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Task 1: Basic Measurement

The changing role of Italian R&D

In the Second European Report on Science and Technology (S&T) Indicators, published in 1997, the R&D systems of the four largest R&D spending countries in the European Union¹ (EU) are compared using several indicators of both inputs and outputs of their national research and innovation systems. Italy, which is the smallest out of these four countries in terms of the amount of financial and human resources devoted to S&T activities, emerges as being the weakest, as well. All performance indicators (including the number of patents granted in the US per 1000 population as well as the share of high-tech exports on total export) are lower than those of the other countries and the Report argues that: “over the whole range of indicators used, Italy has the weakest R&D system of the [European] big four.”

In the defence field, the gap between Italy and its European partners is even wider. According to indicators like the total expenditure for military R&D or the ability to manage the development of major weapon systems, the “military national innovation system” of Italy looks more similar in size and international relevance to those of countries like Spain or Sweden than to Britain, France or Germany. While in the past the Italian authorities have often claimed to compete with the largest military industries in Europe, they have only recently become aware of such a “disqualification”.

Until a few years ago, for instance, both public incentives to innovation and direct support to R&D activities, although being significantly lower than those of France and Britain, have been spread over many industries and firms only aiming at maintaining a basic domestic production capability in all defence sectors.

Funding shortages and the need for restructuring the military innovation system after the end of the Cold war have led to the identification of defined priorities in sustaining the military R&D (mainly related to a few Italian “areas of excellence”). Below the most recent attempts by the Italian government to focus on the technological development of specific firms and sectors will be described.

Italian R&D expenditure

As to the dimension of the R&D expenditure in Italy, the most reliable data are provided by the OECD (1998). In table 1, OECD data on the recent evolution of R&D spending in Italy are shown. Definitions are those provided by the OECD *Frascati Manual* which considers the following items: *GERD* (which covers all R&D carried out on the national territory in the year concerned), *GBAORD* (Government Budget Appropriations for R&D), and *Defence GBAORD* (Budget Appropriations for Ministry of Defence R&D). The table 1 shows that the overall R&D spending, after a decrease in the 1993-95 period (mainly due to the reductions in public R&D spending because of budgetary constraints), has been increasing during the most recent years as result of an effort by the Government to shift available resources towards research funding.

In addition, the MoD since 1995 has also been increasing the share of its budget devoted to research activities. In fact, the year 1995 can be considered the lowest point of a spending cycle. Despite this

¹ The four countries are: UK, France, Germany and Italy.

rising trend, the Italian MoD spending for R&D (\$304.5 million in 1995) can be considered quite low compared to those of other European countries. It has already been pointed out that – leaving aside the UK and France which are big R&D spenders, operating large military research facilities and nuclear laboratories - Germany has devoted more than \$ 1.5 billion to military R&D in 1996, Spain is spending around \$600 million per year in military R&D and even Swedish military R&D expenditure has been in recent years higher than Italy's.

As to the percentage of GBAORD devoted to military purposes, Italy is largely below that level of ten per cent which can be considered the threshold separating countries which consider military R&D as an essential element of their overall R&D and innovation effort from those which are not willing to enlarge their technological competencies in the defence field.

Tab. 1 Italian R&D expenditures (OECD data)

Data are in \$ million current PPP.

	1992	1993	1994	1995	1996	1997
GERD	12299,8	11483,2	11340,5	11244,1	11794,8	12503,8
Total GBAORD	8266,4	7017	6719,8	6477,9	n.a.	n.a.
Defence budget R&D As a percentage of total GBAORD	7,1%	8,5%	8,9%	4,7%	n.a.	n.a.
Total defence budget R&D expenditure	586,9	596,4	598,1	304,5	n.a.	n.a.
Defence R&D as a Percentage of GERD	4.8%	5.2%	5.3%	2.7%	n.a.	n.a.

Notes: GERD=Gross Domestic Expenditure on R&D; GBAORD=Government Budget Appropriations for R&D.

Source: OECD, 1998.

From the methodological point of view, it may be of interest to describe how data in table 1 have been collected. In Italy, two institutions are involved in R&D data collection: ISTAT, the National Institute of Statistics, and CNR, the National Research Council.

