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FOREIGN TECHNOLOGY AND LOCAL INNOVATION: SOME LESSONS FROM SPANISH DEFENSE INDUSTRY EXPERIENCE

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1.- INTRODUCTION

The subject to be dealt with here - technology imports as against local production - is a question open to debate within the recent industrial experience of countries such as Spain, with a medium level of development. Placed in the general framework of this meeting, this subject takes form in the simultaneous discussion of two problems.

In the first place, Spanish policy on transfer (importation) of foreign technology has, in recent years, followed certain guidelines, the efficacy of which should be discussed in the light of experience in technology imports in the defense industry sector. In the second place, and closely linked to the former, we wish to make an analysis of the effects of those foreign technology imports on other than the defense industries, but which are closely connected with them. Obviously, in this discussion, the problem will constantly be raised as to what the balance should be between the importation of technology and the creation of technology from our own resource.

We think that this discussion acquires particular relevance in the Spanish case, for the following reasons:

a) The recent major industrial development of this country, and our weakness in the generation o local technology[1].

b) Spain is no international military power so that it is not possible to automatically transfer the conclusions which may be obtained from studies of the more advanced countries.

c) The technological insufficiencies of the national defense industry means that the main flow of technology for this sector comes from overseas[2].

d) The marked State control of this sector which, amongst other things, reduces the presence of foreign interests - in relation with the average situation in the manufacturing sector - and greater capacity for use of the State's purchasing power to boost the industry and plan development.

e) Spain's recent entry to the EEC and NATO, providing a new framework for our military industry.

For these reasons, we think it is of the greatest relevance to ask the following questions. What has been the pattern followed by the Spanish defense industry in the importation and/or creation of technology? What nave been the effects on the sector itself and on the rest of the industry? What are the lessons to be taken for technology policy, in particular in connection with technology transfer? These are clearly very complex matters which can hardly be dealt with fully in a paper such as this one, especially when it is remembered that there are great difficulties in securing information of a precise nature on this type of industry. Our more modest aim will be to organize the discussion and provide the materials which, we think, are most important in reaching certain initial conclusions, which will of course be provisional. The following are the specific steps to be taken.

- Background on Spanish technology transfer policy and on the Spanish defense industry.
- Basic aspects of technology development of our defense industry in the present situation, especially in the light of the new defense programs.
- Conclusions, with special reference to repercussions in the industry and technology in the military field on the rest of the industrial sector.

2.- BACKGROUND TO THE PRESENT SITUATION

2.1 The Technological dependence of the Spanish Industry, and Government Policy on Technology Transfer

A general point of reference for this paper is the historical lateness of Spanish industrialization and the heavy burden of technological dependence formed on nationalistic bases for the creation of an industrial structure, and strong protection against overseas competition[(3)].

As this nationalistic stage gave way to an increasing external opening-up of the Spanish economy, from the fifties onwards, a situation was to arise in which the technological weakness of our industrial structure was to be decisive in the large-scale admission of foreign technology, wether in incorporated form (direct investments, capital goods imports), or otherwise (licences, technical assistance, etc.). This led to a vicious circle in which the scant local technological prowess boosted the importation of technology; as this was not done with clear guidelines or assimilation and progressive replacement, it had a negative effect on local efforts.

In this situation, the concern of the Spanish authorities did not, in the best cases, go beyond a relatively correct diagnosis of the problems, particulary as, time and again, international reports coincided as to this serious weakness in the Spanish economy(4).

In practice, action intended to promote science and technology at the local level were scant, and yielded very poor results.

At the same time, the awareness of the need to import technology from overseas has been present throughout recent industrial development, to the point where the State played an important part in its acquisition, principally in the final moments of industrialization in substitution for imports (fifties and part of the forties). However, the process of incorporation of foreign technology took place in large part without the presence of a suitable policy as to selection, adaptation and assimilation of the imported product(s) and/or process(es)(5).

In the most difficult years of Spanish economic isolation, the Government's virtually sole concern in the face of technology imports was their cost in foreign currency given this country's difficulties in obtaining this(6). But, with the expansion of the sixties and the consequent acceleration in the purchase of foreign technology, a new concern arose, in connection with the so-called technology transfer agreements' contents, especially concerning their restrictive clauses; this meant that, as early as 1965, there was an initial regulation which sought to avoid such clauses by means of tentative administrative control[7].

The studies carried out during the sixties and into the early seventies show that those initial regulations hardly affected the content of the agreements[8], to the point where the restrictive situations were not very different in this country to those known elsewhere in developing nations, as can be seen from Table I. This led to the need to develop a more active policy which took from in a new control framework on technology transfer, developed from 1973 onward and whose content may be summarized as follows:[9]

- This is based on the assumption that the conculsion of technology transfer agreements by Spanish companies may involve social costs or undesirable losses for the Spanish economy not compensated by the private benefits of the transaction. This made public intervention advisalbe in order to supervise the selection and acquisition of foreign technology, as well as the types produced, so that the application of that technology would have maximum utilization in the domestic economy.

- The administrative mechanism created is a Technology Transfer Contracts Register in which all agreements concluded by Spanish resident companies must be entered. This registration may be refused if there are restrictive clauses in the contracts, although exceptions may be made; this is particularly the case with technology for the production or use of equipment for defense.

- The list of contractual clauses includes a wide range of cases, from the prohibition of exports to third countries to "binding" purchases of capital goods, and covering compulsory transfer of patents, improvements or innovations introduced by the Recipient, or developed by it, on the basis of the acquisition of foreign technology etc. In 1981, the number of restrictive clauses was reduced, (e.g. transfer of obsolete technology, input over-billing linked to the transfer provided by the transferer); but some new

Table nº 1

CONTRACTUAL CLAUSES REGARDED AS RESTRICTIVE IN DIFFERENT COUNTRIES

TYPES OF CLAUSES	ARGENTINA	BRASIL	COLOMBIA	MEXICO	VENEZUELA	OTHER COUNTRIES IN ANDES PACT	PORTUGAL	SPAIN
Subsequent restrictions when the contract or rights of industrial ownership expense.	YES	YES	NO	YES	YES	NO	YES	YES
Obligation to transfer improvements to the suppliers.	YES	YES	YES	YES	YES	YES	YES	YES
Restrictions on Receiver's R&D.	YES	YES	NO	YES	NO	NO	NO	YES
Restrictions on acquisition of technology competitive with or complementary to that given by the donor.	YES	NO	YES	YES	YES	YES	NO	YES
Restrictions on access to new technology.	YES	YES	NO	NO	NO	NO	NO	YES
Restrictions on volume and structure of production.	YES	YES	YES	YES	YES	YES	YES	NO
Setting up of purchases of finished raw materials goods, equipment, etc.	YES	YES	YES	YES	YES	YES	YES	YES
Donor quality control.	NO	NO	NO	NO	YES	NO	NO	NO
Restrictions on business or personal organization.	YES	YES	YES	YES	YES	YES	NO	YES
Selling or reselling price fixing.	YES	YES	YES	YES	YES	YES	YES	NO
Obligation to pay supplier's taxes.	NO	NO	YES	NO	YES	NO	NO	NO
Restrictions regarding distribution in home markets.	NO	YES	YES	YES	YES	YES	YES	NO
Limits on export.	YES	YES	YES	YES	YES	YES	YES	YES
Obligation to use supplier's brands.	NO	YES	NO	NO	NO	NO	NO	YES
Restrictions on receiver publicity.	NO	YES	NO	NO	NO	NO	NO	NO
Obligations to pay for unused technology or non-registered rights to industrial ownership.	NO	YES	YES	NO	YES	YES	NO	NO
Payments for technology available in the country or obsolete.	YES	YES	YES	YES	YES	YES	NO	YES
Renunciation of the right to question the rights to industrial ownership of the donor.	NO	YES	NO	NO	NO	NO	(**)YES	(**)YES
Excessively high price fixing.	YES	YES	YES	YES	YES	YES	YES	YES
Excessive indeterminate duration of contract.	YES	YES	YES	YES	YES	YES	YES	YES
Imposition of contract versions predominantly in a foreign language for the purposes of interpretation.	s.d.	s.d.	s.d.	s.d.	s.d.	s.d.	YES	YES

SOURCES: CORREA (1980) and drawn up by ourselves for Portugal and Spain

NOTES: (*) Bolivia, Chile, Ecuador and Peru.

