filter cigarettes about 5%. Therefore, the Argentine market offered ample possibilities for the spread of these new forms of the product.

Given the strong customs protection which this industry has always had (common to most countries), smuggling is a special way of introducing brands, flavors and forms of cigarettes. This mechanism is usually employed when a country does not produce international brands domestically. Of course, after the admission and installation of foreign firms, smuggling declines markedly until it practically disappears. Exceptions would be when the domestic price is higher than the international one or vice versa, in which case illegal exporting to neighbouring countries occurs.

Between 1961 and 1967, according to estimates by the Cámara de la Industria del Cigarrillo, illegal entry of light tobacco cigarettes into Argentine markets amounted to an average of 112.4 million packets annually. This figure represented 8.5% of the total annual consumption and 14.8% of that of light tobacco cigarettes. In the special case of 1962, when importation was temporarily made easier, 63.8 million packets were imported, while the annual average for the period mentioned, as far as legal entry of goods was concerned, was 3.3 million.

With the influence of the foreign firms on domestic ones - whether subsidiaries or by license - the means used to reinforce external demand patterns and preference for international brands is advertising.

As can be seen in Table III.7, from 1967 onwards expenditure on advertising by firms, at constant values, begins to rise rapidly. In 1969, expenditure per thousand packets was three times that of 1965. At this point, which is the peak of this period, expenditure begins to decrease, reaching similar values to those at the beginning, in 1973.

The growth of total expenditure on advertising bears a certain similarity to the process of introduction and securing new brands in the market. Advertising expenditure consists of two parts: the launching of the new brand and its maintenance on the market. The major part of the cost of a campaign is concentrated on the initial period; once the brand has been introduced, the maintenance cost per unit is considerably reduced 21/.

21/ According to estimates in the Gaceta Financiera, it costs three times more per packet to launch a brand than to keep it on the market. See Gaceta Financiera, Year III, N° 665, May 19th, 1970.

TABLE N° III.7
Expenditure by Cigarette Companies
on Advertising and Publicity,
1965-1973*

| Years | Millions m\$ <u>n</u> | Millions 1960 m\$ <u>n</u> ** | Expenditure per 1000 packets 1960 m\$ <u>n</u> |
|-------|--------------------------|----------------------------------|------------------------------------------------------|
| 1965 | 546.8 | 192.5 | 153.5 |
| 1966 | 676.8 | 198.6 | 164.5 |
| 1967 | 1,023.8 | 293.2 | 236.6 |
| 1968 | 2,465.8 | 525.5 | 401.5 |
| 1969 | 3,015.1 | 605.9 | 440.0 |
| 1970 | 2,702.8 | 476.1 | 324.8 |
| 1971 | 3,408.4 | 430.4 | 287.5 |
| 1972 | 3,242.4 | 231.3 | 146.0 |
| 1973 | 5,934.8 | 282.2 | 169.4 |

*/ Between September 1969 and July 1971 radio, cinema and television advertising were stopped by a voluntary agreement between the Companies, as a means of maintaining profitability. This agreement was ratified by a Decree of the Executive. (Gaceta Financiera, Year V N° 976, July 2nd, 1971).

**/ Deflated by the Wholesale Prices Index, General Level.

Source: Companies' Balance sheets.

The period 1967-70 is one of introduction of the new forms and brands and, therefore, of information about the products and attraction of consumers. The entry of new foreign firms into the Argentine market implied the rapid spread of production of new forms of the product and the launching of many international brands. Once "presented", after the big initial effort, it is only necessary to maintain the product's image.

However, a distinction must be drawn between the launching of already reputable international brands and that of new brands, whether international or local. In the first case, the consumer requires less persuasion and therefore the necessary expenditure on promotion is less. In this respect, some of the international brands launched from 1967 onwards were already known to consumers because of their illegal entry during the early 1960's. Therefore, a sales expansion strategy based on known international brands had, a priori, greater chances of success 22/.

In any case, the movement observed in the expenditure levels on advertising must be attributed basically to the increase in oligopolic competition in the industry, especially with the appearance of Philip Morris in the Argentine market. This firm adopted an extremely aggressive and, as could be seen earlier, considerably effective sales policy, since it enabled it to double its share of the market.

The struggle between firms seeking to increase their market share and those trying to maintain their position is reflected in a sharp increase in advertising costs, since sales promotion is the means employed by the differentiated oligopoly in order to compete. If a firm increases its advertising expenditure in pursuit of a larger share of the market, its competitor will be obliged to follow suit, since there is a danger that it will lose its share of overall sales.

As can be seen, a struggle of this can lead to similar results to those of a price war. To the extent that, from a particular advertising expenditure level, returns on additional expenditure decrease, this will be reflected in a reduction in the profit

22/ This seems to have been the strategy employed by Massalín & Celasco. This is the firm which launched most international brands on the market. Of a total of 13 brands, 7 are international. The rest have, at most, 2 international brands per firm.

margin 23/. As a result, the struggle initiated requires that an agreement, whether tacit or explicit, be reached.

This seems to be what happened in the period 1967-1969. While in 1965 advertising costs represented 6.7% of the total cost, in 1969 this ratio reached 23.5%, to drop in 1972 to 9.9%. In this way, advertising costs during the peak years reach unwonted proportions, with a consequent reduction of the profit margin. This happens because sales increase by about 5% per year, while prices, at constant values, drop slightly because of state controls.

Between September, 1969 and July, 1971, the firms agree to stop radio, television and cinema advertising, and this is ratified by a Decree of the Executive, which in this way became the arbiter of competition. In any case, after the agreement expires, expenditure not only does not rise, but rather decreases.

The behavior mentioned suggests to us that, in the case of an oligopoly, advertising expenditure can be above the level we might call "optimum", since not only is it concerned with sales expansion, but basically the relative share of each firm. This causes an increase in total expenditure by the firms as a group, reaching a higher level than that required to achieve the same growth in total sales. In this case, a monopoly holder is in a much more advantageous position, because his attention is exclusively centered on sales expansion 24/.

Therefore, we can conclude by stating that, although the expansion in demand for cigarettes shown from 1967 onwards can be attributed to the sales policy of the multinational firms, the extent of growth of the overall cigarette market does not correspond to the very high level registered by advertising expenditure. Thus, the level of expenditure is more an indicator of the sharper rivalry between firms than an attempt to expand overall sales. In the final analysis, as an orthodox defender of competition would assert, this was the force which made market growth possible.

23/ Telser calculates for the American cigarette industry marginal rates of return on advertising. L. G. Telser, op. cit., pp.473-483.

24/ According to Scherer, it is to be expected that the ratio advertising expenditure-total sales value will be higher under oligopolic conditions than in cases of monopoly or monopolistic competition. Op. cit., p.334.

IV. PRODUCTIVITY AND EMPLOYMENT IN THE INDUSTRY

In the previous chapter we analyzed the supply structure of the industry. However, we have not yet exhausted all its aspects. In this chapter we shall analyze in detail two topics related to supply: productivity and employment. We consider that this is a prior step necessary to clarify certain matters before we go into the main subject of this paper, related to the technological behavior of the industry.

Certain technological changes assume improvement in efficiency in the use of the factors of production. The latter may be reflected in the values of the product per man employed ^{25/}. Thus, the analysis of the growth of productivity would allow us to detect not only the moments at which certain changes occurred, but also the direction they took. In this chapter we develop these topics, and also pose some questions which we try to answer in the following ones.

However, the productivity value, besides expressing - to a certain extent - efficiency in the use of the factors of production, also reflects the different alternatives in the use of capital and labor. In the analysis of employment, we try to show the limited capacity of absorption of labor in the industry, quite apart from the age or modernity of the technology employed.

1. Growth of Labour Productivity

From a long term point of view, labor productivity in the cigarette industry has shown a very similar behavior to that of manufacturing industry as a whole. In fact, if we analyze the growth of both, we can observe that while productivity in the tobacco industry grows at an average annual rate of 4.2 in the period 1957-72, manufacturing industry does so at 3.9,

^{25/} Greater efficiency in the use of the factors of production is one of the determining factors in the increase in labour productivity. However, there are others, such as scale economies, substitution of capital for labour. This has been the subject of many studies; see, among others, E. F. Denison, The Sources of Economic Growth in the U.S. and the Alternative Before Us, Supplementary Paper 13, Committee for Economic Development, New York, 1962 and C. Kennedy and A. P. Thirwall, "Technical Progress: A Survey", Economic Journal, March, 1972.

Although the productivity growth rate does not exceed that of industry as a whole by very much, a comparison with rates observed in other branches of industry gives certain evidence which is worth emphasising. In this connection, the variations in labor productivity for the period 1951-70 in the 16 industrial sectors in which manufacturing industry was divided can be found in the paper by Canitrot and Sebess 26/.

The average annual productivity growth rate in the Tobacco sector is 4.4 and is exceeded by only four sectors: Rubber; Chemicals; Non-Electrical Machinery and Transport Materials; and Electrical Machinery; the last two sectors had the highest growth rate with 5.8 (excluding miscellaneous industries).

Thus, the cigarette industry is among the branches of industry which have shown dynamic growth in labor productivity.

The values for labor productivity in cigarette manufacturing can be seen in Table IV.2. In the period 1957-1973 the product per man (measured in packets of cigarettes per worker employed) grows at an average annual growth rate of 4.2, that is, that during the period it almost doubles its initial value.

It is appropriate, however, to clarify a point with respect to the productivity measure used. Although the correct way would have been to use product per man-hour, this information is only available from 1970 in INDEC statistics. Therefore, we had to fall back on the information supplied by the Departamento Tabaco de la Secretaría de Agricultura y Ganadería.

In any case, for the period 1957-73, production per man reflects satisfactorily the productivity levels of the sector. Between the years 1957 and 1970 these values agree with those supplied by some of the firms interviewed, since the number of hours worked monthly per worker did not show great variation, being in the region of 160 hours per month. Between 1970 and 1973, the monthly hours do not vary greatly either, as can be seen from the corresponding table.

In 1974 and 1975, if we take production per man as productivity value, disadvantages begin to appear. In fact, during these years there is a sharp increase in overtime worked, which means

26/ Canitrot, A. and Sebess, P. El comportamiento histórico (1950-1970) del empleo en la economía argentina, Inst. T. di Tella, Buenos Aires, 1973.

TABLE N° IV. 1

Labour Productivity in Manufacturing Industry

| Industrial Groups | Productivity (thousands of 1960 pesos m/n) | | Average Annual Growth Rate |
|-----------------------------------------------------|--------------------------------------------------|----------|-------------------------------------|
| | 1951 | 1970 | |
| Food and drink | 240.06 | 314.27 | 1.4 |
| Tobacco | 423.67 | 962.00 | 4.4 |
| Textiles | 181.52 | 307.64 | 2.8 |
| Shoes and Ready Made Clothes | 190.35 | 207.41 | 0.5 |
| Wood and Cork | 73.47 | 118.49 | 2.5 |
| Furniture | 89.67 | 176.35 | 3.6 |
| Paper | 231.48 | 501.49 | 4.2 |
| Printing | 229.20 | 194.59 | -0.9 |
| Leather | 332.70 | 505.13 | 2.2 |
| Rubber | 258.57 | 660.53 | 5.1 |
| Chemicals | 278.75 | 751.08 | 5.4 |
| Oil and Coal Derivatives | 1,563.57 | 2,435.22 | 2.4 |
| Non-metallic Minerals | 142.46 | 281.97 | 3.7 |
| Basic Metals and Metal Products | 132.60 | 288.57 | 4.2 |
| Non-electrical Machinery and Transport Materials | 129.86 | 379.98 | 5.8 |
| Electrical Machinery | 129.86 | 379.98 | 5.8 |
| Miscellaneous | 89.64 | 490.53 | 9.4 |
| All of Industry | 172.68 | 364.57 | 4.0 |

Source: Canitrot, A. and Sebess, P.: Op. Cit., Table N° II.4.

TABLE N° IV.2

Production, Employment and Labour Productivity in the Cigarette

| YEARS | Production (thousands of Packets) | Number of Workers Employed | Productivity | | |
|-------|------------------------------------------|----------------------------------|-------------------------------------|----------------------------|---------------|
| | | | thousands of pkts. per worker | Index base 1960 =100 | Increase % |
| 1957 | 1,096,677 | 5,475 | 200.3 | 80.9 | ... |
| 1958 | 1,117,824 | 4,952 | 225.7 | 91.1 | 12.7 |
| 1959 | 1,124,375 | 4,688 | 239.8 | 96.8 | 6.2 |
| 1960 | 1,103,763 | 4,456 | 247.7 | 100.0 | 3.3 |
| 1961 | 1,153,312 | 4,743 | 243.2 | 98.2 | -1.8 |
| 1962 | 1,164,839 | 4,487 | 259.6 | 104.8 | 6.8 |
| 1963 | 1,190,779 | 4,345 | 274.1 | 110.6 | 5.6 |
| 1964 | 1,253,571 | 4,310 | 290.8 | 117.4 | 6.1 |
| 1965 | 1,253,831 | 4,209 | 297.9 | 120.3 | 2.4 |
| 1966 | 1,206,570 | 4,119 | 292.9 | 118.2 | -1.7 |
| 1967 | 1,239,147 | 4,055 | 305.6 | 123.4 | 4.3 |
| 1968 | 1,309,406 | 3,809 | 343.8 | 138.8 | 12.5 |
| 1969 | 1,376,807 | 3,541 | 388.8 | 157.0 | 13.1 |
| 1970 | 1,466,280 | 3,878 | 378.1 | 152.6 | -2.8 |
| 1971 | 1,497,168 | 3,871 | 386.8 | 156.1 | 2.3 |
| 1972 | 1,584,330 | 4,251 | 372.7 | 150.5 | -3.6 |
| 1973 | 1,666,275 | 4,294 | 388.0 | 156.6 | 4.1 |
| 1974* | 1,885,415 | 4,186 | 450.4 | 181.8 | 16.1 |
| 1975* | 1,901,138 | 4,758 | 399.6 | 161.3 | -11.3 |

* / Artificially high productivity value because of overtime.

Source: Drawn up from information supplied by the Cámara de la Industria del Cigarrillo y Departamento Tabaco, Secretaría de Estado de Agricultura y Ganadería.

that the productivity data show artificially high values. Therefore, we shall analyze the period 1957-73 first, and then the years 1974 and 1975 will be considered.

From a study of Graph IV.1 it appears that, while up to 1967 productivity grows at a steady rate (with the exception of the two slight setbacks in 1961 and 1966), it increases sharply in 1968 and 1969 and then remains at 1969 levels.