Figure 1 R&D data collection in Italy

ISTAT - National Statistics Institute	CNR - National Research Council
It carries out every year a survey on: - R&D in business firms, - R&D in public institutions.	It carries out every year a survey on: - R&D budget appropriations in Ministries and public institutions.
It provides OECD with: - All available data on R&D in Italy, including BERD and GOVERD.	It provides OECD with: - Data on GBAORD.
Remarks: - ISTAT has a general responsibility for statistical data collection and its surveys are mandatory; - The R&D survey may be improved in order to identify more clearly data on MoD intramural R&D and the share of BERD devoted to defence needs.	Remarks: - The analysis of the ministerial budgets is complex and budget appropriations are often hardly comparable to actual spending.

ISTAT carries out every year a survey on the R&D activities of both firms and institutions following the *OECD Frascati Manual's* definitions and methodologies (OECD, 1994). The results of the ISTAT R&D survey are provided to the OECD and are used to calculate GERD as well as its main components: BERD (Expenditure on R&D in the Business Enterprise Sector) and GOVERD (Government Intramural Expenditure on R&D). On the other side, CNR collects yearly data on R&D budget appropriations in Ministries and other public institutions. Thus, the CNR data are used to calculate the GBAORD (and the Defence GBAORD) raising several problems as to the comparison between GBAORD and GERD-related indicators. Figure 1 above shows the current situation.

From this brief overview, it clearly emerges that giving ISTAT the responsibility for the collection of all data related to R&D in Italy would streamline the surveying process assuring an easier comparison of collected data (also thanks to methodological homogeneity). Moreover, such a development could make ISTAT able to improve the current approach to asking public institutions to provide information about the matching between R&D budget appropriations and actual R&D spending; and matching data on MoD extra-mural R&D with data provided by industrial firms performing military R&D.

Coordination in collecting data on MoD R&D spending it is strongly needed since – at present - it is very difficult to compare data on military R&D published by ISTAT or by CNR with data released by the MoD.

Data on military R&D provided by the MoD

Three main documents have to be considered as primary sources of information on the Italian MoD R&D spending:

- the MoD Budget Proposal, presented by the MoD to the Cabinet as preliminary estimation of the annual MoD financial needs;
- the MoD Budget, approved by the Parliament, from which budget appropriations are taken;
- the Additional Note to the Budget Proposal, produced by the MoD in order to provide the Parliament with more specific information on Italian military spending.

In order to gather data on the breakdown of defence R&D expenditure by “sectors” (as well as by Services), data from the MoD Budget Proposal have to be considered. These data (see table 2) raise some problems.

Tab. 2 R&D Budget proposals by the MoD

Data are in current billion lire.

Category	<i>Year</i>	1992	1993	1994	1995	1996	1997	1998	1999
Army		87.0	26,2	20.0	30,72	35,99	25,09	15,58	33.00
Navy		121,1	101,6	101.2	73,49	53,00	71,94	72,50	67.00
Air Force		607,4	656,1	556.7	744,60	593,10	64,51	387,00	482.47
Joint R&D	Total	336,2	410,4	411.4	388,46	328,77	369,54	301,09	200.00
	Army							6,50	9.10
	Navy							114,50	63.00
	Air Force							145,00	87.90
	Other							35,09	40.00
Other								19,50	7.00
TOTAL		1151,70	1194,30	1089.30	1237,27	1010,87	531,08	795,66	789.47

The first problem which emerges from data in table 2 is a methodological one: the MoD does not explicitly use definitions from the Frascati Manual. This means that, lacking a process of methodological harmonisation, data from the MoD are not comparable with those either from ISTAT or from CNR (also if they are using the MoD as primary source).

The second and most relevant problem is that the MoD does not provide very clear definitions about which expenditures are included in the R&D budget. This is mainly due to the organisational structure of the Italian MoD where decisions about resource allocation are taken by the technical directorates. They mainly manage specific “procurement programmes” for developing or producing a weapon system and are not able to distinguish ex-post between funding devoted to extra-mural R&D and payments for actual acquisition of hardware.

Table 2 also shows that until 1997, the MoD R&D budget was broken down in four items:

1. R&D (mainly product development) funding by the Army technical directorate;
2. R&D (mainly product development) funding by the Navy technical directorate;
3. R&D (mainly product development) funding by the Air Force technical directorate;
4. R&D (mainly applied research) funding by the Office of the Secretary General on behalf of the Joint Chief of Staff.