(**) This aspect is not legislated for in the national legislation of Portugal and Spain, but the prohibition set up in Europea Community Legislation is, i.e what is stipulated in Article of (E.E.C.) Regulation, number 2349/83 of July 23rd which came into force on January 1st, 1985.

s.d.= no data.

cases were introduced, such as the transfer of polluting technology, those excessively intensive in energy use or those replacing domestic production with imports[10].

. The Register was, at the same time, to be a source by which to ensure greater transparency in the foreign technology acquisition market, and to plan internal research programs towards complementary technological objectives and improvements to imported technology[11].

Leaving to one side the criticisms of principle of such a policy, the results of its application for more than a decade permit the following assertions:[12]

a) It has not lessened the rate of acquisition of foreign technology.

b) The Ministry of Industry has hardly used it power to refuse the registration of agreements.

c) A significant number of contracts with restrictive clauses has been admitted. It is true that their frequency has dropped off, but there is a suspicion that they have been replaced on many occasions by "Gentlemen's Agreements".

d) The data bank available has not be used to orientate technology policy.

e) There have been bureaucratic and coordination problems with the different administrative stages involved in information on and registration of the agreements.

f) The reduction in the mean costs of the agreements vaunted by the Ministry of Industry and Energy is at the very least open to debate. In fact, this assertion is sustained with payment forecasts in the agreements themselves, and this does not tie in with investigations available on payments made[13].

This brings us to the present situation, in which that technology transfer policy must be rethought. Apart from the reasons already given, such a revision must be made in view of the new context of the modernization of Spanish industry, the increase in productivity and the new competitive situation in which it is to develop as a result of the increasing opening-up of the Spanish economy; the entry to the EEC is just the most visible external expression of this process.

As is almost always the case, the discussion is debated between two positions: those who entrust everything to market forces , for whom the best policy is the absence of intervention, and those others who, while admitting the need to update mechanisms, think that a certain government presence is necessary so as to correct the worst defects of complete de-regulation, especially in a field such as technology where the uncertainty of results and the imbalance of points of departure make it more difficult for the market control forces to operate. Is it possible, in all this discussion, to throw any further light, following the examination of the defense sector's experience? Before we go into details, certain facts should be recalled on the development of this sector in Spain.

2.2 Policy Development Lines on the Spanish Defense Industry

Following the Spanish Civil War (1936-39), there was a first moment in which the autarchic projects also reached - in a particular manner- the military industries. In fact, as the result of initial doubts as to intervention in the Second Word War and, subsequently, of international isolation, a policy was developed of increasing domestic military production as far as possible. The National Institute of Industry (INI), formed in 1941, played a fundamental role in this target.

There was a first major change in 1953 when the military bases agreement was signed with the U.S.A. From that time on, the modernization of the armed forces was carried out on the basis of materials from North American aid. This improvement in matériel scarcely affected the technological advance in the Spanish military industry, because of its very tenuous relation with a wholly external set of resources. In some cases, this improved armament supply (on the other hand, somewhat obsolete) even caused a reduction in our small technological potential because the domestic industry was no longer required to produce new arms.

Throughout the sixties, it was gradually realized that it was necessary to modify this excessive dependence on the US; a decisive element in this process was the sense of frustration on the part of the Spanish military on verifying that the North American arms could not be used in the last colonial conflicts against Marocco (first SIDI-IFNI and, later, the SAHARA).

It was necessary to wait for the seventies in order to see the formation of a new policy to boost the Spanish defense industry. On the most obvious level, this policy was implemented with the reorganization and promotion of the main arms companies: CONSTRUCCIONES AERONAUTICAS, S.A. (CASA), EMPRESA NACIONAL BAZAN and EMPRESA NACIONAL SANTA BARBARA. As well, some of the Research Centers, most notably the Center for Technical Studies of Matériel (CETME) were given a boost(14).

From the productive and technological point of view, the qualitative change was marked by the beginning of production under license of new arms, from 1971 onwards. It must be remembered that this began a diversification away from the US; the major partner was to be France (the AMX 30 combat tank is the most significant product).

From the institutional point of view, the transition to a democratic system of government was to promote changes of the greatest importance. Without doubt, the most important was the creation of the Ministry of Defense, uniting the three previous Army, Navy and Air Force Ministries. Within this Ministry, the Director-General of Arms and Matériel (DGAM) was created, to play a decisive role in the new notion of war matériel procurement, assuming a broad range of transfer from previously dispersed bodies. There were to be later

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steps of significance, such as the preparation of the National Strategic Plan, the creation of the Arms and Matériel Advisory Commission, and the passage of the Budget Provisions Act for Investment in and Maintenance of the Armed Forces (1982) which made funds available for the period from 1983 to 1990.

For the purposes of this paper, the new defense policy will be specified in two types of basic action; procurement policy and R & D policy. The fundamental point of departure for both is the Armed Forces Modernization Plan which, in addition to providing an import re-adjustment in the total Army numbers, foresees a set of projects for the modernization and procurement of matériel, of which the most outstanding are the following:

- The creation of a new combat group for the Navy, based on the aircraft carrier "Principe de Asturias" and provided with new FFG-7 frigates.
- The procurement of three further Descubierta class corvettes and three Galerna submarines.
- Purchase of Harrier aircraft and ASM helicopters.
- Development of the FACA program (Future Combat Aircraft) with the evaluation of the F/A-18 Hornet and Tornado aircraft.
- The importance of the "Combat Grande 3" and "Combat Grande 4" programs connected with the air control and alert networks in the South of Spain and the Canary Islands.
- Spain's intention to participate in all the stages of the European project for a future combat aircraft (ACA).

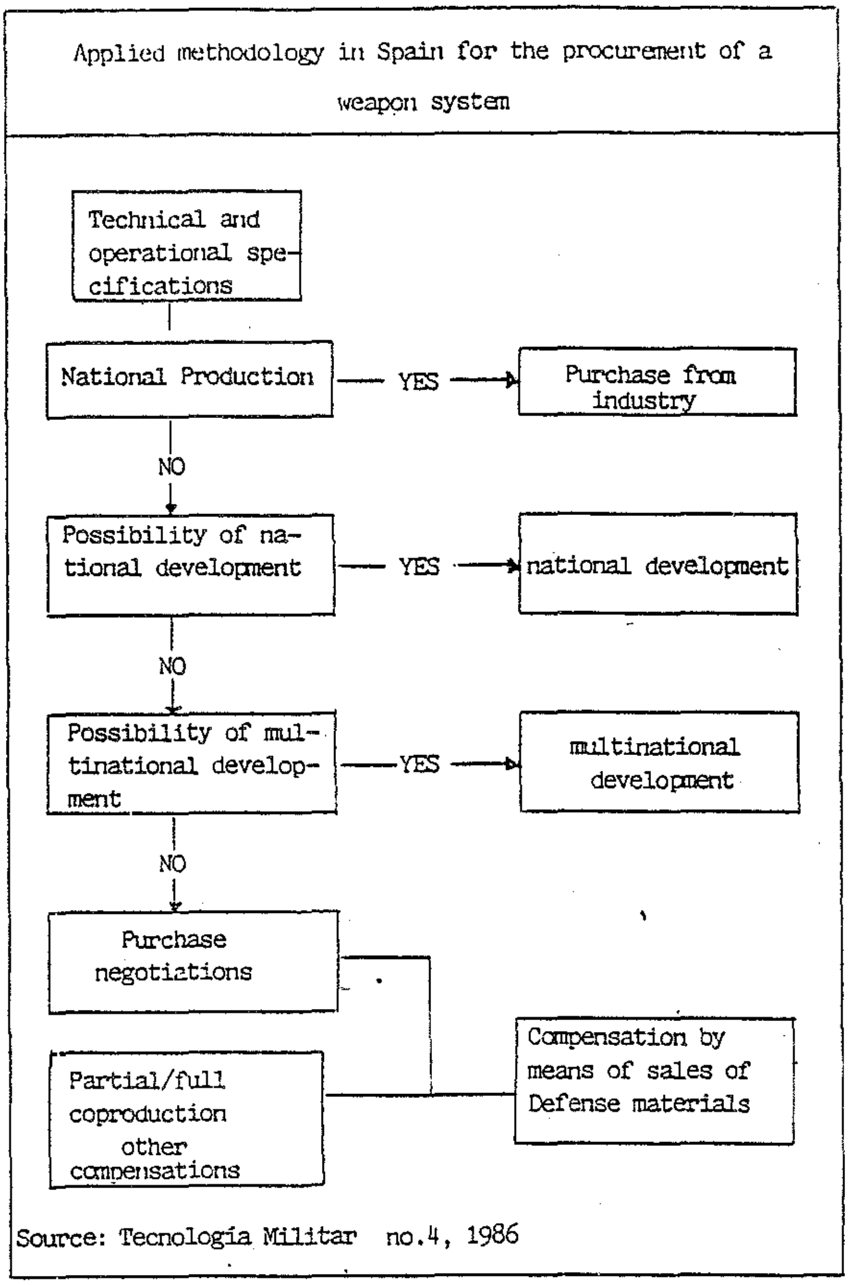
The idea is to give maximum participation to domestic industry for which, if necessary, a boost will be given to the procurement of technology and the know-how required for production in Spain. The means for determining the access channels to the products and technology is summarized in graph no. 1, from which it is seen that there are four main routes:

- Manufacture under license
- Joint production
- Joint manufacture
- Own R & D

Until recently, the most commonly used of these was manufacture under license; however, the Plan provides that the best way of getting access to advanced technology is through joint production and joint manufacture, which may remove some of the most important problems of manufacture under license(15).

All this must be backed up by greater attention to R & D at the local level - with the boost given by the Research Centers - and by an export promotion policy. In fact, the resources given over to R & D were to rise sharply from 1985 onwards; similarly, exports have undergone a substantial increase, from 12 million dollars in 1977, to 332 million dollars in 1983 (at contant values). This represents a significant penetration of markets, from 0,1 % of all Third World imports in 1977 to 3,8 % of their arms imports in 1983(16). The main export products are set out on Table II.

Graph no. 1



The new defense policy is financially backed by a increasing budget for military outlay. This growth is not reflected in the overall defense data which, in the period 1980-87, rose an average of only 1,6 % per annum, in real terms. However, against the virtual stagnation of personnel payments (up 0,8 % per annum in real terms) and of goods and services procurement (up 0,7 % per annum in real terms) arms procurement items have risen an average of 6,9 % per annum in real terms in the eighties, with a particulary marked increase in 1980-83, when the annual average rate of increase was 7,9 %[17].

These are thus the components of the basic situation, on which we embark on a more detailed description of Spanish military technology.

Table no. 2

Principales armas

Production and exports of major weapon in Spain, 1974-84

Weapon category	Manu-facturer	Number of employees	Weapon designation	Weapon description[a]	Year of first prototype	First year of production	Number Planned	Number Produced	Exported Yes	Exported No	Comments
Aircraft	CASA	8 300	C-101 Aviojet	Trainer/strike	1977	1979	88	79	×		For Spanish Air Force the requirement is 120 aircraft
			C-212 Aviocar	Transport	1978	1979		360	×		Also assembled by Nurtanio, Indonesia
			CN-235	Transport	1984	1984	130				Co-produced with Nurtanio, Indonesia; options from Argentina, Puerto Rico and Saudi Arabia
Armoured vehicles	ENASA	10 000	BMR-600	ICV	1975	1979	500		×		
			AMX-30	MBT		1974[a]		400			Spain obtained licence from France in 1980
	Talbot S.A.	500	M-41E TUA Cazador	TD	1983	1983					Shown for the first time at Paris Air Show, 1983
Ships	E.N. Bazán	14 000	F-30 Class	Frigate		1974	9	8	×		1 500 t displacement
			FFG-7 Class	Frigate		1981	5			×	Licence-produced with USA
			Principe de Asturias	Aircraft carrier		1977	1			×	90% indigenous; commissioning 1986
			S-70 Class	Submarine		1975	8	2	×		French Agosta Class
			Halcón Class	PC		1980		11	×		85% indigenous
			Cormoran Class	FAC		1980	6	4	×		370 t displacement
			Piranha Class	PC		1981		3			130 t displacement
			Barcelo Class	PC		1975		6	×		135 t displacement
			Lazaga Class	PC/FAC		1975		6		×	275 t displacement

"Assembly 1974-80

Source: SIPRI arms trade and production registers, taking from LOOSE-WEINTRAUB (1984)

3.- THE TECHNOLOGICAL DEVELOPMENT OF THE SPANISH DEFENSE INDUSTRY

The Spanish defense industry has, therefore, undergone a mayor transformation and, with that, its technological level and its links with other industrial sectors. However, before making a more detailed examination of the arms systems, it must be recalled that the relations of the armed forces with the national economy cover a broad range of possibilities beyond just arms. In the case of Spain, on-going attention to a group of more than 300,000 persons requires procurement of many and varied products. If 1982 is taken by way of a sample, we are able to list 569 army contracts with the widest variety of sectors, in order to acquire, amongst other things, workshop equipment, plate, tooling, paint, pharmaceutical products, measuring equipment, construction machinery, furnishings, computers, motor-cycles, bread, preserves, fabrics, footwear, straw, animal feed, surgical equipment, etc. This year, the number of civilian supply companies will reach the figure of 877.

If we refer to the strictly military field, links with civilian industry are created basically through a twin mechanism: the participation of other industrial sectors in parts or inputs in military industry, and the civilian application of technology to products developed in the first instance in the defense sphere. In order to explain some of these realities adequately in Spain, we have divided the Spanish military industry into three sub-groups: the State arms industry, the standard private defense sector, and auxiliary defense industries.

3.1 The State Arms Industry

Integrated into the INI group, these companies have a total share capital of almost 48,000 million pesetas, and sales of some 220,541 million, of which about half go to overseas markets. They have a payroll of 38,295 persons and plants throughout Spain; they work mainly in the fields of ground arms, aerospace, vehicles, vessels and electronics (see Table 3).

The Spanish defense industry integrated into the INI group has acquired technological capability by means [1] of the procurement of technology overseas, together with its own R & D processes, beginning the development of its own advanced technology products. It should be mentioned that most of these companies began their main activity in the civilian field; as time has gone on, and given the scant demand for their products, together with an increase in the demand for defense matériel, their military involvement has increased to stand at high percentages.

The following are some of their most important developments, particularly taking account of their relations with civilian industry.

Table no. 3

VARIABLE DATA OF DEFENSE INDUSTRY - INI (1984)

	Equity capital (millions)	Personnel total	% Technicians	Manufacture Area	R + D (millions)	Total income (millions)	Export (millions)	Factories	Production per man in mi[illegible]
SB	2,150	3,870	21.36	Armament Ammunition	404 (1981)	24,095	14,084	Oviedo/Toledo Coruña/Palencia Sevilla/Granada	6.[illegible]
EESA	1,500	455	21.31	Electronics equipment and elements	62 (1981)	2,881	430	Madrid Barcelona	6.[illegible]
EISA	1,625	657	24.35	Professional electronics	256	5,632	2,113	Madrid	8.5[illegible]
BAZAN	9,450	13,571	23.57	Ships, engines, turbines, guns	68 (1981)	76,896	28,309	La Coruña Murcia Cádiz	5.66
ENOSA	1,500	638	21.31	Optics, precision mecanics	74	2,244	32	Madrid	3.51
CASA	4,485,86	10,037	24.53	Aerospace	1,050	43,365	36,741	Madrid Sevilla Cádiz	3.66
CETME	575	464	--	R+D in Defense materials	--	1.472	82	Madrid	3.17
ENASA	26,500	8,603	20.9	Trucks, engines armoured vehicles	2,200	63,956	21,122	Madrid	7.43

Source: INI annual reports 1984 - Taken from RANNINGER (1987)

- In EMPRESA NACIONAL BAZAN, should be highlighted the construction of the largest ship in its history - the aircraft carrier "Príncipe de Asturias". An original US design has been modified and adapted by the company, and an important group of civilian companies is participating: ENSIDESA (steels), ASTILLEROS ESPAÑOLES (auxiliary machinery), ALCAN and ENDESA (plating and aluminum sections), TUBACEX (piping), FIBRAS MINERALES (insulation), ANGLO NAVAL INDUSTRIAL (cooling systems), TUBOS REUNIDOS (steel piping), PIRELLI and ROQUE (electric wiring), and a further large number of companies.