TABLE IV.3

| <u>Hours Per Worker in the Cigarette Industry</u> | |
|---------------------------------------------------|---------------------------------|
| <u>Years</u> | <u>Monthly Hours-Worker</u> |
| 1970 | 153 |
| 1971 | 152 |
| 1972 | 159 |
| 1973 | 164 |
| 1974 | 179 |
| 1975 | 180 |
| Provisional | |

Source: INDEC

If the average annual productivity growth rates for the two sub-periods are compared, it can be observed that, while between 1957 and 1967 the rate is 4.3, in the following sub-period (1967-1973) it is 4.1. The average annual rate does not show any considerable variation; but, although up to 1967 productivity shows a steady growth, it then twice exceeds 10% and finally remains at the same level. Therefore, the average annual rate of the second sub-period is strongly affected by the increases of 1968 and 1969 27/.

It is tempting to analyze in more detail what occurred from 1967 on, since it coincides with the purchase by foreign firms of three firms in the sector. In the first place, the sharp increases of 1968 and 1969 are closely linked to the investments made in the industry. In fact, during those years, investments in machinery,

27/ If productivity had continued to increase at the rate registered between 1957 and 1967, the value for 1969 (390,000 packets per worker) would not have been reached until about 1973.

equipment and installations, at constant values, markedly exceed those made previously.

TABLE IV.4

Investment in Machinery, Equipment and Installations

| <u>Years</u> | <u>Investments</u> <u>Thousands of</u> <u>Pesos M/W</u> | <u>Base Index</u> <u>1965 = 100</u> |
|--------------|---------------------------------------------------------------|----------------------------------------|
| 1965 | 97,601 | 100.0 |
| 1966 | 117,020 | 119.8 |
| 1967 | 188,921 | 193.5 |
| 1968 | 362,299 | 371.2 |
| 1969 | 300,522 | 307.9 |
| 1970 | 211,629 | 216.8 |
| 1971 | 125,163 | 128.2 |
| 1972 | 164,554 | 168.6 |

Deflated by the Wholesale Price Index for Non-Agricultural Products.

Source: Firms' Balance Sheets.

As can be observed in Table IV.4, from 1967 heavy investments begin to be made in the industry, and then fall after 1969. Massalín & Celasco and Compañía Nobleza de Tabacos made 65% of their investment between 1966 and 1969. That is, the sharp increases in productivity registered during 1968 and 1969 were probably connected with the investment flowing into the industry.

We have already said that the productivity values of 1974 and 1975 could not be compared with those of the previous years, because of the sharp increase in overtime. During those years, the monthly hours worked increased by about 14%; therefore, the productivity measure is overvalued.

To be able to analyze what happened during 1974 and 1975, we referred to the Physical Productivity Index per Man-Hour Worked, supplied by INDEC from 1970. Taking as base: 100 in 1970, the values for the years quoted are 94.6 and 94.5 respectively, which means that, during those years, productivity measured in man-hours is about 5% below the base year. The INDEC index corresponds to approximately 360 thousand packets per man-year, that is, 7% below that registered for 1969. Therefore, in terms of the index used

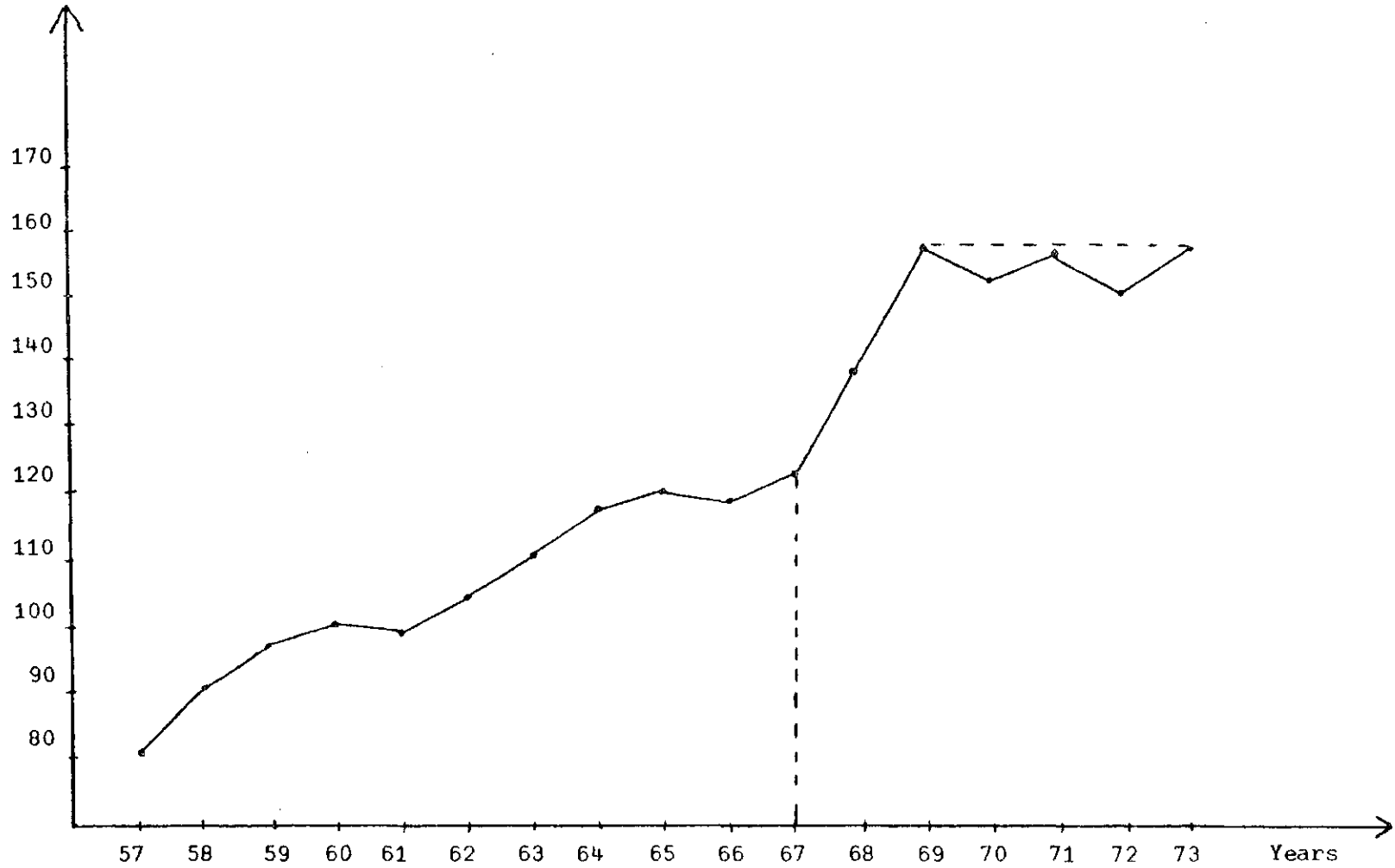
GRAPH N° IV. 1

Development of Labour Productivity in the Cigarette Industry

(Base 1960 = 100)

Productivity

- 41 -



Source: Table N° IV.2

in Table IV.2, it would be 144.5 for 1974 and 1975, which means that during those labor productivity underwent a sharp fall 28/.

The values obtained confirm the existence of a productivity ceiling, of 390 thousand packets annually per worker; that is, that for 6 years this maximum reached in 1969 does not change. The increases which occurred in 1968 and 1969 (in both years it increases by 27.2%) are much higher than the trend observed during the period 1957-1967. But after this "jump", productivity stagnates. Between 1969 and 1975, productivity rises and falls, but the peaks after 1969, though near the level of that year, never equal it 29/.

This last point would modify our previous statement concerning the productivity growth rate in the second sub-period, if we include the years 1974 and 1975. Taking into consideration the maximum value of 390 thousand packets per man-year, an average annual productivity growth rate of 3.1 is obtained; lower than the 4.3 shown between 1957 and 1967. Therefore, it can be argued that the productivity growth rate slows down between 1967 and 1975.

If labor productivity values are compared with those observed in American industry, it can be noted that, although there was a relative closing of the gap by Argentine manufacturing it still showed less than half the productivity levels of American industry. Although one should be cautious in comparing values of American and Argentine industry - since it is being done on the basis of production per worker-year - for the period 1958-60 the Argentine cigarette industry's productivity was 3.2 times lower than the American, while in the period 1970-73 the difference was reduced to 2.3 times. This shows a certain closing of the gap by Argentine industry, but there is still a significant lag.

To sum up, labor productivity in the cigarette industry,

28/ These data were corroborated in conversations with those in charge of production in the firms. The fall in labour productivity when overtime increases is caused by two factors: the reduction in labour performance and also a less efficient use of machinery, because of inadequate maintenance.

29/ The value of 390,000 packets annually per worker is equivalent to about 4,000 cigarettes per hour, at 160 hours per month per worker; a value which, in the opinion of those responsible for production in the firms, corresponds to the average in the industry at the moment.

TABLE IV.5

Labour Productivity in Cigarette Manufacture
in the United States

| <u>Years</u> | <u>Productivity</u> (Thousands of Packets/Worker) |
|--------------|------------------------------------------------------|
| 1958 | 758,2 |
| 1959 | 765,5 |
| 1960 | 768,0 |
| 1963 | 860,3 |
| 1965 | 870,0 |
| 1970 | 833,1 |
| 1971 | 900,6 |
| 1972 | 889,7 |
| 1973 | 827,4 |

Source: Statistical Abstract of the U.S., 1974, U.S.
Government Printing Office, Washington, D.C., 1974.

during the period analyzed, was very dynamic. However, from 1967 - and contrary to what could have been expected - the entry of foreign firms into the industry, far from initiating a new trend of long term growth, stimulates a sharp increase in the first two years, and then reaches relative stability in productivity values.

After the two years of sharp growth, productivity stays at the same level, as if it had reached a ceiling which is difficult to break through. Everything would appear to indicate that between 1967 and 1969 the factories were "tuned" and that then this process stopped. During the 7 subsequent years the product per man rises and falls at levels close to the maximum value.

What has gone before was probably reflecting a specific behavior by the industry. Labour productivity reflects the intensity of use of the labor factor in a specific technology. The stagnation of productivity from 1969 - if it is not accepted as a chance occurrence - would indicate that the industry chose technological processes with a certain level of labor intensity. Once a certain level of productivity had been reached, no effort was made to replace labor.

This point poses a number of questions. What does the relative stagnation of productivity tell us? One explanation may be provided by the ratio, cost of labor/price of machinery, to the extent that relative prices did not encourage the substitution of

labor by machinery. However, the sharp increase in productivity in the two years prior to stagnation obliges us to investigate further regarding the processes into which investment was directed in the peak years.

Another matter of interest concerns the existence of a productivity ceiling. What is the relation between this and the vintage of the technology in use in the manufacturing plant? We should ask if the utilization of equipment of more recent vintages would alter the maximum productivity value.

Finally, we have seen that the entry of foreign firms signifies an important change in the development of productivity. It should be borne in mind that the growth rate slows down. This makes us ask whether there is any relation between the entry of international firms and the industry's technological behavior.

Several hypotheses or questions arise from the discussion in this section, in which we have basically described certain characteristics of productivity. In subsequent chapters some explanations of this behavior are attempted.

2. Capacity to Generate Employment

As was noted in the previous section, labor productivity in the industry has grown at an intensive pace - although slowing down in the latter years - during the last two decades; at a more intensive pace than that shown by production. Thus, the industry has behaved as a dismitter of labor. The number of workers employed dropped from 5,475 in 1957 to 4,758 in 1975. Although the average annual rate of dismissal was 0.8, it was not any higher because of the strong expansion in production registered from 1967, with the parallel reduction in the productivity growth rate.

However, its condition as dismitter of labor is not the only outstanding characteristic of the industry. If we bear in mind that in 1975 less than 5,000 workers produced 40,000 million cigarettes, it is remarkable how few people the sector employs. Of the different industrial sectors, it is the one which employs the least number of workers.

Therefore, its effect on industrial employment is almost insignificant, especially if compared with its share of the industrial GDP. In 1957, it accounted for 0.6% of employment in manufacturing industry and 0.4% in 1972, while tobacco represented 1.9% and 1.4% of the industrial GDP for those same years.

TABLE N° IV.6

Labour Employed in the Tobacco Industry in Relation
to Total Employment in the Manufacturing Sector

| Countries | Labour employed in the tobacco industry (in thousands) | Percentage of total employment in the manufacturing sector |
|------------------|-----------------------------------------------------------------|------------------------------------------------------------------|
| United States | 94.9 | 0.6 |
| United Kingdom | 41.3 | 0.5 |
| Sweden */ | 1.3 | 0.2 |
| Canada */ | 9.9 | 0.7 |
| France */ | 10.0 | 0.2 |
| Japan */ | | 0.4 |
| Italy */ | 51.2 | 1.6 |
| Argentina (1969) | 7.4 | 0.45 |
| Brazil (1970) | 14.1 | 0.81 |
| Colombia (1969) | 3.4 | 1.04 |
| Chile (1967) | 0.9 | 0.41 |
| Venezuela (1970) | 2.8 | 1.14 |

*/ Data from 1955.

Source: Joe S. Bain. International Differences in Industrial Structure: Eight Nations in the 1950's, New Haven. Yale University Press, 1966.

ECLA . Anuario Estadístico de América Latina, 1973, Santiago de Chile, 1971.

This phenomenon - the small share of the tobacco industry in employment in the manufacturing sector - is also observed in other countries. As can be seen in Table IV.6, the effect on employment is extremely limited in them all, especially in the developed countries.

If we compare the productivity values in the tobacco industry with the other industrial sectors, we can see that in several countries the industry studied occupies the second or third place. It is an industry with a high Product/Labor ratio. This, its low capacity to create employment is a direct consequence of the high product per man value it generates.

That is, it can be stated that the sector technology is inherently low labor intensive. What must be emphasized is that the utilization of a limited number of workers is characteristic of cigarette production. Thus, given its high Product/Labor ratio, the sector is severely limited as a creator of employment. Its capacity to generate employment is, in fact, practically nil 30/.

TABLE IV.7

| <u>Location of the Tobacco Industry in Order of Productivity</u> | | |
|----------------------------------------------------------------------|-----|---------------|
| Ecuador | 3rd | (1969) |
| Peru | 2nd | (1969) |
| Venezuela | 2nd | (1966) |
| U.S.A. | 3rd | (1969) |
| Argentina | 2nd | (1951 & 1970) |

Source: V.E. Tokman, Distribución del ingreso, Tecnología y Empleo, ILPES, Santiago de Chile, 1975, Statistical Abstract and A. Canitrot and P. Sebess, op. cit.

These conclusions do not agree with the image of a "traditional" industry, which is normally given to the manufacture of cigarettes.

30/ If we assume an annual increase in production of 5%, without an increase in productivity (similar to what has happened during the last few years), the cigarette industry would create 200 new jobs per year.

Usually industries characterised as traditional are those which utilize more labor intensive techniques and have a low labor productivity growth, found in sectors which produce non-durable consumer goods. From this it can be deduced that the utilization of strategies based on expansion of demand for this kind of goods would enhance the absorption of labor.