Such a distinction can only offer some general information about the extent the three Services are involved in the process of developing new systems. For instance, the Air Force is confirmed as a big R&D performer because of its need to design and test systems which are often totally new, while the Army's development activities appears as being very limited and mainly linked to the integration of new or improved devices in existing equipment.

Additionally, the criterion used in order to distinguish between R&D and other services more related to the delivery of new systems (integration of new weapon in existing systems, training and related activities, development of a logistic system, etc.) has changed over the last years. Thus, in the 1997 Budget Proposal, the Air Force technical directorate judged the activity to be carried out in the year under review more oriented to "acquisition" than to R&D - clearly using different criteria from those used in previous years - causing a break in the time series.

Since the 1998 Budget Proposal, the MoD publishes more detailed data on R&D than in the past, mainly distinguishing between R&D related to products under acquisition and "pure" R&D funded by each service. Such a development makes MoD Budget Proposal data more reliable and useful in order to identify the share of R&D funding the MoD is willing to devote to the needs of each armed force. Nevertheless it is important to stress two limitations of such data:

- 1) they are administrative data, thus "R&D spending" means for the MoD "all expenses included in the R&D budget items", a purely administrative concept;
- 2) they are forecasts, so they are relevant as indicators of the "political" orientation of the Italian MoD but may not be comparable with both budget appropriations and actual spending.

MoD Budget Appropriations are obviously able to provide more "official" data on military R&D defence spending than Budget Proposals do. These data are also more easily compared to the overall MoD investments, as well as to the total military expenditure (see table 3).

Data on MoD Budget Appropriations come from a document presented by the MoD to the Parliament during the discussion on the Government Budget Proposal. In this document (Additional Note to the Budget Proposal) the MoD give extensive information about the contents of the budget items. As to R&D spending, the MoD provides the Parliament with data on total expenditure as a share of the total MoD investments.

Table 3 are shows figures on: total expenditures for defence needs (which covers the largest part of the MoD Budget); defence investment (broken down by category: equipment, infrastructures and R&D); share of total defence expenditure devoted to R&D (all figures refer to budget appropriations).

Tab. 3 MoD Budget Appropriations 1986-98

Data are in current billion lire.

Year	MoD Investments			Total defence expenditure	% of R&D spending on total defence expenditure
	Major weapons	R&D	Infrastructure		
1986	3511	397	711	13981	2.8%
1987	3905	522	675	15113	3.5%
1988	3882	906	677	16517	5.5%
1989	4356	496	535	17977	2.8%
1990	3813	610	669	17929	3.4%
1991	3118	721	382	18304	3.9%
1992	3197	1071	510	17768	6.0%
1993	2766	918	465	18136	5.1%
1994	2429	915	421	18480	5.0%
1995	2481	904	478	18398	4.9%
1996	2975	1142	468	21901	5.2%
1997	3492	1279	263	21767	5.9%
1998	4133	981	391	22108	4.4%

On the one hand, it can be pointed out that data on R&D coming from the Additional Note (table 3) differ from those provided by the MoD through the Budget Proposal (table 2). This is not surprising since the two documents are drawn up by different offices within the MoD. Unfortunately, it is not possible to compare data from such sources since the criteria for compilation of the two documents have never been made clear.

On the other hand, data from the Additional Note are directly related to the MoD budget figures approved by the Parliament and, as a consequence, these R&D data can be considered the most reliable ones.

Data in table 3 show a constant effort of the MoD over the last years to maintain a level of funding sufficient both to fulfil its international commitments (including those needed to complete the EF 2000 development phase) and to support the restructuring activities which are taking place in several military firms. The MoD is obviously considering R&D spending as a share of total investments and, given that in 1998 the then Defence Minister Andreatta publicly stated that it would not be possible to spend yearly more than 5,000 billion lire for defence investments before the next decade, any acquisition of new weapons will proportionally reduce the resources available for R&D.

By the “qualitative “ point of view the MoD R&D spending is concentrated in a few large procurement programs. In table 4 the largest on-going procurement programs of the Italian MoD are listed.

Several programs in table 4 have began early in the '90s and are expected to last well into the next decade. These programs - including the Ariete MBT, the A-129 and EH-101 helicopters or the Skyguard SAM - can be considered a heritage of the previous period of military investments in Italy, when the MoD attempted to boost the acquisition of autonomous capabilities of system integration by the Italian defence industry in selected fields.