  This company also destines some technological developments obtained by the military sector into the civilian sphere. Mention may thus be made of development on high speed ship forms, studies for a floating electrical power station, and the project for exploitation of wave energy, ship structures and propulsion control.

- The most important case in recent years has been that of EMPRESA NACIONAL SANTA BARBARA, and the project for the license-production of the French AMX-30 combat tank. The participating companies, with their percentages, are shown in graph no. 2. The actual presence of civilian industry exceeds the estimated percentages, since defense companies incorporate a large number of components from the civilian field; and all the plant, production line, etc. are manufactured by civilian industries.

- CONSTRUCCIONES AERONAUTICAS S.A. (CASA) provides other important examples:

  Its C-212 Aviocar, so successful in its military missions, is also sold for civilian applications. Also, there is the new project between CASA and the Indonesian firm of NURTANIO, for the CN-235, designed equally for civilian and for military use.

  mejoras.

  In addition to the improvements made to the aircraft developed by it - C-212, C-101 and CN-235 - CASA has worked in the creation of a materials laboratory for civilian and military uses, in the development of new materials technology (CASA patent for application in the civilian Airbus 320 program), the development of a robotized system (for civilian and military use), automation of the production line, a project for a wire rolling system, cooperation with Universities and National Bodies, etc. This is all at the same time as continuing with international collaboration, with important foreign manufacturers in both the civilian and military fields, for the production of components for a large number of aircraft and helicopters (Mirage F-1, BO-105, Airbus 300, Airbus 310, Airbus 300-600, Falcon 10, Falcon 20, Super Puma, Gazzelle, Boeing B-757, DC-9, DC-10) giving CASA international technological prestige. It is, as well, collaborating in the space field.

- ENASA and ENOSA provide less well-known examples. This is the case of the improvements made to ENASA's civilian vehicles as a result of its experience in the military field, and in ENOSA's optics developments, including microscopes, binocular magnifiers, telescopes, etc. In both cases, the possibility of many of the technological efforts would be difficult to imagine without the demand and specifications for defense products and the associated captive market.

. EISA and EESA, both in the electronic sector, operate in standard twin use technology, like many others in this referred to below. The importance of this sector in the new defense-civil industry relationship is seen from the fact that the National Electronics Plan foresees almost 50 % of our electronic output going to defense by the end of this decade.

Through training and the technological efforts organized, there have been major advances, with a relatively solid base for entry to international markets. It will be shown that there still remains a great deal to be done, but one measure of what has been achieved is found in military technology offered for export by the INI companies, and presented in the "Technology Catalog". Table 4 summarizes this technology.

Table no. 4

OFFER OF EXPORTABLE MILITARY TECHNOLOGY - INI (1984)

COMPANIES	Explosives and ammunition	Various armament	Warships	Aircraft	Military vehicles	Military electronics	Optics	Services
Casa	—	—	—	7	—	—	—	1
Bazán	—	—	8	—	—	—	—	2
Enasa	—	—	—	4	—	—	—	—
Eisa	—	—	—	—	—	4	—	—
Eesa	2	4	—	2	—	7	—	—
Enosa	—	—	—	—	—	—	3	—
Sta. Bárbara	—	—	—	—	—	—	—	—
Cetme	14	13	—	—	—	1	1	—

NOTE: CASA offers its C-212, C-101 and CN-235 aircraft, and maintenance and overhaul technology. BAZAN has production technology for aircraft carriers, coastguard vessels, patrol boats, submarines, corvettes, frigates and ship repairs. ENASA has different military vehicles, and EISA has technology such as automatic knockdown target systems, laser telemeters and air traffic control systems. EESA offers mines, fuses of various types, transmitters, radiotelephones, etc. ENOSA has 3 optical products and CETME a wide range of explosives, arms and munitions developed in its laboratories.
(Source: RANNINGER 1987)

These results are the outcome of a relatively large investigation program by these public companies. In spite of the difficulties in securing exact data that are up to date, some aspects of their R & D activity may be summarized as follows:

- All assign singificant sums to R & D, which is in contrast to the average situation of Spanish private industry.
- In general, they spend rather more in their own R & D than on acquiring overseas technology; this too is a characteristic which is different from that of the typical Spanish company.
- There is a clear relationship to be seen between R & D efforts and a rising export level.

Finally, there are two structural features of these companies which we think are of interest for their implications for the strategic decision-making process. In the first place, the majority are 100 % owned by the INI, with the important exception of CASA, where different foreign aircraft producers have 26 % of the share capital. The second refers to the INI defense companies participation in other local and foreign companies; table 5 is a summary of this participation, highlighted as an important complement both to their production capacity and to their export capability.

Table no. 5

COMPANIES OF INI-GROUP HAVING PARTICIPATION IN EQUITY OF OTHER COMPANIES

	OWN EQUITY CAPITAL (MILLIONS)	IN NATIONAL COMPANIES			IN FOREIGN COMPANIES		
		NAME	MILLIONS	%	NAME	MILLIONS	%
SB	2,150	SB Sistemas	8	50	--	--	--
		Defex	412.5	10,2	--	--	--
		Placencia	173.4	1.4			
EESA	1,500	I-Cuatro	103	100	--	--	--
		Piher	238	34.33			
		Isel	40	20			
		Infoleasing	1,775	5,63			
EISA	1,625	Defex	412.5	10,2	Selesmar	2.5 (Pounds)	20
		Piher	238	34.34			
		Isel	40	20			
		Infoleasing	1,775	5,63			
		Eria	100	2,8			
BAZAN	9,450	Astillero G. Canarias	2.4	100	S.I. Reparaciones	14 (US-$)	50
		Delastres	602.5	80	I.S.S	0,056 (Deutsch Mark)	14.28
		Defex	412.5	10,2	Bazan, Brasil	20 (Cruceiros)	100
ENOSA	1,500	Defex	412,5	10,2			
		Piher	238	6.3			
		Isel	40	10			
		Mischiatti	0,1	10			
CASA	26,500	Purolator	57	33,33	Aircraft Technol.	6 (US-$)	50
		Marconi Españ.	0,05	0,2	Casa, Usa	0.5 (French Francs)	100
		Defex	412,5	10,2			
		Chadesa	181	19,34			
		Arianspace	120	1,9			
ENASA	4,485.86	Comercial Pegaso	100	100	Pegaso Chile	726 (Pesos)	99.58
		Jorsa	250	100	Pegaso Automatrices	42,2 (Pesos)	99.92
		Matacás	55	100	Hisp. Venezolano	25 (Bolivares)	49
		Financ. Pegaso	100	100	Desarrollo Ind.	46 (Bolivares)	49
		Enasa Internac.	1,700	81	Pegaso France	7.1 (French Francs)	100

Source: RANNINGER (1987). Primary data taken from various annual reports of INI

3.2 The Standard Private Defense Industry

Table 6 shows the civil sector defense product manufacturers. On occasions, these companies acquire overseas technology in order to have acces to new manufacturing lines but, in general, they do seek to introduce their own improvements. In the technological field where these industries operate they do not usually incorporate the latest technology, and their activity may be summarized in terms of small arms, explosives, medium and large gauge munitions, and mortars with their munitions.

The technology developed or acquired for the manufacture of their products is not usually applicable to the civil sector, as this technology is usually very specifically for the munitions sector. Thus the effect of these industries on the growth of the civil sector can be seen in the jobs created, numbering some 3.000.