As we have seen, the cigarette industry would not comply with any of these attributes, except that of producing mass consumer goods. But, although it can be argued that it is an exception in this kind of industry, this does not seem to be the case. According to Tokman, there is no direct relation between production of "traditional" consumer goods and intensity of labor use 31/. In his study of the industrial sector of some Latin American countries, it can be seen that when the industrial groups are separated into branches or sub-branches, some of them - such as beverages and tobacco - have a product per man exceeded only by oil and coal derivatives; and others, like the food industry - although to a lesser degree - show a productivity much higher than the average of the manufacturing sector. Only shoe and clothes production and furniture manufacture are highly labor intensive.

Thus, the categorization of traditional industries is a very relative matter. A particular industrial sector cannot be called - as a whole - traditional, stagnant, dynamic or modern; since within each sector there are different branches and sub-branches with very different behaviors. The performance of the sector as a whole will depend, therefore, on the relevance of the different branches and sub-branches at each particular time. From this arises the need to analyze in greater detail the specific industrial groups in order to determine different kinds of behavior.

Another way of showing the limited capacity to generate employment found in the cigarette industry, is to calculate the difference between employment at the present time and that which would result from utilizing an older and, therefore, more labor intensive technology. That is, we can ask ourselves the following question: to what extent would employment increase at the moment in Argentina (with 1973 production, for example) using a second vintage technology? And, at the same time, what would be the difference between the level of employment thus obtained and the present level?

In order to be able to measure the effect on employment of

31/ Tokman, V. E. Op. cit.

alternative older technologies, the following exercise can be carried out 32/: there is information on employment and production of the cigarette factories of North Carolina and Virginia for 1929 and the statistics are reliable 33/. In that year, the technology was 2nd vintage, since during the First world War more primitive techniques had been discarded. This allows us to estimate the volume of employment in the Argentine cigarette industry, if a 2nd vintage technology were used.

Let us suppose, in the first place, that it were feasible to use this technology (second vintage, well developed and proven) in Argentina for cigarette manufacture. This assumption leads us to two others: a) that equipment of this vintage could be found, bought, or made and b) that the Argentine cigarette market were completely for 70 mm non-filter cigarettes, since the long filter ones did not exist in 1929.

The productivity levels reached in the North Carolina and Virginia factories are representative of second vintage technology, since in 1929 these factories produced 4,959 million packets of 20 cigarettes, that is, 81.0% of United States production at that time.

We must bear in mind some limitations. In the first place, we refer here only to employment of laborers, both in the United States and Argentina. Using second vintage technology would increase employment of laborers, but this would have a depressive impact on employment of skilled workers, such as technicians, clerks, quality control personnel etc. Utilizing a more mechanized technology almost always involves increasing employment of this kind of personnel.

In the second place, the data on employment in the United States for 1929 also include people involved in the manufacture of cigars, although production of these was minimal in North Carolina

32/ The analysis uses part of the methodology of the so-called "new economic history". See Conrad, A. and Meyer R. The Economics of Slavery and other Studies on Econometric History, University of Chicago Press, Chicago, 1964; and Fogel, R. Railroads and American Economic Growth, John Hopkins Press, Baltimore, 1964.

33/ N. M. Tilley, The Bright Tobacco Industry 1860-1929, University of North Carolina Press, Chapel Hill, 1948, and U.S. Department of the Treasury, Bureau of Internal Revenue, Annual Report of the Commissioner of Internal Revenue, 1929, U.S. Government Printing Office, Washington D.C., 1930.

and Virginia. However, there was considerable production of loose tobacco for rolling cigarettes and for pipe smoking. This implies that the productivity values may be, to some extent, undervalued 34/.

Thirdly, the number of worker-hours worked during that year must be borne in mind. It is probable that the number of hours per day worked per worker was more than eight. Although in the larger factories at that time there were labor agreements with unions (National Tobacco Workers Union), it is possible that in some factories 10-hour shifts were worked.

Some productivity indices (production per worker-hour) in the United States cigarette industry for the period 1919-1957 have enabled us to work out the number of worker-hours worked in the industry in 1929 35/. According to these calculations, only 1257 worker-hours were worked in the year, whereas in the 1950's 1929 worker-hours annually were reached 36/.

This leads us to suppose that that year there were a fair number of workers who did not work permanently, but who were included in the employment data. Furthermore, during those years, minors were employed temporarily, and they must also be included in the statistics 37/. Thus, with the information about over-valued employment for 1929, our estimates of possible employment

34/ In Argentina, at the present time, cigarette factories also produce - although in smaller proportion - loose tobacco for rolling cigarettes and for pipes.

35/ U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the U.S. from Colonial Times to 1957 (Washington D.C., U.S. Government Printing Office, 1960).

36/ According to ibidem, the productivity index for 1929 was 55.4, the base index being 1947: 100, 328.7 packets of cigarettes per worker-hour. That is, 182.1 packets per worker-hour were produced. As production in North Carolina and Virginia was 4,950 million packets, we get 27,232.50 hours worked which, divided by the number employed (21,660 workers) gives us 1,257 worker-hours worked during the year.

37/ See N. M. Pilley, op. cit.

in Argentina may be rather excessive 38/.

TABLE IV.8

Employment, Output and Productivity in Cigarette Factories:
North Carolina and Virginia (1929) and Argentina (1973)

| | <u>North Carolina and Virginia</u> | <u>Argentina</u> |
|------------------------------------------------|----------------------------------------|------------------|
| <u>Workers Employed</u> | 21,660 | 4,294 |
| <u>Cigarette Output</u> (Thousands of pkts) | 4,959,050 | 1,666,275 |
| <u>Productivity</u> (Thousands pkts/worker) | 228.9 | 388.0 |

Source: United States: N. M. Tilley, op. cit.; U. S. Department of the Treasury, op. cit.

Argentina: Calculated from data from the Cámara de la Industria del Cigarrillo and from the Depto. de Tabaco, Secretaría de Agricultura y Ganadería.

With the data from the previous table we can begin to calculate possible employment in the cigarette industry in Argentina. As can be seen, productivity in 1929 in the two states of the United States was a little more than half Argentine productivity in 1973. If Argentine cigarette production in 1973 is divided by the productivity of North Carolina and Virginia in 1929, we obtain the Argentine worker employment which would result from the utilization of second vintage technology.

Output in Argentina in 1973 = Worker Employment
Productivity in United States in 1929 in Argentina Using
1929 Technology

1,666,275 packets = 7,279 Workers
228.9 Thousand Packets/worker

38/ For Argentina, the calculation is made for 1973, because of the problems of measuring production per worker employed during 1974 and 1975 as a result of the increase in hours worked monthly per worker.

That is, employment - with a productivity of 1929 in the United States - would be 7,279 workers. Given that worker employment in 1973 was 4,294, the utilization of 2nd vintage techniques would increase employment by 2,985 people; that is, by 69.5% with respect to employment in 1973 39/.

From the exercise we can draw the following conclusions:

a) The industry's capacity to generate employment is very limited, even if a more labor intensive and relatively older technology were used.

b) We have utilized certain assumptions and estimates which undervalued the labor productivity of second vintage technology. Therefore, the increase in employment may be even less.

c) From the point of view of employment in the industry (without taking into consideration retrospective effects, such as suppliers of equipment, etc.), the return to a second vintage technology is not justified. The obsolescence and lowered quality of the products, together with the problems of manufacture and/or importation of equipment, would be very serious, so that it is not possible to argue reasons of labor absorption.

39/ in the same way it could be calculated by how much employment would be reduced in the Argentine cigarette industry if a middle vintage technology like that used in the United States in 1973 were used. Taking the productivity value in the United States in 1973 (see Table IV.5) - since the monthly hours worked per worker are very similar in the two countries - employment would be reduced to 2,014 workers.

V. CHARACTERISTICS OF THE SECTOR TECHNOLOGY

1. General Characteristics of the Productive Process

Before describing the historical development of the international technological frontier in the cigarette industry and the characteristics of Argentine technology, we shall try to clarify certain concepts. In this section, besides an overall examination of the general manufacturing processes, the scales of production required and the degree of divisibility of the process are examined.

Cigarette manufacture has three different stages or processes. In each one of them there are different operations which are carried out with several machines or manually and which we now describe.

The first stage is the preparation of the tobacco fibre 40/. The tobacco, compressed into bales of 100-200 kgs each, first passes through a vacuum chamber to open it up and then goes on to the line where the conditioning, moisturizing, drying, etc. operations are carried out. Once the tobacco is deposited on the line, a number of conveyor and feeder belts carry it automatically to the different machines, until the fibre is stored for subsequent making into cigarettes. The open tobacco strips are first of all steam-treated to soften them, then they may be cleaned of sand and undergo several stages of pre-drying and cooling. All these operations are carried out in large cylinders or drums (800 kgs per hour or more) with ingredient injectors and steam or heaters. After having been treated in this way, the tobacco goes to the blending silos where the different types and classes for a specific brand are blended.

So far, we have spoken only of the sheets of tobacco leaf. The stems from the stripping process undergo a similar treatment,

40/ Before the fibre preparation process as such, several pre-manufacturing operations which clean and prepare the green leaf from the field, including cleaning, stripping, classification into processing types, storing and maturing, are carried out. All these operations are usually carried out in processing plants in the tobacco-growing areas of the country and in this paper we do not analyze the technology employed in these plants. It should be emphasised that the treatment of tobacco in the fibre preparation process differs from one firm to another, for which reason we describe the most general characteristics.

except that, as they are thicker, they pass through rolling mills which press them for separate cutting into fibre.

Before cutting, the leaf and stems may pass through casing cylinders in which certain essences and molasses are added to them. Then they are moistened sufficiently for the cutting machines, which contain self-sharpening rotor blades.

Once cut, the leaf fibre is blended with the stems and they go to other casing cylinders to receive top flavoring ingredients. The blended fibre is deposited in small boxes to await making up. During this storage period of 2-3 days, the blend settles and reaches a uniform aroma and flavor.

The second stage is the making up of the cigarettes themselves. The fibre goes to the processing machines by means of a pneumatic system, using buckets, or they are loaded manually with forks. The processing machine makes up the cigarettes as follows: a roll of cigarette paper (about a metre long) is fed through a mechanism which prints the brand name and then through a tube which receives a continuous flow of fibre. The paper with the fibre is fed into another tube which makes a continuous cigarette which is stuck, closed and dried by a heat press. Afterwards a rotor blade cuts the continuous cigarette into the correct size for the brand. If it is a filter cigarette, it goes to a filter machine which places a filter tube between two units, covers it with paper and then sticks it and cuts it in half, making two filter cigarettes. From the filter machine, the finished products go to a belt to be inspected and packed in trays of 4,000 cigarettes. Most of the making-up machines in Argentina produce between 1,300 and 2,500 cigarettes per minute.

The manufacture of acetate filters is similar to that of cigarettes in the sense that the acetate fibre is directed through a number of guide tubes to form a continuous filter a metre long which is then cut into tubes.

The trays of 4,000 cigarettes are transported to the packing section, which is the final manufacturing process. The packing machines take 20 cigarettes, inspect them and wrap them simultaneously in silver paper and the brand packet. Then the packets are closed and the tax stamp is stuck on. These machines work, in Argentine factories, at a speed of about 140-150 packets per minute.

The stamped packets then go to the cellophane wrapping machines, where they are wrapped in cellophane with the opener strip and sealed with a heat press.

Once wrapped in cellophane, they are taken to the baling machines, which make up the 10 packet cartons 41/. The made up cartons go to a table where they are packed manually into boxes of 50 to 60 units.

After this brief description of the general processes of cigarette manufacture (see Diagram 1), it is possible to see that the technology is not very complex. Furthermore, the basic operating technology incorporated into the machines is designed and developed outside the sector by the equipment manufacturers, so that it is known throughout the world and improvements and new developments are immediately disseminated.

It follows from the summary of the three manufacturing processes that some technological requirements or control operations are necessary to ensure efficient and economic cigarette production. In the first place, the temperature and moisture of the tobacco must be strictly checked. The quantities of tobacco which must be transported from one process to another and the movement of the cigarettes through the different machines must be carried out by means of a controlled and sufficiently mechanized flow. Quality and homogeneity of fibre, cigarettes and packets must be constantly checked by the technical staff and/or by automatic controls.

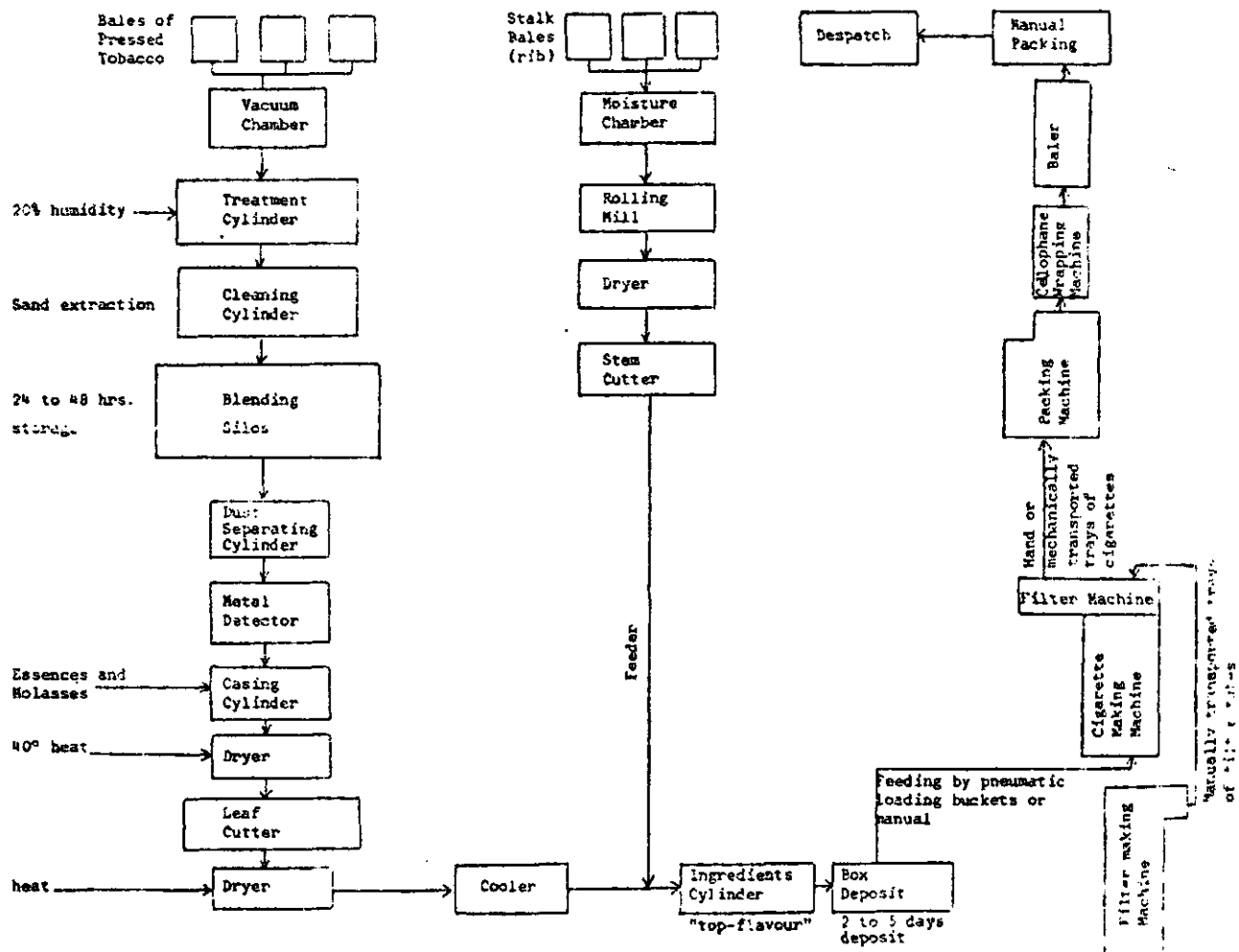
None of these operations is carried out with scale economies; on the contrary, the technology of cigarette manufacture is highly divisible 42/. In almost all its aspects, it is easily adaptable to small scale production. Moisture and temperature control can be carried out perfectly well with very small quantities and there is no reason for thinking that it would be advantageous to do it with large volumes. The flow of tobacco and materials would seem to be more awkward when quantities are greater. The number of staff required to inspect and check is not very high and is easily adjustable to the operating volume of small or large plants.