On the other hand, the next batch of acquisition programs, mainly launched over the last two years, include mainly licensed productions (U212 submarine or C-130J aircraft) and international collaborations (ranging from the EF 2000 to the PAAMS SAM).

Tab. 4 Main procurement programs, 1998

Data are in 1998 billion lire.

Source: MoD Budget Proposal 1999

Programs	Total cost	Beginning	End
<i>Army</i>			
Ariete MBT	1,692.3	1993	2001
Skyguard Aspide SAM	963.0	1990	1997
A.129 Armed helicopters	777.8	1991	1999
<i>Navy</i>			
Submarine U 212 A	1,750.0	1996	2007
EH-101 Transport helicopters	1,498.5	1991	2001
AV-8B V/STOL aircraft	1,234.0	1992	2000
PAAMS Naval SAM	680.0	1996	2006
<i>Air Force</i>			
EF 2000 Fighter aircraft	20,405.0	1987	2014
MRCA Fighter aircraft (mid-life update)	8,242.0	1969	2005
AM-X CAS aircraft (mid-life update)	7,480.0	1984	n.a.
C-130J Transport aircraft	2,253.4	1997	2005

Task 2: Elements of an institutional map

Several actors, both within and outside the Ministry of Defence, play a role in the Italian defence R&D system. It can be pointed out that, while the MoD is totally funding military R&D in Italy and the MoD's technical branch has a key responsibility in co-ordinating research and technology activities in the field of defence (following some general directions approved by the Parliament as well as considering the operational needs of the armed forces), most Italian military R&D is performed outside the MoD. In fact, lacking adequate research facilities within the MoD, the Italian defence industry carries out almost all the R&D activities funded by the MoD.

R&D management in the MoD

Within the Ministry, a key role is played by the Office of the Secretary General of Defence who is the head of the technical-administrative branch of the MoD (see figure 2 below).

Figure 2: The structure of the Italian MoD



The Secretary General has been recently given a stronger control than he had in the past over the activities of the technical directorates and he should be now able - in collaboration with the operational branch of the MoD, as well as the defence industry - to identify long-term research priorities and short-medium term development needs to make easier a matching between industrial firms capabilities and MoD needs. The Secretary General - who, as long as he will be a military officer, he will be also National Armaments Director - is responsible for managing international collaborations defined at governmental level and for joint R&D programmes involving two or three armed forces.

To fulfill these tasks the Secretary General relies on a very limited staff. He has no technical advice available, since the technical staff working in the technical centres of the MoD mainly depend on

their own armed forces' Chiefs of Staff. On the other hand, the largest procurement programmes - including those with significant investments in R&D - are designed and managed by each armed force on its own, leaving to the "technical branch" of the MoD only an administrative role.

In order to define the national R&D and procurement policy, the Secretary General has to collaborate with two main advisory groups: the Defence Technical and Scientific Council (CTSD), which is a MoD committee which gives advice to the Joint Chief of Staff on technical and scientific matters, and the Defence-Industry Committee, in which representatives from both the MoD and the defence industry meet to co-ordinate their activities.

R&D in the Italian defence industry

In Italy, most of the scientific and technological activities related to MoD needs are carried out by industrial firms. Four main industrial groups currently control most Italian military production: Finmeccanica, Fincantieri, Fiat and Marconi. Basic information on these groups is shown in table 5.

Table 5 Main Italian industrial groups with military activities

Groups	Size	Main military activities
Finmeccanica	Total turnover 1996:13,883 bill. lire Military turnover 1996: 3,540 bill. lire Total employment 1996: 60,012	Combat and transport aircraft, missiles and missile systems, radars, EW equipment, avionics, optronics, artillery and armoured vehicles, helicopters, submarine defence systems.
Fincantieri	Employment 1996: about 10,000 Employment in the mil. branch 1996: about 2,000.	Military surface ships, submarines, naval engines.
Fiat	Total turnover 1996: 78,000 bill. lire Dual-use turnover 1996: 3,000 bill. lire Total employment 1996: 237,400	Aircraft engines, military vehicles, ordnance and explosives, naval electronics.
Marconi	Total turnover 1995: 1,048 mill. \$ Mil. turnover 1995: about 335 mill. \$ Total employment 1995: 7,568	Strategic and tactical telecommunications, electronics.