Table no. 6

PRIVATE INDUSTRY TYPICALLY OF DEFENSE (1982)

COMPANIES	Equity in millions	Personnel total	Annual sales in millions	Factories	Manufacture	General use of techno-logy	Export of Defense products
Astra	140	359	819	Guernica Lugo	Pistols revolvers	own	--
Esperanza	30	428	7,000	Marquina	Mortars and mortar gra-nades	own	6,500 (estimated)
EDB	350	159	2,047	Burgos	Aircraft bomb char-ges and artillery cartridges	own	--
Expal	--	--	--	Vitoria	Various Defense materials	own	6,000
Instalaza	540	192	1,000	Zaragoza	Grahade launchers, various ammo	own	616
Llama	160	250	653	Vitoria	Handguns, rifles	own	--
Placencia	173.4	469	1,588	Andoain	Antiaircraft artillery material	own/ foreign	--
Star	490	340	720	Eibar	Pistols	own	--

Source: RANNINGER (1987)

The Auxiliary Defense Industry

It can be said there is a large number of civilian companies supplying civilian materials to the Armed Forces; in these cases, the Spanish Army is an important recipient of products from the civilian area, and gives over a large part of its budget to the acquisition of these materials, thus re-investing some defense expenditure in the civilian field.

Table 7 classifies the 83 most important Spanish auxiliary defense companies; they are divided into sectors according to activity[20].

It is feature of these companies that, often, they have the latest technology disponible available; of particular note is the R & D work done by ISA (auxiliary aviation mechanics components), AISA (aeronautics components), ARESA (Surveillance launches and study of new materials), ASTILLEROS VIUDES (a variety of vessels), TALBOT (tank conversion technology), CECSA (design and production of a variety of electronic equipment), CHACONSA (a hovercraft, in collaboration with the Navy), GAELICO (its own alpha-number equipment system), HISPANO RADIO MARITIMA (radio-telephones and radars), RYMSA (different types of antenna), SAINCO (tactical combat simulators), SENER (laser guided bombs), etc.

It should be pointed out that the technology developed or acquired by these companies for application in the output of military products is also used for production intended for the civilian sector, as is the case with almost all the companies referred to proviously.

Some companies manufacture under license, as is the case with the AMX-30 combat tank element suppliers AISA (brakes and shock absorbers), CETASA (precision gears), UGO (gearboxes), FORT-70 (clutch housing and discs), GAMESA (miscellaneous components), etc. Table no. 7 shows those companies which generally use foreign technology for the production of their materials.

Others, with part of their share capital foreign owned, have easy access to technology developed by their parent companies - MARCONI (76 %), SESA (57 %), BRESSEL (73 %), MOTOR IBERICA (55 %), LAND ROVER (47 %), FEMSA (98 %), PIRELLI, TUDOR (25 %), etc.

However, in many of the above cases, it can be seen that the technology level reached has been the result of assimiliation of technology acquired overseas which has enabled the company to obtain its capability. One of the most significant cases is CECSA - COMPAÑIA DE ELECTRONICA Y COMUNICACIONES, S.A., which began its operations by collaborating with foreign companies rich in the latest technology in the military electronics field. With a team of 50 engineers and 200 specialists, it has achieved parallel R & D which enables the company to make highly qualified electronic defense systems.

Table no. 7

COMPANIES COLLABORATING IN DEFENSE PRODUCTS (1982)

AREA	Location	Nº factories	Equity capital	% foreign partic. in equity capital	Personnel	Annual invoicing 1982 millions	Manufact. of components	Manufact. of end products	Services/ technical support	USE of foreign technology	Export of Defense products	Payment R + D
MILITARY AERONAUTICS												
Aeronáutica Ind.	Madrid	1	100	0	219	391	YES	YES	YES	YES	—	—
PARTS FOR ARTILLERY AND ROCKETS												
Forjas y Aceros	Reinosa	1	2,772	0	2,268	7,873	YES	YES	NO	NO	—	—
Gamesa	Vitoria	1	447	0	350	1,519	YES	YES	NO	NO	—	—
Iasa	Huesca	1	240	0	225	671	NO	YES	NO	NO	—	0
SHIP CONSTRUCTION												
Astilleros Reunidos	Barcelona	1	15	0	74	240	NO	YES	NO	NO	35	—
Astilleros Rodmann	Vigo	1	—	—	84	283	NO	YES	NO	NO	69	—
Astilleros Viudes	Barcelona	1	—	—	—	—	NO	YES	NO	UNKNOWN	—	—
Astilleros Celaya	Vizcaya	1	—	—	—	—	NO	YES	NO	UNKNOWN	—	—
Chaconsa	Murcia	2	58	0	82	439	NO	YES	NO	NO	—	—
ELECTRONICS-OPTICS												
Cecsa	Madrid	1	500	0	255	1,100	YES	YES	YES	YES	—	—
Incosa	Madrid	1	—	—	—	—	YES	YES	YES	YES	—	—
Eurotrónica	Madrid	1	90	0	130	1,063	YES	YES	YES	UNKNOWN	—	—
Gaelico	La Coruña	1	—	—	—	—	YES	YES	NO	NO	—	—
Marconi	Madrid	1	1,404	76	2,900	7,958	YES	YES	YES	YES	—	302
Rymsa	Madrid	1	30	0	43	243	NO	YES	NO	UNKNOWN	—	—
Radair	Madrid	3	9	0	40	97	YES	YES	YES	NO	—	—
Sesa	Madrid	5	3,065	75	15,937	38,663	YES	YES	NO	YES	—	1,690
R+D IN ARMAMENT												
Dytasa	Madrid	1	—	—	—	—	YES	YES	NO	NO	—	—
Sener	Madrid	1	1,028	0	1,150	3,500	NO	NO	YES	UNKNOWN	—	—

AREA	Location	Nº factories	Equity capital	% foreign partic. in equity capital	Personnel	Annual invoicing 1982 millions	Manufact. of components	Manufact. of end products	Services/ technical support	USE of foreign technology	Export of Defense products	Payment R + D
ENGINEERING-SIMULATORS												
Cecsa	Madrid	1	500	0	255	1,100	YES	YES	YES	YES	—	—
Eria	Madrid	1	75	0	116	325	NO	NO	YES	YES	—	—
Sainco	Madrid	1	250	0	640	1,749	NO	YES	YES	YES	—	—
AMMUNITION,POWDER												
Amado Laguna Rins	Zaragoza	1	—	—	—	—	YES	YES	NO	UNKNOWN	48	—
Bressel	Madrid	2	725	73	1,407	3,013	YES	YES	NO	YES	—	—
Plásticas Oramil	S.Sebastian	1	30	0	94	276	YES	YES	NO	UNKNOWN	24	—
Faex	Madrid	1	25	0	14	208	YES	YES	NO	UNKNOWN	—	—
Forgasa	Orense	1	1,065	0	405	1,100	YES	YES	NO	UNKNOWN	—	0
Lecea	Vitoria	1	12	0	27	67	YES	YES	NO	NO	—	—
Pirotecnia Oroquieta	Navarra	1	50	0	26	750	NO	YES	NO	NO	—	—
ERT (Div. Explos.	Madrid	7	16,260	0	1,890	10,593	YES	YES	NO	UNKNOWN	2,204	477
MILITARY VEHICLES												
Talbot	Madrid	1	—	—	—	—	YES	YES	YES	YES	—	—
Motor Ibérica	Barcelona	6	4,942	55	8,501	39,396	NO	YES	YES	YES	—	1,023
Land Rover	Madrid	4	1,730	47	4,477	18,500	NO	YES	YES	NO	—	217
Macosa	Barcelona	4	725	0	3,086	12,569	NO	YES	NO	NO	—	—
STUDY OF AUXILIARY ARMAMENT INDUSTRY												
AUXILIARY AERONAUTICS												
Confecciones Industriales Madrileñas	Barcelona	1	45	0	73	171	NO	YES	NO	NO	—	—
Femsa	Madrid	8	5,242	98	5,605	17,400	YES	NO	NO	UNKNOWN	—	362
Ind.Subsid.de Aviac.	Sevilla	1	440	70	870	1,960	YES	NO	NO	UNKNOWN	600	0
Maarsu	Madrid	1	—	—	—	—	NO	YES	NO	UNKNOWN	—	—
Pirelli	Barcelona	4	4,800	98	5,008	19,239	YES	NO	NO	YES	—	320