41/ The packaging for packets of 20 cigarettes, as also for cartons of 10 packets, can be either of paper or cardboard; what is different in some cases is the machinery used.

42/ On the divisibility of technology, see Richard B. Tennant, The American Cigarette Industry, Yale University Press, New Haven, 1950, pp.237-245. Although the present technology is much more mechanized and automated than that of 1950, divisibility of the manufacturing process continues to be its outstanding characteristic. Thus, Tennant's analysis is still valid.

Diagram 1

Description of the Production Process used in Cigarette Manufacture



But even more important is the fact that the machinery employed is easily adapted to limited scales of production. Tobacco cutting, making up and wrapping require machines of a certain degree of technical complexity, but there is no scale economy, because the production of each one is small in relation to the total output of a firm, whatever its size. These machines are relatively small in size and self-contained, each working independently of the others. The efficiency of a single cigarette producing machine is equal to that of a large number, if we leave out the cost of maintenance and supervision, for which reason a certain degree of indivisibility appears only in some indirect costs. The same characteristics can be observed in the packing machines, the cellophane wrapping machines and the balers.

A proof of the high degree of technological divisibility is seen in the following table, which shows the quantity of each one of these machines in the four factories in the Federal Capital. Even in a medium-sized market like Argentina, each firm has many machines carrying out the same process, which allows adjustment of the plant to the size of the local market.

TABLE V.1

Average Number of Machines Per Cigarette Factory
in the Federal Capital

| Machine | Total Number | Average Per Establishment |
|------------------------------|--------------|---------------------------|
| Cutters | 39 | 10 |
| Cigarette making-up Machines | 134 | 34 |
| Packing Machines | 94 | 23 |
| Cellophane wrapping Machines | 81 | 20 |
| Balers | 46 | 11 |

Source: Drawn up by the authors from data provided by the firms.

2. Description of the Historical Development of the International Technological Frontier

It is appropriate, at this point, to recapitulate on the concept of technological change. This can appear in two ways: one, by means of the introduction of new products or the improvement or greater sophistication of existing ones; another, by means of innovation at production process level, which allows more efficient utilization of factors of production. Naturally, these two manifestations of technical progress never occur in an absolutely pure form; rather, one usually prevails over the other.

a) Technological Change in Products

Many changes have occurred since the time when the Spaniards copied cigarettes from the Aztecs 43/. Its predecessor, discovered in Mexico, was very similar to the modern cigarette, although the tobacco was wrapped in vegetable material which was possibly tender maize leaf. From Spain, the cigarette (made of paper) spread to Portugal, Italy, Turkey, Russia and Egypt, and at the beginning of the 19th century was no longer a novelty in these countries 44/; however, it took more than 50 years to become known in Northern Europe and the United States. In the 1860's some Turks and Greeks began to make cigarettes in New York, but as an industry it did not take shape until about 1870. At that time the product was made by hand everywhere, using tobacco from the East, while in the United States and England some Virginia tobacco was added.

As in the introductory stage of all products, the form and characteristics were not standardized; there were cigarettes of several sizes, with different kinds of packets and different qualities of tobacco. This situation continued even when mechanization began.

Standardization of the product was reached in the United States, England and France about 1913-14. In the United States, Camel cigarettes were launched with the "American Blend" of Burley, Virginia, Maryland and Oriental tobaccos. In England, Player's appeared (with 100% Virginia tobacco) as the standard "English

43/ For the origin and history of the cigarette, see Tilley, Bright Tobacco Industry, op. cit., pp.504-10.

44/ Ibidem, p.504

blend". Both cigarettes were packed as they are today: Camel in paper packets of 20 cigarettes ("soft pack" or "soft cup"), and Player's in cardboard ("slide and shell box"). In 1932-33 firms introduced the cellophane wrapped packet to keep the cigarettes fresh.

During all this period, the size was always 70 mm and all cigarettes were non-filter. In the United States new products were tried out, such as: mentholated cigarettes (1934), longer ones (80 and 85 mm) and also with a type of filter (1938), but they were not successful commercially. After the Second World War, longer cigarettes began to experience a certain degree of growth and, in 1952, acetate filter cigarettes were launched, and rapidly increased their sales until they became the most important proportion of the United States market (87% of sales in 1975).

As can be seen in Table V.2, from their introduction in 1904 to the present time, 100 mm cigarettes have captured about 27% of the United States market and the 120 mm cigarette shows 1.1% in the first year it was launched. There have also been various modifications in packaging, such as cardboard packets ("hinge box") since 1956.

We should ask whether the latest changes introduced into the product are really relevant. Often things like new forms of presentation and marketing give a novel appearance to products which in fact do not include any substantial innovation. This may be the case, for example, with the extra long cigarettes of 120 mm or even those of 100 mm. However, we consider the 120 mm form as one of the products on the international technological frontier in cigarettes, because of their repercussions on the equipment employed, or because of the possibility of applying technical adaptations.

A product which really introduces innovations and more advanced technology is the low nicotine and tar content cigarette (total particulate material - TPM) 45/. This is the result of the growing concern in the United States over the harmful effects of cigarettes on the smoker's health. Since their appearance in 1902, they have gradually increased sales, till they covered about 15% of

45/ See Mark D. Rosenzweig, "Low-Tar Technology: A Burning Issue for Cigarette Makers, Chemical Engineering, June 21st, 1976, pp.78-84.

the United States market in 1976 46/. Essentially, from the point of view of technological change, this product represents the international frontier. As its design is new and higher consumption would involve certain changes in production technology, it is worth examining it in some depth.

TABLE V.2

Share of the Chief Forms of Cigarette
in United States Sales in 1975
(in percentages)

| Form of the Product | Sub-totals | Percentage |
|---------------------------------------------------|------------|------------|
| 1) 70 mm non-filter | | 5.4 |
| 2) 85 mm non-filter | | 7.6 |
| 3) 85 mm with ordinary acetate filter | | 52.8 |
| - non-mentholated filter | 34.3 | |
| - mentholated filter | 15.7 | |
| - activated carbon filter | 2.8 | |
| 4) 100 mm with ordinary acetate filter | | 25.4 |
| 5) 85 and 100 mm with low tar and nicotine (*) | | 7.7 |
| 6) 120 mm with ordinary acetate filter | | 1.1 |

(*) The 70 and 85 mm very low tar and nicotine content (1-7mm) cigarettes are not included because they came on sale in 1976.

Source: Authors' own calculations, based on information from John C. Maxwell, "1975 Cigarette Report", Tobacco Reporter, Vol. 102, N° 11 (November, 1975), pp.20-25.

In general, there are two types of low nicotine and tar content

46/ Ibidem, p.78.

cigarettes, which are the result of different processes and designs. Reducing the amount of nicotine and tar to certain levels can be achieved with a relatively well known technology. In the United States the product is considered to have low nicotine and tar content if it contains less than 0.9 milligrams of nicotine and less than 14 milligrams of TPM. These levels can be achieved with what we call a "physical process" 47/. This reduction process is based fundamentally on three techniques: in the first place, the cigarette contains less tobacco fibre because of "puffing". Secondly, a more porous paper is used and/or one with perforations around the filter to dilute the smoke with more air. Finally, a blend of tobaccos with a lower nicotine and tar content is used 48/.

The other process to lower these levels is what could be called a "chemical process". A problem presented by the previously described techniques is that, although it is possible to lower the nicotine and tar content in the smoke, the cigarette's taste diminishes at the same time. With less and less nicotine and tar (there are brands in the United States with only 1 or 2 mg of tar), the cigarettes gradually lose flavor: The chemical process tries to retain the smoking flavor by means of new ways of treating the tobaccos, the design of special filters and the use of synthetic materials (up to 30%) blended with the fibre 49/. While the European cigarette firms have concentrated on experimentation with synthetic materials to replace tobacco, the American firms have given more emphasis to the development of designs for filters and natural treatment of the tobacco 50/. Whatever the final result of these experiments, the fact is that the low nicotine and tar cigarette is at the international technological frontier in products.

Table V.3 is intended to synthesize the main cigarette design changes over time.

47/ The first cigarettes of this type were exclusively the result of physical processes. See Max Samfield, "Low-Tar-Nicotine Content Design", Tobacco International, Sept., 1973, pp.26-28.

48/ The concentration of nicotine and tar components is much greater in the higher and medium level leaves of the tobacco plant and in some varieties more than others. Thus, by using the lower leaves of new varieties with low nicotine and tar content, levels can be significantly reduced.

49/ Rosenzweig, Low-Tar Technology, op. cit., pp.79-84.

50/ Ibidem, p.82.

TABLE N° V. 3

Shifting of the International Technological Frontier in Products
(On the basis of introduction into the United States)

| YEAR | Size | Characteristics of the Cigarette | |
|------|----------|----------------------------------|-------------------------------|
| | | Filtration | Nicotine/Tar Level (TPM) |
| 1913 | 70 mm | non-filter | High (more than 24mgs TPM) |
| 1938 | 80-85 mm | non-filter | High (more than 24mgs TPM) |
| 1952 | 80-85 mm | ordinary acetate filter | Medium (16-24mgs TPM) |
| 1964 | 100 mm | ordinary acetate filter | Medium (16-24mgs TPM) |
| 1965 | 85 mm | special acetate filter | Low (7-15mgs TPM) |
| 1967 | 100 mm | special acetate filter | Low (7-15mgs TPM) |
| 1975 | 120 mm | ordinary acetate filter | Medium (16-23mgs TPM) |
| 1975 | 70-85 mm | special acetate filter | Very Low (1-6mgs TPM) |

Source: Drawn up by the authors, from data from John C. Maxwell Jr., "1976 Cigarette Report", Tobacco Reporter Vol. 103 N° 11 (November, 1976), pp 16-17 and Rosenzweig, Low-Tar Technology, op.cit. pp. 78-80

We must make it clear that, depending on the time, the cigarette market (kind of product) is made up of different forms, though it is necessary to point out that some of these have already entered the stage of decline of their life cycle, while others are in full growth or maturity. In general, the majority of sales of a particular kind of product will be of a relatively mature form. Such is the situation in the United States (see Table V.2), where the two forms of non-filter cigarettes hold only 13% of the market and continue to decline every year. The 85 mm filter cigarettes hold more than half the sales, keeping a stable level as a mature form of the product. Those of 100 mm with a filter seem to have entered the mature stage with 25.4% of the market; on the other hand, the two forms at the height of their development are the 85-100 mm filter cigarettes with low nicotine and tar content and the 120 mm ordinary acetate filter type. Although they only have 8.8% of the

market, these are the products which represent the international frontier.

b) Technological Change in Processes

The historical development of technology for cigarette manufacture is a very broad subject which we cannot discuss in detail in this paper. However, we attempt to make a brief summary of the most significant advances in processes, emphasising the most recent ones.

The first cigarettes were made by hand by craftsmen but, even with skilled labor, a single persona could not make more than 3,000 cigarettes per 10 hour day 51/. With increasing labor costs and labor problems, such as the supervision of workers, the lack of mechanization represented a bottleneck for the incipient industry.

In the period 1877-85, two machines were invented which permitted the sector's subsequent expansion, the most important being, obviously, the cigarette making-up machine invented by a young man of 20, James Bonsack 52/. In its general design, this machine worked exactly like the modern making-up machines, had a fibre feeder, made the continuous cigarette, included rotor blades, etc. The original machines worked at an average speed of 200 cigarettes per minute with only 3 permanent operators 53/. It can be stated without exaggeration, that the Bonsack machine revolutionised the industry.

The other technological change of importance during the 1880's was the fibre cutter invented by Pease and improved by John B. Adt 54/. Previously, the tobacco could not be cut into fibre, but was broken down and crushed into small pieces. With the introduction

51/ R. Tennant, The American Cigarette Industry, op. cit., p.17.

52/ For the history of the Bonsack cigarette-making machine, see Tilley, Bright Tobacco Industry, op. cit., pp.568-76 and Tennant, The American Cigarette Industry, op. cit., pp.19-22.

53/ Tilley, Bright Tobacco Industry, op. cit., p.572. The output of a single Bonsack machine was the equivalent of the manual work of 48 workers.

54/ Ibidem, p.569. A similar machine was invented by Robert Legg in England, and it was subsequently used in factories throughout the world.

of the machine, mechanical production of cigarettes with a fine and even fibre was made possible.

About 1890, other improvements in the fibre preparation process occurred. In the first place, the drying machines invented by Proctor made possible the storing and aging of the tobacco for two or three years, to improve the quality. There were also advances in the application of ingredients with Frost-Carter's casing cylinder 55/.

An innovation which revolutionised the progress of the industry, almost as important as Bonsack's machine, occurred in the preparation of the fibre for the manufacture of the American Blend type of cigarette. Before 1913, Burley tobacco was not used because when cut it lost its flavor. As this tobacco absorbs essences and molasses much more easily than Virginia or Turkish tobacco, the incorporation of 30-35% of Burley in the blend permitted a very important change in the product. After several years of experimentation with casing and cutting, R. J. Reynolds succeeded in eliminating the loss of flavor by means of a preliminary drying process 56/.

From 1920 there were remarkable improvements in the output and quality of the cigarette making-up machines, reaching a speed of about 800 units per minute 57/. Furthermore, a number of smaller changes rationalized production by means of the installation of conveyor belts to facilitate the flow of tobacco, materials and finished products. The use of air-conditioning and compressed air for greater control of temperature, humidity and waste elimination was also emphasized. Finally, there were improvements in the design of treatment cylinders (Carrier Softening Machine) and of the rotary Quester-type cutter, by Briggs-Shaffner 58/.