The bulk of the Italian defence industry, namely Finmeccanica and Fincantieri which jointly account for more than two thirds of total military production in Italy, consists of large public-owned groups which are slowly going through a process of privatisation. Such process of privatisation and restructuring is mainly oriented to sell up some high-tech activities: prospects for platforms

producers and traditional arms producers are not very clear, so far. A main consequence is that, even if such industrial groups are currently spending an increasing share of their turnover on R&D (between 5 and 10 per cent), they do not seem willing to identify their own priorities in research with reference to a long-term strategic planning based on market evaluation. They mainly continue to define their plans to be consistent with the needs of the Italian military and with short-term funding opportunities from the MoD.

The future prospects for these groups are quite uncertain. On the one hand the setting up of a “common” European arms market will give them chances for defining collaborations or strategic agreements or even mergers with larger and stronger European defence groups. The current process of privatisation is also aimed at making such a process of European integration easier. On the other hand, the process of restructuring and privatisation on going in Italian military industry is taking place in a period in which both MoD procurement spending and other sources of public support are shrinking. This will probably have a negative economic and social impact as well as threatening the preservation of key technological competencies.

Compared to the above described public-owned companies, the strategies of the two main private defence groups in Italy, Fiat and Marconi, appear to be more open to the challenge of the integration of international markets and more flexible in facing the rapid evolution of the international arms industry. Some remarks can be made on their main, and to some extent common, characteristics. Firstly, they are both multinational enterprises having affiliated companies operating in several countries around the World. Thus, these groups are highly diversified and are also able to support for some periods losses in their military branches due to a low phase of the military economic cycle. At the same time, they can exploit technological and commercial synergies which can be developed among their different branches.

Secondly, the military branches of Fiat and Marconi are producing quite exclusively high-tech, R&D intensive military products. Market forecasts for such products are quite positive and they will be probably able to offer their products to different customers to avoid becoming too dependent on a single national customer. A key point is that private groups do not have to support additional costs due to the political choice to keep alive uneconomic production of military platforms (such as Main Battle Tanks or large combat ships) for national security or national pride motivations, such as in the case of Finmeccanica and Fincantieri.

The table 6², describing the most advanced technological capabilities in the Italian defence industry, shows to what extent Finmeccanica, Fincantieri, Fiat and Marconi are playing a leading role in the technological development of the industry. It emerges that the four groups are controlling not only significant shares of the domestic arms market, but also key technological capabilities in several high-tech industries. As assumed above, the competencies available in Fiat and Marconi appear to be much more marketable than those of Finmeccanica and Fincantieri which are largely related to design and production of military platforms. While the European integration will pose a serious challenge to all four industrial groups, the joint effect of both the privatisation and restructuring processes will strongly influence and, probably, downsize the activities of Finmeccanica and Fincantieri in the near future.

² Data in this table mainly come from Weidacher, 1998.

Tab. 6 Technological capabilities in the Italian defence industry

Weapon systems	Companies	High-tech competencies
Combat and transport aircraft	Alenia <i>Finmeccanica</i>	Wing construction and system integration
Trainer aircraft	Aermacchi (participated by <i>Finmeccanica</i>)	Design and system integration
Helicopters	Agusta <i>Finmeccanica</i>	Design, transmission and system integration
Surface ships	<i>Fincantieri</i>	
Submarines	<i>Fincantieri</i>	
Minehunters	Intermarine	Design and construction
Land vehicles	Iveco <i>Fiat</i> , Otobreda <i>Finmeccanica</i>	Design and assembling of AFV
Aircraft engines	Fiat Avio <i>Fiat</i>	Production of components
Naval engines	Fiat Avio <i>Fiat</i> , <i>Fincantieri</i>	In <i>Fincantieri</i> design and propellants development
Engines for land vehicles	Iveco <i>Fiat</i>	
Air defence systems	Fiar/Alenia/Elsag <i>Finmeccanica</i> , Elettronica, Oerlikon-Contraves	System integration in <i>Finmeccanica</i> shared in international consortia with <i>Marconi</i>
Naval radars	Fiar/Elsag <i>Finmeccanica</i> , WASS <i>Fiat Finmeccanica</i>	System integration in <i>Finmeccanica</i> shared in international consortia with <i>Marconi</i>
Airborne radars/avionics	Fiar <i>Finmeccanica</i> , Litton Italia, Microtecnica	Design of GRIFO radars in <i>Finmeccanica</i>
Command, Control and Telecommunication	<i>Marconi</i>	Design and system integration for MIDAS system
Electronic warfare	Elmer <i>Marconi</i> , Elettronica	Design in Elettronica
Missiles	Alenia/Otobreda <i>Finmeccanica</i> , WASS <i>Fiat Finmeccanica</i> ,	Design and production shared in international consortia with French firms
Naval weapons	Elsag <i>Finmeccanica</i> , WASS <i>Fiat</i> <i>Finmeccanica</i>	Design
Artillery	Otobreda <i>Finmeccanica</i> , BPD <i>Fiat</i>	
Small arms/ordnance	Simmel Difesa <i>Fiat</i> , Beretta	Design and production