AREA	Location	Nº factories	Equity capital	% foreign partic. in equity capital	Personnel	Annual invoicing 1982 millions	Manufact. of components	Manufact. of end products	Services/ technical support	USE of foreign technology	Export of Defense products	Payment R + D
ELECTRICAL AREA												
Conductores Eléctricos Roque	Barcelona	1	—	—	—	—	YES	NO	NO	UNKNOWN	—	3
Control y Aplicaciones	Madrid	1	9,950	0	2,300	9,950	YES	YES	YES	UNKNOWN	3,450	8
Fanya	La Coruña	1	50	0	85	338	YES	YES	NO	NO	—	—
Gelter-Ringsdorf	Madrid	1	50	40	134	326	YES	NO	NO	NO	—	—
Indar	Madrid	1	49	0	80	707	NO	YES	YES	NO	—	—
Jema	Lasarto	1	123	0	78	324	NO	YES	NO	UNKNOWN	—	—
Tudor	Madrid	4	3,215	25	2,816	12,021	YES	NO	NO	UNKNOWN	—	170
AUXIL. ELECTRONICS												
Electrific. del Norte	Madrid	1	300	0	2,340	6,562	NO	YES	YES	UNKNOWN	—	—
Elbasa	Barcelona	1	135	9	104	413	YES	NO	NO	UNKNOWN	—	—
Electrónica Boar	Madrid	1	12	0	42	2	YES	NO	NO	UNKNOWN	—	—
Hispano Radio Marítima	Madrid	2	400	0	501	1,755	YES	YES	NO	UNKNOWN	—	—
Industrial Electrónica	Madrid	1	13	46	24	107	YES	NO	NO	NO	—	—
Piher Electrónica	Madrid	1	70	0	258	2,150	YES	NO	NO	UNKNOWN	—	78
Secoinsa	Madrid	2	2,480	25	651	4,224	NO	YES	YES	UNKNOWN	—	—
MECANICS												
Bendibérica	Barcelona	4	742	65	2,195	9,942	YES	NO	NO	NO	—	163
Cetasa	Elgoibar	1	71	0	252	810	YES	NO	NO	UNKNOWN	—	—
UCO	Vitoria	1	220	0	276	849	YES	NO	NO	YES	—	—
Fort-70	Zaragoza	2	100	0	140	400	YES	NO	NO	UNKNOWN	—	—

AREA	Location	Nº factories	Equity capital	% foreign partic. in equity capital	Personnel	Annual invoicing 1982 millions	Manufact. of components	Manufact. of end products	Services/ technical support	USE of foreign technology	Export of Defense products	Payment R + D
METALLURGY												
Adaibra	Barcelona	1	90	0	175	643	YES	NO	NO	UNKNOWN	—	—
Tubacex	Llodio	2	2,304	0	1,121	11,794	YES	NO	NO	UNKNOWN	—	20
Indox	Lérida	1	79	0	128	653	NO	YES	NO	NO	—	—
Acesa	Vitoria	1	—	—	—	—	NO	YES	NO	UNKNOWN	—	—
Máquinas Coser Alfa	Eibar	1	725	0	1,250	3,216	YES	NO	NO	NO	—	39
Nueva Montaña Quijano	Santander	2	3,083	0	2,250	14,960	YES	YES	NO	NO	—	10
Talleres Aragoneses	Zaragoza	1	185	0	87	234	YES	NO	NO	NO	—	6
AUXILIARY SHIP CONSTRUCTION												
Auxitrol	Madrid	1	55	0	53	220	YES	NO	NO	NO	—	0
Ebroacero	Zaragoza	1	81	0	240	1,250	YES	NO	NO	NO	—	—
Gruber Hnos.	Vizcaya	1	75	0	110	—	YES	NO	NO	NO	—	—
MTM	Barcelona	1	4,249	3	2,658	10,053	YES	NO	NO	NO	—	68
Navalips	Madrid	2	60	50	140	1,005	YES	NO	NO	NO	—	—
Nemrod Metzeler	Barcelona	1	—	—	—	—	YES	NO	NO	UNKNOWN	—	—
VARIOUS PRODUCTS												
Autógena Martinez	Madrid	6	304	0	394	1.772	NO	YES	NO	NO	—	4
Aitor	Vizcaya	1	28	0	118	338	NO	YES	NO	NO	146	—
Esab Ibérica	Madrid	1	240	75	289	1.471	YES	NO	NO	UNKNOWN	—	16
Fimesa	Madrid	1	—	—	—	—	NO	YES	NO	NO	—	—
Gomy	Pontevedra	1	125	0	130	650	YES	NO	NO	UNKNOWN	—	—
Industria Corchera Bertrán	Gerona	2	731	0	209	749	YES	NO	NO	UNKNOWN	—	—
Manufacturas Carrero	Gerona	1	0,6	0	12	—	YES	NO	NO	NO	—	—

AREA	Location	Nº factories	Equity capital	% foreign partic. in equity capital	Personnel	Annual invoicing 1982 millions	Manufact. of components	Manufact. of end products	Services/ technical support	USE of foreign technology	Export of Defense products	Payment R + D
CHEMICAL PRODUCTS												
Barnices Valentine	Barcelona	1	400	50	601	4,447	YES	NO	NO	NO	UNKNOWN	40
Brugarolas	Barcelona	1	16	0	112	776	YES	NO	NO	NO	UNKNOWN	—
Glasurit	Madrid	2	328	99	701	4,950	YES	NO	NO	NO	UNKNOWN	—
Hoechst Ibérica	Madrid	—	—	—	—	—	YES	NO	NO	NO	UNKNOWN	—
VARIOUS VEHICLES												
Fruehauf	Madrid	1	250	0	250	1,688	NO	YES	NO	NO	YES	—
Mercedes Benz	Madrid	1	4,176.9	54	3,929	27,411	NO	YES	NO	NO	YES	263
TOTALS		135	82,239		83,643	330,553						

RANNINGER (1984)

Source: Own made-up from data received from companies

The electronic sector groups a major set of companies which are, yet again, a clear example of the application of military technology in the civilian field. The following can be singled out from amongst the most important:

* CESELSA:	Radar systems, flight simulators, using its own technology, or technology developed in cooperation with the Universities.
* SAINCO:	Automatic operation simulators, computerized electronic systems, remote controls.
* TEKTRONIK:	a mulitnational. Graphic data processing, communications, digital products and measuring instrumentation.
* C.D.E. ELECTRONICA S.A.:	Rectifiers, converters, power supplies. Local technology.
* ENSA:	This company belongs to the group by CESELSA. Direction finders. The company has its own technology.
* EUROTRONICA S.A.:	Communications, electromedicine, naval electronics and teletransmission.
* PAGE IBERICA:	Radiocommunications units and units for Air Traffic Control.
* OTEMA:	Mobile radio-communications, repeater stations, ground-to-air equipment.

From expierence outside the electronic sector, mention should be made of the company CHACONSA which has, on order from the Defense Ministry, developed an amphibious vehicle on the basis of a project for research into vehicle technology on air cushions, known as hovercraft, and with possible civilian applications.

3.4 Current Defense Programs and their effect on Civilian Industry

Table 9 shows the main programs for defense which as a whole, exceed one thousand billion pesetas. For the most part, this financial effort goes overseas, as local industry lacks the technological capability which is able to meet the needs of the Spanish armed forces; the most favorable case is that of EMPRESA NACIONAL BAZAN which is able to meet 60-70 % of its programs.

It seems that, in this situation, the decision has been to import the foreign technology which makes it possible to manufacture as much as possible in this country and, in the cases where this is not possible - as in the FACA program - to raise trade compensation as far as possible, even to including non-military industry.

One of the most important problems facing the companies for participation on better terms in these programs is the lack of planning by the Ministry of Defense which, when it announces its decision, leaves virtually no time in which to adjust the local industry - and even less so in order to compete with the big international companies.

On the other hand, there is clearly a very low level of participation by private local companies, which reduces the capacity to spread the impact on the industrial network.

The development of these new programs, and the formula used, will involve a major increase in the level of technological complexity in military matériel which, because of the capacity of our industry, will mean a reduction in the rate of national supply. This means that for some industries the future loo,s somewhat bleak and it will be difficult to speak in this country of a real military-industrial complex such as may exist in more deveoped countries.