During the 1930's, the first cellophane wrapping machines appeared and the cigarettes began to be packed in containers of 10 packets, either paper or cardboard. From 1935, the first making-up machines of what could conventionally be called "3rd vintage" were

55/ Ibidem, pp.582-83. At the same time glycerine and aluminium paper began to be used to keep the cigarettes fresh.

56/ Tennant, American Cigarette Industry, op. cit., p.76 and Tilley, Bright Tobacco Industry, op. cit., pp.610-12.

57/ Tilley, Bright Tobacco Industry, op. cit., p.615. A typical cigarette making machine of this 2nd vintage was the famous Molins Cigarette Making Machine which appeared in 1924.

58/ Ibidem, pp.626-27.

tested, with speeds of over 1,000 cigarettes per minute. These making-up machines were like prototypes of the AMF 1-90 (models 10, 12 and 14), frequently used throughout Latin America and in the rest of the world. The first AMF 3-79 packing machines appeared with outputs of 70 to 80 packets per minute. In this decade, the linking of the different processes began to be perfected, with the addition of pneumatic transport systems. Besides the mechanization of the tobacco flow, automatic humidity and temperature control in fibre preparation was successfully installed 59/. However, in the making-up and packing processes there was no link-up between the machines, nor automatic quality control. The transportation and feeding of the fibre into the cigarette making machines was still done manually, as was the supply of trays of cigarettes to the packing machines and of packets to the cellophane wrapping machines and balers.

During the Second World War, there were practically no transformations, because of the lack of new machinery and scarcity of raw materials, so that the firms were unable to supply a rapidly growing demand. Despite this, production increased by 45% between 1939 and 1945 60/. After the war, there was an almost complete renewal of installed capacity, not only in the United States, but in many countries, with machinery of the so-called 3rd vintage. That is, cigarette making machines with 1,000 to 1,800 cigarettes per minute, packing machines with outputs of over 70/80 packets per minute, cellophane wrapping machines with the same capacity and balers with a capacity of up to 50-55 cartons per minute.

With the launching of the filter cigarette (1952), filter machines were developed to be attached to the cigarette making-up machines. A typical machine of this period was the AMF 1-122. Around 1950, the cardboard packet was brought on to the market ("Crush-proof box", "Flip-top box", etc.), which required another model of packing machine. One of the most used machines of this type was the Molins Hinge Mid Packer (HMP 1), with an average speed of 100-140 packets per minute, according to the quality of the raw material 61/.

59/ R. M. Cone et al, "Cigarette Industry Rules Out Rule-of-Thumb", Chemical and Metallurgical Engineering, Vol. 43, Nº 1, March, 1936, pp.128-31.

60/ Tennant, American Cigarette Industry, op. cit., pp. 23-24.

61/ Today there are about 3,000 Molins HLP 1 packaging machines functioning in 75 countries, with variations in the kinds of packet. See "New Generation of Molins Machinery: Molins' Centennial Exhibition Step Forward in Engineering", Tobacco Reporter, Vol. 103, Nº 2, February, 1976, pp.50-52.

In the 1950's, a number of advances occurred, designed to achieve a greater integration of the manufacturing processes. There was rationalization on the fibre preparation lines, and at the same time, the flow of finished products was mechanized by means of tray loaders, conveyor belts with photoelectric controls, etc.

Towards the end of the decade, the first cigarette making-up machines to exceed 1,500 cigarettes per minute appeared 62/. This 4th vintage had an average production speed of 2,000 units, which gradually increased by means of technical improvements till an output of 3,500 cigarettes per minute was reached. The filter machines also had to be improved to prevent their placing a limit on the new speeds. New and improved quality and weight control systems were incorporated into both machines. Cigarette making-up machines typical of this 4th vintage were the Molins Mark VIII (1950) and, later on, the Mauni Garant I, connected to the Molins PA-7 and Mauni Max filter machines respectively.

About 1965, other innovations occurred in the fibre preparation stage, amongst which the process of pumping gas into the fibre ("puffing") to achieve more economical use of the tobacco and a better made cigarette stands out. This process, which allows an increase in the volume of the fibre of 8-10% and is used with Virginia and Burley tobaccos, was invented as the result of the high cost of tobacco as a raw material. If we add to this other aspects, such as the greater share of filter cigarettes (which contain less fibre) in production, it can be deduced that a reduction in the quantity of tobacco per cigarette made was brought about 63/. Another innovation is the retrieval of tobacco waste and its subsequent utilization in production by means of an agglomeration process ("sheet").

As far as the packing machines were concerned, they were improved and redesigned to achieve greater speed and efficiency and better materials quality control. These changes came both from the gradual improvement of already existing models (as with the AMF 3-B,

62/ When the speed of cigarette making machines is mentioned, the quantity is always given in units 70 mm in length, to allow a homogeneous comparison between different models. With products of different sizes, with and without filter, the average output varies.

63/ See, for example, "The Effects of Puffing and Imported Leaf: U.S. Tobacco Content Down 30% in Two Decades, Tobacco Reporter, Vol. 102, No 12, December, 1975, pp.55-57.

series 1,400 and 3,000), and from new designs (Hauni KDW). The same thing happened with the cellophane wrapping machines, such as the Scandia series 500, 600 and 700, the AMP BOD and the Hauni Trabant.

It should be pointed out that the 4th vintage cigarette making-up machines were also gradually modified during the 1960's, with the development of different models of the original designs (as in the case of Garant 2 and 3 or Molins Mark VIII - SM and D).

From 1971, a big jump occurs in the technological development of the industry, which has revolutionised almost all the manufacturing processes. With some very important advances introduced into the cigarette making-up machines, higher speeds were achieved, giving an output of over 4,000 cigarettes per minute. In order to be able to link speeds and/or capacities, highly automated machinery has been incorporated, giving a complete link-up of the three processes: fibre preparation, making up and packing 64/. These are the most significant characteristics of the latest generation, that is, the automation of almost all stages of production and complete integration from fibre preparation to despatch of boxes to the distribution and sales organization.

In fibre preparation, for example, the new designs integrate two or three machines which carry out different processes into one multifunctional machine. That is, while previously the tobacco went through three cylinders (drying, cooling and treating), now with this technology, it goes through one machine with three completely separate areas which carry out the same operations 65/. Other examples of changes can be seen in the cutters, improved to process more than 6,000 kgs. per hour and in the new pneumatic fibre feeding

64/ Perhaps the best example of a factory completely equipped with 5th vintage machinery is the new Philip Morris plant in Richmond, Virginia. With a daily output of 200 million cigarettes, it will exceed 140 thousand million per year in 1977. From the moment the tobacco reaches the factory, neither it nor the materials, nor the finished products are touched by hand. All production lines are computer controlled and highly automated. See, "Advanced Processing and Materials Handling Techniques", Tobacco International, August 8th, 1975, pp.29-30.

65/ Some of these machines, such as the Sargent dryer-cooler-conditioner, have capacities of over 20,000 pounds of tobacco per hour. Tobacco Reporter, Vol. 102, N° 9, Sept., 1975, p.31.

systems 66/.

Besides the quantitative modifications at the level of automation and output, there have been qualitative changes in the fibre preparation processes. The chemical treatment of tobaccos to reduce the nicotine and tar (nicotine reduction systems) stands out on the one hand, and the improvement in cigarette flavor, on the other (flavor enhancement) 67/. These two improvements have the advantage of making it possible to modify, to some extent, tobacco quality, improving the lower quality raw material. That is, converting bitter low quality tobacco into mild tobacco with a neutral flavor.

We have mentioned previously the great jump in output from the making-up machinery. In fact, speed was almost doubled and, among the representative brands and models of this latest vintage, the Molins Mark IX, the Hauni Garant IV and the AMP Ypsilon 4000 can be mentioned. Since it was launched in 1971, there are more than 700 Molins Mark IX machines functioning in several parts of the world 68/. To accompany the high speeds of the making-up machines, it was necessary to introduce changes in the cigarette and filter inspection systems and in the filter machines. Among the latter, the Hauni Max S, Molins PA8 and Molins Aphis 2 (automatic plug handling and inspection system) stand out.

Perhaps one of the most important changes in production technology has been the direct integration of the making-up and wrapping processes. The most important machine, in this respect, has been the Molins Oscar (overhead spiral conveyor and reservoir), which allows a controlled and automatic flow between making-up and packing machines and which was introduced at the same time as the Molins Mark IX (1971) making-up machines. Recently, this innovation has been complemented by another two machines, to even further automate the system. In the first place, a huge flow lift which allows the

66/ Among others, the Cardwell system stands out; it allows 24 high speed cigarette making-up machines to be fed from a single fibre source or deposit.

67/ Rosenzweig, Low-Tar Technology, op. cit., pp.79-80. The flavor of a low nicotine and tar cigarette is improved by means of the distillation of chemical compounds found in the smoke, and which have been identified as "good" or "bad" as far as flavor is concerned. Then these compounds are added during the conventional casing process.

68/ New Generation of Molins Machinery, op. cit., p.50.

use of trays when there are problems with making-up and/or packing machines. On the other hand, there is the Olga system (open loop group automation) which automatically redistributes cigarettes which exceed the capacity of a group of packing machines, from a reservoir to another group which needs them 69/. With these kinds of innovation we could speak of a "6th vintage" of machinery which completely automates cigarette production.

With the growing automation of the link-up between making-up and packing machines, integration within the packing line has taken on new forms. In fact, there is a single packing-cellophane wrapping-baling machine which produces as a single unit. Furthermore, the high speeds of the making-up machines were accompanied by significant speeding up of the packing process (from about 240-250 packets per minute to more than 400) 70/. Typical machinery of this vintage are: the GD XI-4350/Pack (integrated unit), the Molins dLP 3 and the Schermund KG or Model LS/ES/KW (integrated unit).

From this brief history of the most important innovation in cigarette production technology, we can see that the international frontier lies in high speed/capacity machinery, highly integrated and automated at all stages. Table V.4 gives a summary of the classification of this development by vintages of the making-up and packing machinery 71/.

c) Relation Between Products and Processes

Although in some studies of specific branches of industry the explicit or implicit assumption is made that a change in the product involves parallel modifications in the process technology, in order to produce the goods in question, there is no consensus of opinion in the economic literature on this question. On the contrary, it is a subject which requires more detailed research.

69/ Ibidem, p.52

70/ Only cigarettes packed in paper packets (as in the Argentine case) are referred to. The speeds of 5th vintage packing machines, which use cardboard containers, have also increased (from 180 to 250 packets per minute), but they are still below those for paper. Ibidem, p.50.

71/ Fibre preparation machinery is not included, because this process contains diversified treatments and machines, according to the type of tobacco and blends utilized.

TABLE N° V. 4

Classification of Making-up and Packing Machines in Vintages,
According to Output 1880-1975

I. Cigarette Making-up Machines

| Technological Vintages | Period used in U.S.A. | Representative Machine (Brand and Model) | Output (in cigarettes/minute) 70 mm. long |
|------------------------|-----------------------|--------------------------------------------------|-------------------------------------------|
| 1st. | 1880-1920 | Bonsack | 200-450 |
| 2nd. | 1920-1938 | Molins Cigarette Making Machine (Mark I) | 500-1000 |
| 3rd. | 1938-1960 | AMF 1-90 Molins Mark IV Hauni KDZ | 1000-1800 |
| 4th. | 1960-1971 | Molins Mark VIII Hauni Garant I & II | 1800-3000 |
| 5th. | 1971- | Molins Mark IX Hauni Garant IV AMF Ypsilon | 4000 |

II. Packing Machines

| Technological Vintages | Period used in U.S.A. | Representative Machine (Brand and Model) | Output (in packets of cigarettes/minute) |
|------------------------|-----------------------|-----------------------------------------------------------|------------------------------------------|
| 1st. | 1880-1920 | Carried out manually | |
| 2nd. | 1920-1935 | Molins Simplex Packer | 40-75 |
| 3rd. | 1935-1960 | Arenko REY AMF 3-79 | 80-135 |
| 4th. | 1960-1971 | Molins HLPI Hauni <DW AMF 3-79B-3000 | 135-250 |
| 5th. | 1971- | Molins HLP III GI XI Schmermund Duplo Blitz o KG | 250- |

Source: Drawn up by authors from catalogue information.

From the previous examination of product and process technology for cigarette production, it could be deduced that the changes in the manufacturing processes would be connected with modifications in the design of the cigarette forms. But it would be an error to assume that a change of product necessarily involves a change in the basic technology of this sector of production.

We shall explain this point. It is true that a change in the product design involves some transformation of the manufacturing processes. It is obvious, too, that it is not possible to make a new product using exactly the same processes previously in use. But the nature of the changes may be very different according to each case, representing radical innovations or relatively simple adaptations. Between these two extremes there exists a range of technological alternatives which involve greater or lesser difficulties and the availability of the technical capacity to carry them out. In other words, there is not, in many industries, a simple, direct or linear relation between changes in products and processes, and, as we shall see later on, among these industries can be mentioned the cigarette industry.

As certain forms of the product did not exist in earlier periods, it is logical that there is a certain link between cigarette forms and process vintages. For example, it would be very difficult to produce a low nicotine and tar cigarette or one 120 mm long with a first or second vintage cigarette making-up machine, which was used more than 45 years ago and when even filters had not been incorporated. But when there is not such a time difference nor an accumulation of modifications in the goods produced, the relation between product forms and processes necessary to manufacture them changes markedly. That is, although these machines were not originally designed to make more modern forms, since they had not been introduced or launched, it is still possible to make adaptations.

This statement is closely linked to the type of country being studied and with its return on factors of production. Thus, for example, it is possible that in economies where technicians and professionals are highly paid, the alternative of modifying machinery to produce goods which only incorporate some small distinguishing feature, is not even considered. The decision would be, in that case, to directly acquire new machines, designed to make the goods in question, and which also incorporate other kinds of developments or improvements.

If we apply this kind of reasoning to the case of cigarettes, we find that to produce a 120 mm cigarette, which is different in length and diameter, in the U.S. and in other countries, 5th vintage

TABLE N° V. 5

Relationship between Product Forms and Cigarette Making-up Machines

A. Original Design Machines

| Product Forms | Vintages and Average Speeds of Making-up Machines | | | | |
|---------------------------------|---------------------------------------------------|-----------------|------------------|------------------|------------------|
| | 1st. 300/min | 2nd. 800/min | 3rd. 1500/min | 4th. 2300/min | 5th. 4000/min |
| 120 mm | no | no | no | no | yes |
| Low nicotine & tar | no | no | no | yes | yes |
| 100 mm | no | no | no | yes | yes |
| 80-85 mm filter & non-filter | no | no | yes | yes | yes |
| 70 mm non filter | yes | yes | yes | yes | yes |

B. Improved Machines *

| Product Forms | Vintages and Average Speeds of Making-up Machines | | | | |
|---------------------------------|---------------------------------------------------|-----------------|------------------|------------------|------------------|
| | 1st. 300/min | 2nd. 800/min | 3rd. 1500/min | 4th. 2300/min | 5th. 4000/min |
| 120 mm | no | no | yes * | yes * | yes |
| Low nicotine & tar | no | no | yes * | yes | yes |
| 100 mm | no | no | yes * | yes | yes |
| 80-85 mm filter & non-filter | no | no | yes | yes | yes |
| 70 mm non filter | yes | yes | yes | yes | yes |

*/ The improved 3rd. and 4th. vintage making-up machines can manufacture 100 mm, 120 mm and low nicotine and tar cigarettes.