Table no. 9

MAIN DEFENSE PROGRAMS AT MEDIUM TERM

Program	Available budget in millions pesetas	ALLOCATED	NATIONAL MANUFAC-TURES	AVAILABILITY OF TECHNOLOGY TRANSFER	PARTICIPATING NATIONAL MANUFACTURER	COMPENSATIONS TO TAKE PLACE	FINAL TECHNOLOGICAL RESULT OF MANUFACTURE
Project FACA	325,000	McDonnell (USA)	NO	Flight simulator/ automatic analyser stabilizer/leading edge flap/leading edge extension	CASA/CECSA	US-$ 1,800 millions 1981	IMPORT WITH SCARCE NATIONAL PARTICIPATION
Antitank missiles	30,000	not yet decided possibly TOW or HOT	NO	Planned for missile	Santa Bárbara or Talbot	Planned	Probably: NATIONAL MANUFACTURE WITH FOREIGN TECHNOLOGY
Antiaircraft missiles	35,000	Euromissile (French-German)	NO	Engine, 6000 war heads, parts, chassis, mounting	Santa Bárbara ENOSA EISA	12,500 million pesetas	NATIONAL MANUFACTURE WITH FOREIGN TECHNOLOGY
Helicopters	118,000	not yet decided	NO	Planned	CASA new national manufacturer	Planned	Probably: IMPORT WITH SCARCE NATIONAL PARTICIPATION
Tanks	130,000	not yet decided	NO	Acquisition of technology planned for national manufacture	Santa Bárbara	unknown	Probably: NATIONAL MANUFACTURE WITH FOREIGN TECHNOLOGY
Other programs (various ships)	400,000	not yed decided	YES (60 to 70%)	Planned	BAZAN	unknown	Probably: NATIONAL MANUFACTURE WITH INCORPORATION OF 30% FOREIGN TECHNOLOGY

Source: RANNINGER (1987)

3.5 Other Considerations on the Technological Standard

So far, some of the main technological achievements have been set out of the Spanish military industries, normally by means of a combination of technology importation and their own research efforts. In large part, these achievements are reflected in the sector's export rhythm.

However, there are other important elements which must be taken into account in assessing the overall situation of the sector, since the truth is less positive than might by thought from the picture painted above.

In the first place, the general technological level of the products can be classified as medium-to-low, if it is remembered that those of better quality are made under foreign license (as is the case with some frigates, combat tanks, etc.). Evidence of this relatively low technological level is in the small number of patents produced by Spanish companies in the field, and in their content. Table 10 is highly illuminating in this sense.

A major cause of this situaticn is the reduced R & D potential. In particular, it must be borne in mind that, notwithstanding the progress, the situation in the research centers leaves much to be desired, for the following reasons, amongst others:

- Lack of resources in technology research centers
- Low proportion of high-qualification staff
- The absence of a research personnel training policy
- Low level of funds and subsidies from the government
- On occasion, poor distribution of government funds which have favored the companies over the research centers which, nevertheless, do take a longer term view.
- Low level of cooperation between Military and Civilian Research Centers.
- The lack of electronic research laboratories of some scale.

Table no. 10

PATENTS OF THE ARMAMENT NATIONAL INDUSTRY
(Until December 1983)

COMPANY	NUMBER OF PRESENTED PATENTS APPLIED FOR	TITLE	SORT OF PATENT	APPLICATION PATENT DATE	UNDER USE
CASA	2	-Manufacture of monolithic pieces	Letters patent	2.12.83	Unknown
		-Aerodynamic profile	Model of utility	24.11.78	Admitted
EESA	2	-Proximity fuze	Letters patent	16.07.80	YES
		-Chronoelectronics fuze	Model of utility	16.07.80	Under process
ESPERANZA	19	-Perfectioning of fuzes	Model of utility	20.09.83	Unknown
		-Matrix proyectile	Model of utility	20.09.83	Unknown
		-Illuminating grenade	Model of utility	20.09.83	Unknown
		-Perfection of projectiles	Model of utility	20.09.83	Unknown
		-Improvements in projectiles	Model of utility	20.09.83	Unknown
		-Perfection of mortars	Letters patent	4.09.68	YES
		-Perfection of mortars	Letters patent	4.09.68	YES
		-Perfection of fuzes	Letters patent	19.04.67	YES
		-Improved fuze	Letters patent	19.04.67	YES
		-Fuze exploding in air	Letters patent	9.02.78	Admitted
		-Grenade exploding in air	Letters patent	9.02.78	Admitted
		-New mortars grenade	Letters patent	9.02.78	Admitted
		-Base for mortar	Adition. certif.	7.11.80	Under process
		-Improved base	Letters patent	17.05.80	NO
		-Mechanical fuze	Letters patent	20.04.79	Admitted
		-Mortar fastening	Model of utility	7.07.80	Under process
		-Mortar elev. and folding	Model of utility	7.07.80	Under process
		-Subcaliber mortars	Model of utility	29.01.77	YES
		-Layont of mortar elements	Model of utility	4.11.75	Expired
EXPAL	3	-Perfection of hand-grenades	Letters patent	19.05.69	YES
		-Improvement of containers	Letters patent	1.02.73	NO
		-Hand grenade	Model of utility	10.09.70	YES
STAR	3	-Perfection of sights	Letters patent	15.03.69	YES
		-Perfection of rifles	Letters patent	27.06.69	YES
		-Security device	Model of utility	18.11.75	NO
INSTALAZA	6	-Firing device	Letters patent	9.06.82	Unknown
		-Improvem. of fuzes	Letters patent	10.05.82	Unknown
		-Perfection of igniters	Letters patent	3.08.67	YES
		-Improvem. of grenades	Letters patent	28.03.77	YES
		-Improvem. of grenades	Letters patent	6.11.78	YES
		-Perfection of grenades	Adition. certif.	6.11.78	YES
LLAMA	4	-Layont of pistols	Model of utility	18.12.80	Unknown
		-Perfection of fire arms	Letters patent	30.07.79	YES
		-Pistol firing	Model of utility	22.4.74	NO
		-Hammer	Model of utylity	30.12.71	YES
TALBOT	2	-Tankhunter	Letters patent	21.04.83	Unknown
		-Tankhunter	Letters patent	30.05.83	Unknown

According to this considerations, there is room for doubt as to whether, in a country such as Spain, the effect of military activity in the technological field can generate a considerable driving force on civil technological applications. We have seen examples where this is the case, but it cannot be generalized throughout Spanish arms production as a whole. There have been some achievements until now, by which the industry benefits more than before from defense programs, but the situation is not so positive in the field of the generation and dissemination of technology.

The official response will probably consist of the promotion of joint-production and manufacture, as pointed out above, so giving new and more direct access to new technology. However, not everything is positive in this sphere, either, and the following are some of the disadvantages(22):

- The lack of adjustment to the level of other participants makes it very difficult to rationally and optimally assimilate the technology to be transferred in joint-production programs.

- The difficulties in participating in the most advanced elements may turn the companies into mere subcontracters at first, leading to a marginal position in the subsequent removal. This is particularly dangerous if participation in some programs, decided on for political expediency, means that the few Spanish companies able to participate must relegate other projects of their own which, while, overall, less sophisticated technologically speaking, do however enable the company to enter key fields and global developments. The most revelant example is CASA's 10 % share in the European Fighter Aircraft (EFA), and the suspension of its AX tactical aircraft project.

Finally, it cannot be forgotten that the need to resort to foreign technology is not only being covered by direct access but that, on many occasions, use has been made of technology transfer agree-

Table no. 11

TECHNOLOGY TRANSFER CONTRACTS IN THE MILITARY INDUSTRY

	TOTAL CONTRACTS	FINAL PRODUCT MANUFACTURE	COMPONENTS MANUFACTURE	USE OF PATENT, LICENSE	TECHNICAL SUPPORT	TECHNOLOGY DOUBLE USE	ORIGIN OF TECHNOLOGY	PRODUCTION PREMISES
NAVAL INDUSTRY								
Bazán	43	10	25	4	4	33	11A,13U,2H,5I 3J,2It,5F,1Su, 1N	
San Carlos	2		2			1	1I, 1A	
Astilleros Españoles	1		1			1	1F	
ELECTRONICS INDUSTRY								
Eisa	8		8			3	7F, 1S	
Eesa	4	2	2			2	3F, 1I	
Cecsa	1	1				1	1U	
Sener	1			1		1	1P	
Marconi	1	1				1	1A	
Bressel	1		1				1U	
AERONAUTICAL INDUSTRY								
Casa	25	3	4	5	13	13	10U,8I,4F,3A	
MILITARY VEHICLES								
Enasa	20	2	9	2	7	11	2H,1It,2Su,5I 4F,4U,1B,1A	2
ARMAMENT								
Santa Barbara	3	1	1		1		2F,1A	
Llama	1			1		1	1I	
Barreiros	3		3			1	2U,1H	2
Laguna de Rins	1		1			1	1F	
TOTAL	115	20	57	13	25	70		4

B = Brazil Su = Switzerland It = Italy P = Poland H = Holland S = Sweden
N = Norwege J = Japan F = France A = Germany U = U.S.A. I = United Kingdom

Source: RANNINGER (1987)

ments, the problems of which we have already commented on. Table 11 shows a summary of the main contracts carried out by the defense companies from 1974-1984. We may draw the following conclusions:

1.- The INI group companies are the ones which have concluded most agreements, as a result of the lower technological level of the products made by the standard civilian defense industry.