Source: Drawn up by authors.

Machines are used which appear in this decade. Despite this, it has been demonstrated empirically that it is feasible to produce this good with a technology which has been in use for 20 or 30 years. What we have said can be appreciated in Table V.5, which shows the relation between the main product forms and the cigarette making machines, both in their original designs and in feasible adaptations which involve modifications or replacement of parts. The different ways in which this relation is manifested emphasises the significant role of adaptive technological change to which we shall make special reference when we analyze the specific case of Argentina, and which gives some explanation of her present technological state, as far as the vintages of machinery in use are concerned.

To sum up, we can say that the relation of cause and effect between changes in products and innovations in productive processes is not unique nor does it occur in one direction only, and that it depends on the characteristics of the industrial sector. But what we can add is that, in addition, the nature of this connection depends on three factors: firstly, that the changes be significant and not simply to achieve minor differentiations; secondly, on the relative value of the costs of production and, finally, on the availability of human capital technically qualified to carry out the adaptive tasks.

3. The State of Argentine Technology in 1976 72/

Before going into the analysis in depth, it is necessary to clarify some points regarding concepts and methodology. In the first place, we must place on record that, even when in the course of the text the state of machinery endowment is compared to the international frontier defined earlier, this does not assume that the aim is to acquire the most modern and most highly automated equipment. Also, to refer to the technology in use as one or two vintages behind does not imply a negative judgement. On the contrary, this may mean the adaptation to local conditions, such as

72/ To describe the main characteristics of the state of technology it is necessary to make a break in time, and it is for this reason that the data relating to equipment supply in the firms refers to October, 1976. Only machinery in use or which was recently incorporated and was in the process of being brought into operation was considered; plans for new acquisitions or machinery which had not arrived at the plant were ignored.

TABLE Nº V. 6
Characteristics of Processes and Vintage of Machines.
Argentine Technological Profile, 1976.

| Processes | Unit of Measurement | Vintage of Machines according to Speed | | | Technological Profile Percentage Share of Vintages | | | | | |
|----------------------------------------------------|----------------------|----------------------------------------|-----------|------------------------------------------------|----------------------------------------------------|---------------|------|-------|------|-------|
| | | 3rd. | 4th. | 5th. | 3rd. | 4th. | 5th. | | | |
| | | Average Speed | % | Average Speed | % | Average Speed | % | | | |
| I. FIBRE PREPARATION | | | | | | | | | | |
| 1. Stripping | Kgs/hour | 350-800 | 800-1500 | >1500 | 600 | 54.55 | 1000 | 45.45 | | |
| 2. Blending | Kgs/hour | up to 4000 | 4000-5500 | >5500 | 1500 | 4.72 | 4654 | 95.28 | | |
| 3. Stem cutting | Kgs/hour | up to 500 | 500-1000 | >1000 | 200 | 36.84 | 800 | 63.16 | | |
| 4. Sheet cutting | Kgs/hour | up to 1500 | 1500-4000 | >4000 | 800 | 52.83 | 2000 | 47.17 | | |
| 5. Addition of Ingredients and essences ("casing") | Kgs/hour | up to 1000 | 1000-4000 | >4000 | 425 | 19.32 | 3550 | 80.68 | | |
| II. MAKING UP | | | | | | | | | | |
| 1. Filter making | Filter tubes /minute | up to 1500 | 1500-3500 | >4000 | 880 | 67.48 | 1650 | 20.25 | 4000 | 12.27 |
| 2. Making-up of filter and non-filter cigarettes | Cigarettes /minute | 1000-1800 | 1800-3000 | >3500 | 1333 | 32.82 | 2150 | 62.63 | 3700 | 4.55 |
| III. PACKING | | | | | | | | | | |
| 1. Packing | Packets of 20 units | 80-135 | 135- 250 | > 250 | 120 | 5.65 | 158 | 91.33 | 450 | 3.02 |
| 2. Cellophane wrapping | Packets of 20 units | 80-135 | 135- 250 | > 250 | ... | ... | 154 | 74.43 | 423 | 25.57 |
| 3. Baling | Units of 10 packets | up to 55 | >55 | Integrated w/ packing and cellophane wrapping. | 44 | 81.26 | ... | ... | 42 | 18.74 |
| 4. Packing in boxes | | - Manual loading - | | | | | | | | |

Source: Drawn up by authors from data supplied by firms and technical publications.

relative endowment and the prices of the available factors of production, etc.

Another introductory aspect which it is necessary to clarify refers to the criteria used for the classification of machinery according to vintages. The only significant variable considered was the speed or capacity of the machine, in spite of the fact that, in our opinion, other aspects should be included to enable us to make a clearer definition of a technological vintage. Among those not included we can mention: a) degree of integration. It is possible to distinguish two forms or levels of integration, one of which we could call "primitive", consisting of mechanization by means of conveyor belts, circuits of trays or pneumatic systems which eliminate manual handling from one machine to another and which appears both in the fibre preparation process and in making up and packing. The other, which could be called "modern" or "advanced", includes the complete integration of different processes in a single machine; as an example we can mention the Italian machine GD model 4350 which carries out the cellophane wrapping and baling functions in a single unit; and b) level of automation, particularly everything related to quality control, temperature and humidity control, flow checking of raw materials and finished products.

We have not included these aspects in the description of the characteristics of the different "technological vintages" because of the lack of detailed information and because this report is a preliminary study of the subject. We intend, in a second stage, to complement the norms and characteristics which constitute a technological profile, in order to subsequently make comparisons between countries in the area. Despite the shortcomings described, the conclusions we reach form a useful starting point for the present analysis.

In Table V.6, the elements which characterise the vintages of machines (speed and capacity), already discussed in the section referring to the development of the international frontier, are summarised. It also contains the share of each vintage in the different processes, which shapes the profile of the industry in Argentina 13/.

Before going into some outstanding aspects in some detail, it

13/ We repeat that the description of the industry does not include the machinery of Manufactura de Tabacos Imparciales S.A., which is installed in Goya, Corrientes.

is necessary to clarify the methodology employed in the preparation of this table. Taking as an example the 62.63% of 4th vintage cigarette making-up machines which have an average output of 2,150 cigarettes per minute, the values were reached in the following way: the number of the different brands and models of machine in use in the factories was weighted according to its effective productive capacity, and by adding up, sub-totals were then obtained per vintage, so that the percentage (62.63) represents the proportion of the total installed capacity corresponding to that vintage. The speed of average output (2,150 units), which is the quotient of the sub-totals for the number of machines, indicates in which section, within the limits which define the vintage, the endowment of cigarette making-up machines lies 74/.

A. Concerning product forms. As has been shown in Chapter II, in Argentina there is evidence of the adoption of new forms of consumption. Furthermore, as is shown in Table V.7, the demand structure gives similar proportions to that of the U.S., with slight variations. There is a greater predominance in Argentina of consumption of mature products (90%). There is only some degree of backwardness in the product which represents a real advance of the international frontier: low nicotine cigarettes, although we can hazard a guess that the explanation would be the lack of pressure and legal controls concerning nicotine and tar content, since there is a brand on the market which fulfils those conditions and which is not advertised.

74/ A brief numerical example to clarify concepts:

| Vintage | | Units Per Fraction of Time | Percentage Share | Average Output |
|---------|--------------------------------|----------------------------|------------------|----------------|
| 3rd | 10 Hauni KDZ x 1500 cig/min | 15,000 | 20.7 | 1,433 |
| | 2 AMP 1-90-12x1100 " | 2,200 | | |
| | | <u>17,200</u> | | |
| 4th | 20 Molins Mark 8-SMx2300 " | 46,000 | 74.8 | 2,214 |
| | 8 Hauni Garant 1Bx2000 " | 16,000 | | |
| | | <u>62,000</u> | | |
| 5th | <u>1</u> Hauni Garant 4x3700 " | <u>3,700</u> | <u>4.5</u> | 3,700 |
| TOTAL | | 82,900 | 100.0 | |

TABLE V.7

Comparison of the Share of Cigarette Forms
in the U.S. and Argentine Markets 1975
(in percentages)

| PRODUCT FORM | U.S.A. | ARGENTINA |
|-----------------------------------------------------|--------|-----------|
| - 70 mm non-filter | 5.4 | 1.8 |
| - 85 mm non-filter | 7.6 | 0.1 |
| - 85 mm with ordinary acetate filter | 52.8 | 57.7 |
| - 100 mm with ordinary acetate filter | 25.4 | 40.3 |
| - 85 and 100 mm with low nicotine and tar filter | 7.7 | 0.1 |
| - 120 mm with ordinary acetate filter | 1.1 | - |

Source: Table V.2 and Síntesis Estadística Anual, 1975,
Cámara de la Industria del Cigarrillo.

B. Regarding manufacturing processes. We now discuss the outstanding aspects of each stage in cigarette manufacture. (See Table V.6).

1) In fibre preparation not all the steps in the process were considered, since they vary from one firm to another, according to the type of tobacco and cigarette to be made. Only some parts have been included which are common to the majority of plants and with a certain degree of relevance to the process as a whole.

A problem of measurement must also be emphasised, since capacity as a criterion is linked to the size of the market, which makes the definition of a 5th vintage a relative matter since this, as we mentioned previously, should also depend on the degree of integration and automation. Furthermore, at this stage it is feasible to suit the design of the machinery to the particular characteristics and the diversification of the blends used in each firm which, in turn, depend on the quantity of brands and the weight of each one in the total amount of tobacco to be processed.

What arises from the table is that the Argentine industry lies

between the 3rd and 4th vintages, which implies a lower level in the quality of the fibre thus obtained as far as cut and precise degree of moisture are concerned. But at the same time it indicates a more intensive use of labor.

A significant proportion of the investment carried out in two firms between 1966 and 1969 went to increase the capacity of the processing plants in the field and to mechanize parts of the fibre preparation process which previously had been carried out by hand.

A distinguishing characteristic of the machinery in use, as far as its origin is concerned, is the preponderance of machines produced in Argentina. In rolling, blending and addition of ingredients and essences, all the 3rd vintage machines were built domestically. Further, in the operations which show a greater proportion of 4th vintage in the installed capacity, the percentage of domestically produced machinery is 52% in blending and 50% in casing. Only in cutting, of both stem and leaf, are all the machines used imported.

2) In filter making, most of the capacity in use belongs to the 3rd vintage. Furthermore, 20.25% of the 4th vintage is bordering on the lower limit, as is shown by the average speed. The characteristics mentioned are determined, to a large extent, by the existence of a high degree of local adaptation in machinery which is obsolete and used for different functions, as is explained in the following chapter.

As for the making up of cigarettes, here the 4th vintage predominates, even though a third of the capacity corresponds to the 3rd and there are machines which have been in operation for between 25 and 45 years. In both cases the average speed is close to the lower limit and far from the limit with the following vintage. It is also necessary to clarify the point that the 4.55% which corresponds to three 5th vintage machines is being tested, since they have only recently been installed and it has not been possible to verify their output. Something which stands out is that two of the domestic brands, which are leaders in their respective firms, are largely manufactured with 3rd vintage making-up machines.

One important piece of information is that a possible replacement of 3rd vintage machines by 5th vintage means eliminating 4 making-up machines for each one incorporated, which involves removing 4 or 5 workers per shift, if the manual system of tray loading is used. This is mentioned as information for the later discussion on criteria for the choice of equipment.

3) The classification of machinery according to capacity and

speed is a conventional way of doing it, difficult to define precisely in some cases. This is what happens with the packing and cellophane wrapping machines in which the dividing line between 3rd and 4th vintages is not so clear. If we modify the limit from 135 to 160 packets per minute, the proportions vary completely. In that case, 84.08% of the capacity of the packing process and 63.1% of the cellophane wrapping process belongs to the 3rd vintage, with average outputs of 147 and 145 packets respectively. These two operations are closely related and it is for this reason that in cellophane wrapping the limiting function is the output or speed of the packing machines.

In the Argentine case, the middle point of the industry in packing is represented by one machine: the AMP 3-79 B-3000, of which there are 75 out of a total endowment of 94 packing machines. As far as integration and automation are concerned, there is only one machine which links three operations of this stage, while there are others which link only the cellophane wrapping and baling operations. It should be made clear that the average speed of 5th vintage baling is below the limit imposed on the 3rd vintage because of the link-up mentioned 75/.

A remarkable aspect of the Argentine market is the lack of cardboard cigarette packets (crush-proof boxes). The reasons put forward by the technicians and those in charge of production for the non-utilization of packing and cellophane wrapping machines of this type, are based on: high costs and problems of quality and homogeneity of the inputs, complexity of maintenance and weight of the machines, the latter in relation to the existing buildings 76/ and with regard to baling in cardboard containers, because it is not the usual way of marketing.

75/ While a 3rd vintage baler processes packets of cigarettes from several cellophane wrapping machines, a 5th vintage one bales only the units which have previously been wrapped in cellophane in the same machine. That is, in this case too the limiting function arises from the preceding operation or operations within the same integrated process.

76/ There are various bottlenecks arising from the structure of the buildings belonging to the firms established in the Federal Capital. Besides being old, they lack sufficient space to allow for an increase in capacity. Neither are they strong enough to stand very heavy equipment.

As with fibre preparation, the 81.26% which has 3rd vintage baling includes a significant proportion of domestically produced machines.

Finally, packing in boxes can be carried out mechanically, but this has never been done in the Argentine industry and it is not proposed to incorporate this process. In this operation a single operator per baler is used.

4) In synthesis, the average age of the machines is between 20 and 25 years in the processes using older equipment and 5 years in those which use recently manufactured machinery. The fact that the equipment has been incorporated recently does not mean we can speak of the latest vintage or of automation; on the contrary, despite being, in general, new, they do not incorporate the most advanced technology, so that the average technological age is even greater than that mentioned previously (machines made and incorporated during this decade but which represent a 3rd or 4th vintage technology).

A final note concerning the degree of mechanization and automation which involves less labor, or a shift of labor. In Table V.8, some of the most important operations carried out manually in four manufacturing establishments are set out. In objective terms, it corroborates the statements of the previous paragraph regarding the modernity of the machinery in use and the non-employment of completely integrated equipment.

5) The conclusions drawn from the analysis of the profile of technology in Argentina, oblige us to make some comments on the actions of the multinational corporations regarding choice between labor or capital intensive technologies and regarding the modernity of these technologies.

There are many texts or studies which express the opinion that multinational corporations, in their expansion throughout the world, utilize the technology appropriate to conditions of high labor costs existing in the countries of origin and the size of their markets 17/.

17/ This hypothesis appears in a large number of works. For some of the best discussions, see Richard J. Barnett and Ronald E. Müller, Global Reach: The Power of Multinational Corporations, Simon & Shuster, New York, 1974, pp.167-79 and Miguel S. Wionczek, Inversión y Tecnología extranjera en América Latina, Ed. Joaquín Mortiz, Mexico, 1971, pp.31-32.

TABLE V.8

Operations Carried Out Manually in Cigarette Factories

| Operation | Number of Factories |
|-----------------------------------------------------------------|------------------------|
| - Loading tobacco processing line | 4 |
| - Feeding cigarette making-up machines with fibre | 2 |
| - Loading trays with filters | 3 |
| - Loading trays with cigarettes | 4 (a) |
| - Transporting trays of filters to cigarette making-up machines | 4 |
| - Transporting trays of cigarettes to packing machines | 2 (a) |
| - Loading cellophane wrapping machines | 1 |
| - Inspecting packets of cigarettes | 4 |
| - Transporting packets to balers | 1 |
| - Loading balers with packets | 2 |
| - Packing boxes with cartons | 4 |

(a) In one firm there are two systems, one mechanized and the other manual, but most of the operation is done by hand.

Source: Drawn up by the authors.

What we have established about the Argentine cigarette industry contradicts this general assertion, since even though external norms of consumption have been adopted, the predominant process technology is not the most modern, nor have all the operations which were carried out manually prior to the entry of international firms been automated.

This poses a question: to what extent is this industry an exception to the usual behavior? The study of other sectors of production would allow the truth of such a theory to be verified, and comparisons between countries, within each industry, would

allow the factors which affect the choice of a particular technology to be isolated.

In the Argentine case it is also necessary to bear in mind that the multinational corporations which entered the market in the 1960's did so by acquiring shares in Argentine firms and not by installing new manufacturing establishments. Furthermore, during the last ten years there have been a number of different economic policies which have influenced the sector. All these reasons for specific behavior are considered in the following chapter.

VI. ECONOMIC AND TECHNOLOGICAL PERFORMANCE OF THE INDUSTRY

In the preceding chapters, a description of the industry has been given, covering aspects of cigarette supply and demand, of the production characteristics and of the state of technology. It is appropriate, at this point, to investigate the economic and technological criteria applied by the firms when making their decisions, thus attempting to answer a number of questions posed in the course of the paper.

We have seen that consumer preference moved rapidly in the direction of patterns assimilated from overseas, not only with regard to cigarette forms but also with regard to brands. These variations in demand for the product reflected imitative norms and the accompanying foreign takeover of the sector.

On the other hand, the productivity of the labor factor, in an industry which stands out as being relatively non-labor intensive, has reached an upper limit which has remained unchanged during recent years.

The technological aspect of production shows very special characteristics in relation to the backwardness observed in the manufacturing processes, expressed in average age, modernity and automation of machinery.

All these special aspects of the Argentine cigarette industry are due to inherent characteristics of the sector and to particular conditions. Therefore, the analysis of entrepreneurial response to the conditions in which cigarette manufacture and marketing had to be carried out has been divided into two parts.

In the part on economic behavior we synthesize the main characteristics of the industry and the different reactions of firms to general economic conditions and to the incentives or restrictions on investment. Under the heading of technological behavior we analyze the causes of the present state of technology, considering separately engineering capacity and norms for choice of machinery.

1. Economic Behavior

In the previous chapter, the present state of technology in the sector with regard to manufacturing processes was described. Comparing this picture with that of the international frontier, a considerable lag can be observed. There may be two reasons for this lag on the part of industry: first, a deliberate attitude

by the firms, as the result of a specific entrepreneurial behavior and secondly, as the result of a number of restrictions which made greater progress impossible. A combination of the two is, of course, not impossible.

This obliges us, first of all, to sketch out certain norms of entrepreneurial behavior which have been practised in the industry and, secondly, to analyze the kind of restrictions the sector had to face and which influenced this behavior. In this section, we try to explain these two questions.

The cigarette industry has a number of specific characteristics which we must mention:

a) Product differentiation is the essential characteristic of the industry and advertising the chief instrument used to this end.

b) There are no technological entry barriers, since, as was analyzed earlier, the equipment is extremely divisible. There are, however, barriers arising from large scale sales promotion costs, which we can call "introductory sales costs", which can be absorbed into the fixed costs 78/.

c) The sector shows a high degree of concentration. It is made up of only five firms and one of them controls about 40% of total sales 79/.

d) Prices are determined according to the rules of full cost pricing. Once the rate of profit has been fixed, it tends to remain constant and be considered the normal or minimum rate. This fact, together with the kinked demand curve theory, would explain the rigidity of the sector's prices 80/.

e) The overall demand for cigarettes is relatively elastic with respect to price. Price reductions or rises in the level of real incomes are reflected in an increase in sales. However, there is a limit below which sales do not drop.

78/ See P. Sylos Labini, Oligopolio y progreso técnico, Ediciones Oikos-Tau, Barcelona, 1965, pp.69-72 and F. M. Scherer, Industrial Market Structure and Economic Performance, Rand McNally & Company, Chicago 1971, pp.95-100.

79/ The case of the cigarette industry corresponds to a differentiated oligopoly with high concentration, which Sylos Labini defines as a mixed oligopoly. See op. cit., pp.27-28.

80/ F. M. Scherer, op. cit., Ch. 13.

f) There are groups of cigarette brands into which those which have the same characteristics fall (example: "American Blend" cigarettes, 85 mm long, filter, domestic brand), and which are usually given the same price. The cross elasticity of demand with respect to price, within a group, is positive 81/.

g) The cost structure of the industry reveals that the biggest share corresponds to "other raw materials" (31.6%), following it in order of importance "tobacco" (18.4%), "labor" (13.6%) and "advertising" (6.3%), the remaining 30.1% being the gross margin to cover repayments, profits and any other minor costs 82/.

The entry of foreign firms into the Argentine market breaks the existing stability and, therefore, modifies its structure. Before this happened the market showed a certain degree of stability, with the undisputed leadership of a firm which covered 40% of sales (Cía Nobleza de Tabacos S.A.), while the remainder shared the other 60%. Later on, competition between the firms in the sector increases, since the new firms (especially Philip Morris) tried to capture - as is logical - a larger share of the market, while Nobleza tried to keep its market leadership.

The first impact of this sharpening of the rivalry between firms - given the possibilities for expansion offered by the Argentine market - was a strong increase in total sales. These increased between 1967 and 1975 at an average annual rate of 4.5, although it is possible to pick out two periods: between 1967 and 1970 the thrust came from advertising, while from 1971 greater weight can be attributed to the reduction in relative prices.

The rise in advertising costs could be absorbed in a price war, since in both cases the result is a reduction in the profit margin

81/ In the analysis the cross elasticity of demand for different kinds of cigarette with respect to income variations is not considered. This case represents the change of group, because of the change in the consumer's real income.

82/ The cost structure, which was obtained by averaging the last few years, was calculated from the factory price; that is, it does not include domestic taxes, the Fondo Especial de Tabaco, nor distribution costs. The heading "other raw materials" covers: paper spools for cigarettes, acetate for filters, aluminium foil, cellophane, cigarette packets, boxes, etc.

per unit 83/.

In 1969, advertising costs per packet increase by almost three times over those of 1965, and then begin to fall. This sharp increase in advertising costs - as a result of the greater competition between firms - does not only increase the industry's total sales, but modifies the share of the market held by each firm. In this respect, Massalín & Celasco shows the greatest dynamism, since from occupying 5th place in 1966, with less than 10%, it reaches 2nd place in 1975, with nearly 20%.

There are several reasons for this strong expansion by Massalín & Celasco. It is not the result of a greater share in advertising costs, since this firm only undertakes 14% of the total in the industry between 1967 and 1969. However, this firm is the one which launches most international brands on to the market (7 out of a total of 13), while the remaining firms produce a maximum of two out of a greater number of brands. Thus, the launching of well known brands reduced the size of this initial expenditure 84/.

A second fact which would explain this greater dynamism is: that market expansion occurs by means of an increase in sales of light tobacco cigarettes and Massalín & Celasco produce this type exclusively, so that it can be argued that it also reaped benefit from the expansion of the market in itself 85/.

In contrast, Imparciales and Particular lose some of their market share, since they specialize in dark tobacco cigarettes. The two remaining firms - Nobleza and Piccardo - keep their respective proportions.

The relative reduction in prices which begins to appear from 1968 was the other variable which allowed an expansion in sales. From that year, prices fell steadily and in 1975 reached a level

83/ According to Scherer, there seems to be a positive relation between the degree of concentration and the amount spent on advertising costs. See op. cit., Ch. 14.

84/ The international brands had been introduced between 1961 and 1967 through smuggling, so that the introductory period had already been completed.

85/ Advertising of a brand does not only promote that brand, but also consumption of the product. Thus, the persuasion exercised by one firm benefits the rest. See Scherer, op. cit., pp.334-37.

32.5% lower than that of 1968. This was the result of the price control policy which was imposed on the industry, chiefly from 1970, based on the effect of cigarettes on the cost of the average family basket.

Both advertising costs and the fall in the relative price of cigarettes - although they contributed to market expansion - had negative effects on the firms' profit margin per unit. In fact, while advertising costs normally represented 6% of the cost, in 1969 they rose to about 18%, which meant reducing the gross margin per unit by more than a third.

For that reason the firms decide to make an agreement to suspend advertising on radio, television and in the cinema, an agreement ratified by the State by means of an Executive decree; the latter thus becomes the arbiter over competition between the firms.

However, the fall in cigarette prices - as a result of state control - continued to exert downward pressure on the profit margin per unit. But at the same time it created an additional problem for the firms, since they could not stop supplying the market, because that implied losing their share in it.

In this way, the firms in the sector, in order to reestablish their profit rate, had the alternative of attempting to reduce their direct costs. In this respect, the most important group is made up of "other raw materials". The components of this group are closely connected with the presentation of the product, so that any deterioration in this area means risking losing market presence. On the other hand, it is almost impossible to exert any pressure on the prices of these inputs, since they are either imported or made by sectors which are themselves concentrated 86/.

Another important section of the cost - tobacco - was in part able to reverse the fall in profit margin. By the creation of the Fondo Especial del Tabaco (F.E.T.) in 1967, the cost of this input was reduced by about 50%, since the difference is paid to the producer through the Fund. This allowed the gross margin per unit, plus advertising, at constant values, to maintain the same level until 1969, but from that year it begins to fall slowly 87/.

86/ For example, the acetate for filters is imported and the cigarette paper is manufactured locally by a single firm.

87/ The F.E.T. is financed by means of a tax on each packet of cigarettes, but pays no domestic taxes. Therefore, an increase in the price of cigarettes via the F.E.T. implies a lower tax return.

Another way of reducing costs is by means of the labor component, not at the level of remuneration, which is established outside the firm, but with regard to its replacement by machinery. In this case, the cost-benefit analysis and technical reasons must be considered. Even though it can be argued that, in the period in question, labor costs were not a component on which pressure has been exerted in order to increase operational profit, it is necessary to make a more detailed study of the return on investment in machinery involved in relocation of labor, despite the fact that it has a low share in manufacturing costs.

The firms in the sector, therefore, were faced with a situation in which the rate of profit was below its normal level and declining, with no possibility of further reducing their direct costs, with strict price control and self-regulation of advertising costs 88/.

Nevertheless, the firms' product differentiation policy is not only a problem of demand manipulation. On the supply side it imposes the need to present goods of good quality, the launching of new forms and/or brands and the ability to supply an expanding market in order not to lose its share in it.

The preceding elements are connected to the investment and technological policy of the firms. At times of intense rivalry between firms (as is the period 1967-1975), these elements play an important role. Thus, the firms in the sector faced an extreme paradox: fierce competition between themselves by means of differentiated products with an expanding market, but with a profit margin below normal and declining. That is, a strong incentive to invest, but on the other hand, the severe restriction constituted by the rate of profit.

A number of further restrictions must be added to what has already been indicated. One of them refers to the difficulties the firms encountered in importing machinery, as a result of the

88/ An alternative - not analyzed in this report - is that employed by the pharmaceutical industry in the face of a similar situation. It consists of launching new high-prices brands, as a way of evading state control. In the case of the cigarette industry, this variation is restricted by the fact that the new product must fit into the existing price bands. For an analysis of product differentiating behavior in the Argentine pharmaceutical industry, see Jorge M. Katz, Oligopolio, firmas nacionales y empresas multinacionales. Siglo Veintiuno, June, 1974.

balance of payments problems faced by the country. This becomes more serious in the last few years and not only implies restrictions on imports, but also dearer financial costs.

Another kind of restriction is that connected with the country's general political and economic situation, from 1970. The prospect in view from that year and confirmed in 1973, of the return of a Peronist government, created great uncertainty with regard to the conditions in which industry would have to operate. Thus, the situation created by the political process set in motion in 1970, influenced the sector's investments 89/.

2. Technological Behavior

The present state of technology in the Argentine cigarette industry is the result of a number of factors which have all combined to determine a particular approach to technological decisions.

We stated in Chapter V that, although the industry lies at the international frontier as far as products are concerned, with regard to manufacturing processes the average technological age is fairly high and in general the machinery used is not highly automated. It was also stated that the link between processes and products depends on the return on the factors of production and on the availability of qualified technical personnel.

We consider that in countries where the cost of skilled labor is low, there is only a possibility of adaptation to local factor endowment with regard to the capital or labor intensive alternatives, and therefore with regard to how modern the machinery used is, when there is a developed engineering capacity. This allows, furthermore, the application of certain norms and criteria for the choice of machinery.

a) Engineering Capacity

In this first report we make an eminently descriptive analysis of engineering capacity, as a result of visits to the manufacturing plants and of conversations with the production managers.

89/ The retraction in investment was a generalized phenomenon and not peculiar to this industry only.

We must point out that in this sector technical capacity appears in three different fields:

1) Domestic Manufacture of Machinery and Parts This may be the result of exact copying of imported designs and/or plans or of domestic designs. In turn, manufacturing may be carried out by suppliers or internally, within the firm itself. As a final clarification, a machine is defined as "domestically produced" when most of its components have not been imported.

In Table VI.1 a list of domestically produced machinery and link-up systems which are used in the different stages of cigarette production in Argentina is set out as an example.

The largest number is found in the fibre preparation area. There is great diversity between firms with respect to production lines; each factory has its own design for tobacco treatment, with different processes and machinery make classification and comparison difficult; therefore, it is important to consider the table as an illustration only.

As we said, part of the machinery is a more or less close copy of imported models. This is the case with the rolling mills, the blending silos, some feeders, cellophane wrapping machines and baling machines. Nevertheless, another important proportion is of domestic design, either by the cigarette firms themselves or in collaboration with domestic machinery manufacturers. These designs are most often seen in vacuum changers, washers, treatment cylinders, dryers, casing cylinders and in the mechanical link-up system of the packing machines with the cellophane wrapping machines and of the latter with the balers.