2.- System component production contracts predominate, indicating a major weakness in the structure of the Spanish industry.

3.- 61 % of all the agreements can be classified as for "double-use" technology, i. e. for use equally in the military and civilian spheres. This is, on the one hand, a positive factor, since it may allow for a greater dissemination of training in technology, but, on the other hand, there may be severe limitations in times of political tension, raising major problems of continuity and modernization.

4.- A reduction is being noted in the rate of new contracts over recent years (20 from 1979-1984, as against 94 from 1974-1978), reflecting two important facts; on the one hand, a certain technological assimilation by some companies and, on the other, a change in matériel procurement policy and R & D promotion, which were referred to previously.

4.- CONCLUSIONS

It has been our aim to discuss simultaneously the type of access to foreign technology that the Spanish defense industry has had, and the civilian implication arising from this. We also thus wished to see if it were possible to extract any more general findings for guidelines for a technology transfer policy which needs revision.

From the above, some positive achievements are revealed, e. g.:

1) State policy has made possible a substantial change in the situation in the defense industry over 15 years. It is true that it is a special sector, given the government's capacity to directly influence it, even applying force, as is the case of the public corporations, to some extent. However, not all fields where there is great State influence have seen the positive effects arising from clear technology promotion policies; examples include transport, communications, mining, etc.

2) The means of access to foreign technology have been better adjusted to the industry's possibilities and requirements. Once more here, the government's presence and its negotiation possibilities have had a positive influence not seen in other industrial sectors. But the lesson is there, insofar as the political will can improve the conditions for obtaining technological resources.

3) For this to happen, a basic factor has been the institutional adjustment inside the administration in the search for efficiency which, unfortunately, represents an exception in the Spanish administration in the seventies and most of the eighties. The positive role played by the DGAM might be an example to keep in mind in other public domains when it comes to rationalizing the capital goods field here.

4) The training process has been very important for the technological adaptation on the basis of imported technology. Once more, one structural elements seems to be fundamental - the availability of a domestic industrial base which is able to make this assimilation. This contrasts with the trends in other industrial sectors, which have based their modernization policy in technology almost entirely on the introduction of multinationals.

5) The spin-off effects to other sectors and companies has also been a result of the institutional way in which cooperation has been planned. Thus it is possible, in some way and to some extent, to direct the effects of development and the dissemination of technology.

However, obviously, not all the consequences are positive, and the following should be included in the less favorable balance:

1) Despite the improvements referred to, there still remains plenty to be done in the area of planning, sufficiently in advance of government action. In fact, the delay against our industrial network - not only in connection with defense - makes it necessary to have state plans for the purchase of equipment somewhat in advance, in order to take the necessary steps and try to obtain maximum benefit for this industry. Otherwise, the disadvantage against the large multinational firms is aggravated.

2) The size of the industry associated with defense in this country does not make it possible to think of it as a driving force generating notable effects for the economy as a whole. We are not advocating an increase in Spanish military industry, nor do we deny the existence of positive effects: all we wish to make clear is that the future of our industrial development cannot rely only on a military "push", so that we must look for other sectorial action and possibilities.

3) While we may not deny that the form in which access has been had to some foreign technology has created positive effects, we may not ignore the problems which have existed, such as the transfer of obsolete technology, making exports difficult, the participation in marginal parts of projects, etc. There is probably no miraculous formula, but the example of the AMX30 tank, and its lack of operability, should point down wrong paths which should no to be followed again.

4) While it is remembered that, in recent years, the attention given to R & D at the local level has improved, it is undeniable that its potential is as yet scant, merely in comparison with our own industrial potential. In this sense, the defects pointed to in relation with the state of the research centres should be a matter for solution on a priority basis, in order to provide better access to technology from overseas at the same time as constantly improving our own capabilities.'

Of all the matters connected with R & D, probably the most important in the long term is the training of qualified personnel.

There is a field of agreement which warns that the defense industry in this country has reached a certain ceiling, not only in its capacity to meet domestic demand, but also in exports. The new situation of the modernization of the Army and of integration into NATO, as well as the need to overcome the crisis once and for all and to face up to the challenge of admission to the EEC - define a radically new panorama in which past experience must serve for more accurate decision-making.

The basic problem is in the high political content of the subject of the military industrial sector. From a genuine perceived anti-militarism (due in large part to the on-going major social needs of the Spanish economy), to the need for stable relations between the military structure and civilian society, and including the novelty of our democratic experience, all these are aspects which affect the decision-making function.

N O T E S

1.- On this matter, all availabel studies are agreed, including OECD work on technological efforts. Amongst others, the following may be consulted: PAVON & GOODMAN (1981), MOLERO (1983a) (1983b), OECD (1975) (1984), and BRAÑA, BUESA, MOLERO (1984).

2.- See e.g. BUESA, BRAÑA (1979) and CASTELLS et. al (1986).

3.- It is not possible to go into this matter further here but there is ample literature, including MUÑOZ, ROLDAN and SERRANO (1978), BRAÑA, BUESA and MOLERO (1984), BUESA and MOLERO (1983) and BUESA (1982).

4.- Of particular note are the successive OECD reports. See those referred to in note 1.

5.- This is obviously a generalization and we do admit that some companies have been able to pursue more consistent policies which, with time, has led them to acquire a certain know-how of their own which means that they can operate on certain of the international markets. There is a text on the low technological assimilation from the employer's association itself (CEOE 1980).

6.- See BUESA (1982) and BRAÑA, BUESA, MOLERO (1984).

7.- See Decree 418/1965 of February 25th. See BUESA (1985) on the evolution of official technology imports policy.

8.- See BERMEJO (1967) and UNCTAD (1974).

9.- The basic legal provisions are Decree 2343/73 of September 21st, the Ministerial Order of December 5th 1973, implementing that Decree, and the Order of July 30th 1983 amending the earlier one.

10.- A comparison of the standards can be found, for 1973 and 1981, in BUESA (1985), P. 5.

11.- See Article 2 of Decree 2343/1973.

12.- Included in BUESA (1983), Pp. 6 and 7. On the rate of import of foreign technology, see BRAÑA, BUESA, MOLERO (1984) Pp 296 and 299. On the content of agreements following the 1983 Act, see SANCHEZ (1984).

13.- SANCHEZ (1981) has shown that foreign company subsidiaries have suffered increased costs for the acquisition of technology and BRAÑA, BUESA and MOLERO (1984) offer data on the Balance of Payments from the large industrial companies which do not reveal that reduction in the cost of the acquisition of foreign technology.

14.- A synthesis of the matters referred to here is to be found in BARDAJI (1986) and in LOOSE-WEINTRAUB (1984).

15.- These include substantial royalty payments, second and third generation technology and very restrictive clauses on export of the material produced. See CASTELLS et al (1986) and BARDAJI (1986).

16.- See LOOSE-WEINTRAUB (1984), data taken from SIPRI.

17.- See "Anuario El Pais" (1987), Madrid, P.119.

18.- Data taken from the doctoral thesis of Hermann Ranninger (1987).

19.- Summary of data from RANNINGER (1987). The main source of information is the document on Las Grandes Compañias Industriales of the Ministry of Industry and Energy. MINER (1983).

20.- To these companies we may add a large number which perform more traditional supplies to the Ministry of Defense, such as was pointed out at the beginning of this section.

21.- See CASTELLS et al (1986), P. 781.

22.- BARDAJI (1986).

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