Two firms have built filter making machines from old cigarette making-up machines, using the benches of the latter to mount acetate feeders to produce the filter tubes. The reconditioning and the way all these parts are combined is so ingenious that the resulting machine could be considered domestically produced. However, we have decided to classify them as examples of adaptive tasks, because their component parts are imported.

It is also worth pointing out the manufacture of parts in the firms themselves 90/, which shows confidence in the technical personnel. An important piece of information is that, for machines

90/ Some firms have begun to export parts, some inputs (essences) and quality control machines to other Latin American countries.

TABLE N° VI.1

List of domestically produced Machinery

| Processes and Operations | Number of Firms using them |
|----------------------------------------------------------------|----------------------------------|
| I. Fibre Preparation | |
| Vacuum Chamber | 1 |
| Tobacco Washers | 1 |
| Treatment Cylinders | 3 |
| Rolling Mills | 4 |
| Blending Silos | 2 |
| Feeders (for silos, cylinders, cutters, dryers, etc.) | 4 |
| Cutters | ... |
| Dryers (pre-drying, Burley dryers, etc.) | 4 |
| Casing Cylinders (essences, molasses) | 3 |
| Box depositing of Tobacco Fibre | 4 |
| Feeding Systems (pneumatic or bucks) | 2 |
| II. Filter Production | |
| Filter Makers | ... |
| III. Cigarette Production | |
| Cigarette Makers | ... |
| IV. Packing | |
| Packing Machines | ... |
| Link-up System of Packing and Cellophane- Wrapping Machines | 4 |
| V. Cellophane Wrapping | |
| Cellophane Wrapping Machines | 3 |
| Link-up System of Cellophane Wrapping and Baling Machines | 3 |
| VI. Baling | |
| Baling Machines | 2 |

Source: Drawn up by the authors from data supplied by the Companies.

from 8 to 10 years old, delivery for parts from the factory, made to order, is six months.

2) Adaptations and Improvements We must clarify the sense in which each of these terms is used. The adaptations made to new machinery are based on local conditions or the industrial plant; that is, they are related to the training and use of labor, adapted to inputs and raw materials, to the availability of space and link-up to sections or parts of the production process, etc. The improvements, on the other hand, may be quantitative, when they involve modifications in the speed of operation or extension of the useful life of the machine; and also qualitative, which are those improvements which raise the quality of the final product or make possible the production of new forms.

Table VI.2 contains a summary of modifications and adaptations made to existing machinery; it does not claim to be an exhaustive or detailed list of all the improvements and changes which firms have carried out in this sector. There are surely many more. As has been indicated in the text, the variety and quality of the modifications made are truly admirable, showing a great engineering capacity and very inventive techniques. More exhaustive research into adaptive technological change in cigarette factories requires a much deeper analysis of each adaptation and/or improvement in the machinery, including the technical and/or economic reasons for them.

From the adaptations and improvements referred to it is possible to point out some which are up to international standard because of their importance. Thus, for example, the manufacture of the 120 mm cigarette with 3rd vintage (see Table V.5) machinery by three firms involves improvements in all the machines which carry out the making-up and packing processes. Another example is the joining of two and three 4th vintage packing machines to a machine of the most recent vintage, which links up the cellophane wrapping and baling processes. According to statements by the firm itself it is a unique case in the world, which required only the collaboration of the foreign manufacturer for the design of a distribution lung.

3) Repairs and Maintenance The special characteristics of this third manifestation of engineering capacity can be partly deduced from some inferences, since it has not been possible to go into them in detail for this preliminary report.

It would be important to compare the results of the different maintenance policies applied. Some firms opt for taking machines out of production, after using them to their limit, to carry out a

TABLE VI.2

Principal Adaptations and Improvements to Imported Machinery

| PROCESS AND OPERATIONS | Number of Firms Which Have Carried Them Out |
|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| I. Fibre Preparation | |
| - Modification of vacuum chambers (injectors) | 2 |
| - Modification to wet stem treatment machinery | 1 |
| - Modification of dryers (for Burley tobacco, pre-drying, etc.) | 1 |
| - Adaptation to cutters for domestically produced fibre (change of gearing to cut stems instead of leaf, remaking of parts) | 3 |
| - Modification of feeders (for cutters, for blending silos, for dryers) | 4 |
| - Improvement of machinery for fibre puffing | 1 |
| II. Filter Production | |
| - Adaptation and modification of old cigarette makers to produce acetate filter-tubes | 2 |
| - Adaptation and modification of old cigarette makers to produce filter tips | 1 |
| - Improvements to machines to produce filter-tubes for 120 mm cigarettes (with a smaller diameter) | 3 |
| III. Cigarette Making-up | |
| - Adaptations and improvements in the fibre feeding systems (tires, buckets) | 2 |
| - Modifications to combine making-up and filter machines of different makes | 2 |
| - Improvements in making-up machines to increase efficiency and/or speed (changing of blades, pulpers, teasels, etc.) | 4 |

Table VI.2 (continued)

| | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| - Improvements to making-up and filter machines to produce 120 mm cigarettes (change of blades, pads, pulpers, gears, etc.) | 3 |
| - Modifications in filter machines for different-sized filters | 4 |
| IV. Packing | |
| - Modifications to machinery for 120 mm cigarettes (changes in tray-feeding system, packets, etc.) | 3 |
| - Improvements in packing machines for 100 mm cigarettes with a smaller diameter | 1 |
| - Improvements to old machinery to increase speed (with or without adaptation kit) | 2 |
| - Adaptation to packing machines for link-up systems with cellophane wrapping and baling machines | 4 |
| V. Cellophane Wrapping | |
| - Improvements to machines to take 120 mm cigarettes | 3 |
| - Modifications to cellophane wrapping machines to improve speed and/or product quality (changes of thermostat, heat plates, adhesive applicators, etc.) | 4 |
| - Adaptations to join 2 or 3 packing machines to latest model machinery for cellophane wrapping and baling | 1 |
| VI. Baling | |
| - Improvements and reconditioning of old machinery for longer and/or smaller diameter cigarettes | 4 |
| - Adaptation of baling machines for automatic link-up systems with cellophane wrapping machines | 2 |

Source: Drawn up by authors from data supplied by the firms.

complete service. Others, on the other hand, prefer to carry out periodic preventive maintenance. Each of the options has a different effect on the general operation of the factory and on the possibility of extending working hours or including a new shift.

The fact that machines built over three or four decades ago can still be seen in operation, for which there are no original spare parts, since these are no longer manufactured, presupposes a correct maintenance policy and the know-how to carry out repairs.

Another aspect which stands out is that machinery well known for its defective design, or prototype machinery, should be operating in Argentine industry according to technical standards. This is the case with the filter machines, PA 7 and MAX 211, and the packing machines Hauni KDW.

From all the points mentioned, it is possible to deduce that technological ability, together with the human factor is a vital and determining factor in the present state of technology in Argentina. It made possible the production of forms of the product which are close to the international frontier, with a machinery endowment of two or three vintages earlier.

b) Patterns in the Choice of Machinery

With respect to the acquisition of machinery, we can pose a number of questions which may help to define different levels of analysis: were used or new machines incorporated by the equipment policies effected?; why did entrepreneurs not replace machines with a degree of technological lag by modern, automated equipment?; did criteria of a technical nature or of economic profitability prevail?

By answering these questions, we shall try to dissect these problems in some kind of order.

With regard to the age of the machinery bought, the neo-classical theoretical arguments insist on the convenience, for countries with low wages, of purchase and use of second hand machinery ^{91/}. Objectively, this is not what happened in Argentina; on the contrary, almost all the machinery which increased production capacity during the last ten years was new.

^{91/} M. A. M. Smith, "International Trade in Second-Hand Machines", Journal of Development Economics, Vol. 1, N° 3, December, 1974, pp.261-278.

This is directly linked to the second question, which concerns the replacement policy and the degree of modernity of the new machines. Empirically, a policy of gradual, steady modernization can be observed in the sector; nevertheless, it comes under the general behavior of adaptation to relative factor endowment at the domestic level. This can be seen from two points of view, since these inclusions have been carried out to satisfy the objective of expansion of installed capacity, because of market demands and/or those arising from the firm's development, because of replacement of machines or processes due to complete, as opposed to simply technological, obsolescence; that is, the useful life of the machines has been prolonged to the limit which allows it to continue production.

To justify this kind of behavior, we shall follow in part the reasoning employed by Paul Strassman in an important text on technological change 92/. This author asks if there is a preference by firms for their own old equipment over replacement by apparently better second hand machines.

"Perhaps the answer is that the machines are their own school of learning. As they become older, the workers become more experienced in maintenance methods. They face problems stage by stage, and are not faced with all the problems at once. At the point when the machines have become old, they are completely familiar and the knowledge of the history of each one is a good substitute for the broad knowledge of all the problems which may affect them. There is economy in the development and use of skills, the idle capacity of the human capital is maintained at a minimum". 93/

In relation to investment in machinery of the most recent vintage or of integrated processes of production, there is agreement regarding the technical advantages of these processes, such as homogeneity of raw materials and finished products, electronic control of the quality and weight of the cigarettes, reduction and recycling of waste, etc. In the Argentine case, we can find the answer to this aspect in the equipment policies actually applied, where it can be seen that intermediate solutions have been adopted, since even in the most modern machinery not all the accessories which involve complete automation and a parallel process of dis-

92/ W. Paul Strassman, Technological Change and Economic Development. The Manufacturing Experience of Mexico and Puerto Rico, Cornell University Press, Ithaca, New York, 1968.

93/ Strassman, op. cit., pp.213-14.

missal of labor are included. We can mention as significant examples: the process of picking up the cigarettes expelled by the making-up machine and putting them on trays, which is carried out manually and for which, when machines which double the speed of production have been incorporated, an additional worker is employed instead of using the automatic cascade process. Another example is the packing of cartons, which is carried out by a man and not by a machine (see Table V.8).

This may well indicate a deliberate technological choice, which becomes an alternative, since the machinery may be recently manufactured and even incorporate a technology similar to that used in countries with high salaries, but the distinguishing characteristic lies in the degree of mechanization or automation, which clearly shows us different requirements or a dispensing with labor ^{94/}.

It is possible to give another example regarding two machines in general use in the Argentine cigarette industry. In the packing process, the ANF-3-79 B-3000, which represents 80% of the total stock involved in this process, is a new machine which all firms have been introducing annually, from 1965 to the present time. This packing machine incorporates a technology which was developed from 1950 onwards and whose basic design has not been radically altered. With respect to the degree of mechanization, it is relatively labor intensive in this country. In the case of the making-up of cigarettes, the same relations between variables are found in the Hauni Garant IB and Molins Mark 8 machines, which number 46 out of an endowment of 134 cigarette making-up machines.

Even when criteria like those set out so far have been applied, it is necessary to clarify that other aspects inherent in the manufacturing establishments and in the nature of the inputs have had their effect and have influenced the orientation in the choice of machinery.

We only mention those of greatest relevance to the Argentine

^{94/} Strassman's study includes, besides the factors used, this third element: level of mechanization. In this study it is shown that, in 1960, the degree of mechanization in the United States parent companies of various industrial sectors was much higher than in 70 subsidiaries located in Latin America. While, as far as age of machinery and technological modernity were concerned, they were fairly similar, although there was a slight superiority in the country of origin. Op. cit., p.211.

industry:

- i) The state of the buildings and their geographical location. The age of the plants prevents their physical expansion for purposes of adding new equipment and the incorporation of very heavy machinery (this is the case of the machine which packs cigarettes in cardboard packets). On the other hand, the location of the factories in residential areas of the Federal Capital limits their possibilities of working three shifts.
- ii) Quality and homogeneity of inputs. This is one of the essential requirements of high output and technologically complex equipment and which is not generally complied with as far as the quality of the inputs supplied from outside the firm are concerned (imported acetate for filters, domestically produced paper for cigarettes, etc.)

In short, we can state that the criteria adopted with regard to the incorporation of new machinery has influenced the technology prevailing in the cigarette manufacturing plants, since, although there has been a certain amount of replacement, a general replacement of machinery of one or two previous vintages has not taken place, nor has there been a wholesale and indiscriminate incorporation of completely automated production processes.

All this would tend to confirm the opinions sketched out by Strassman on profitability and the acquisition of machinery, both new and used. This author considers, in this respect, that the decisions on equipment purchase are the result of an "economic calculation", at times pessimistic or incomplete, but in no way the result of the so-called prejudices that it is only possible to acquire the most modern machinery or imitate the use of the technology applied in the most "advanced" countries, ignoring local conditions.

The technical picture drawn for the Argentine cigarette industry, the result of a technological behavior which had to adjust to the conditions and restrictions affecting investment, was made possible by what we could call the "necessary condition" of the behavior referred to: the engineering capacity on which the industry counts.

This raises two questions: what would have been the technological picture if this engineering capacity had not existed? And secondly, what modifications may the given picture undergo, should the restrictions on investment be removed? The first question is difficult to answer. However, we could suggest that probably one

of the consequences would have been, with respect to the products, that the manufacturing plants would not have been able to reach the international technological frontier.

The second question is no easier to answer. If the conditions which influenced the economic and technological behavior of the firms during the period analyzed were to change, a modification of the firms' behavior is to be expected. But, even if there is an acceleration in the process of incorporation of new equipment and machinery, they will not fail to take into account the degree to which the technology to be incorporated is labor intensive.

In this case, it would be extremely important to make calculations to determine the economic viability of replacing machinery and labor with more automated and productive equipment. To do this, one must use indicators such as the rate of return on investment, which may be influenced by the planning horizon of the firms in the sector, since the lower degree of uncertainty involved in the oligopolic behavior of supply allows the higher capital costs associated with more advanced technologies to be repaid during a longer period of time.

Thus, there are opposite alternatives for the choice of technologies, which may succeed in modifying the picture we have observed. It is difficult to predict whether a clearly economic criterion will prevail, or an engineering perspective or an intermediate solution like that adopted up to now. The characteristics which define the two extreme options are synthesized in the following paragraph:

"The entrepreneurial choice of technology appears to be influenced by two objective functions, which in low-wage countries usually come into conflict. The first objective, that of "economic man", is to reduce costs. This leads him to a relatively labor intensive production process. On the other hand, the objective of "engineering man" tends towards a more sophisticated and automated technology. When competition based on prices is normal, the objectives of "economic man" seem to prevail over those of "engineering man". However, when the firm has a monopolistic advantage there is less pressure to reduce costs in order to survive, which makes it possible to achieve the aims of "engineering man" and take the firm to a technological level which is more advanced than that which the "economic man" would have chosen". 95/

95/ Louis F. Wells, Jr., "Economic and Engineering Man: Choice of Technology in a Low-wage Country", Public Policy, Vol. XXI, 1973, pp.337-38.

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