Task 3: Relations between elements in the institutional map

During recent years the Italian military R&D system has not changed very much from the institutional point of view. Relevant developments have taken place only in the structure of the technical branch of the MoD and in relations between the MoD and the Ministry of Research.

The MoD restructuring

A wide restructuring of the Italian Ministry of Defence has begun in 1997 after a law passed in the Parliament (Law no.1157/1997 *Law on the Reform of the Military Top Cadres*) allowing the Minister to design a new structure both for the Armed Forces command chain and for the technical support branch of the Ministry.

As to the operational branch (i.e. the Armed forces), a “vertical” structure has been implemented in spite of a previous “horizontal” one. Now, the Defence Joint Chief of Staff is the actual head of the Italian Armed Forces: he now has superiority over the Chiefs of Staff of Army, Navy and Air Force, while in the past his role was mainly that of co-ordinating the activities of his counterparts in the services.

What is more relevant for the evolution of the industrial and technological policy of the Italian Ministry of Defence is that the Defence Joint Chief of Staff now has superiority over the Head of the technical branch of the MoD (the Secretary General of Defence/National Armaments Director), as well. Until 1997, the Secretary General had the same rank of the Chiefs of Staff and was largely autonomous in the management of procurement, logistics and administration; after the implementation of the 1997 reform, the Secretary General (who now may be also a MoD civil servant) reports to the Defence Joint Chief of Staff.

This attempt to strengthen the role of the Joint Chief of Staff aims at overcoming a previous constant conflict of interest among the Armed forces’ Chiefs of Staff. It will probably make it more difficult for the Secretary General to co-ordinate the technical and administrative activities carried out by the three services and mainly those related to arms procurement and military R&D.

While the independence of the Secretary General from the armed forces has been reduced, the technical and administrative branch of the MoD has been largely restructured as well (Law no.264/1997). Firstly, the Secretary General can now have two Deputy-Secretaries. They will share the responsibilities of the Secretary General and will cover a military technical role in the event that a civil servant would become Secretary General.

More important, some technical directorates have been merged in order to streamline the structure of the MoD technical branch. After such a restructuring, even if the MoD will not continue to have specific agencies for managing arms procurement or R&D activities, three large directorates will concentrate all duties in this field. As in the past, such technical directorates are substantially dependent on the armed forces. They are:

- the Directorate General for ground weapons (resulting from the merger of the former directorate for ground weapons and that for motor-vehicles);
- the Directorate General for naval weapons (basically the same as in the past);
- the Directorate General for airborne weapons (the same as in the past).

It is obvious that in such a context also the relations between the MoD and the defence industry will not change and that this applies to the MoD procurement policy, as well as to the directions for supporting R&D activities.

Military R&D and the guidelines for reforming the national S&T system

In July 1997, the Ministry for Research issued a document (*Guidelines for reforming the National S&T System*) describing the policy proposed by the current Cabinet to “put in order” the “national system of science and technology” which includes laboratories as well as firms and Universities. In a chapter of this document, military R&D is mentioned too, describing the attitude of the Ministry of Research towards it.

The first point the document puts forward is the need to promote collaboration between the Ministries concerned. This is an important point in the Italian institutional context: if the MoD military R&D policy has to be co-ordinated within the national programme for research, it means that it should be any more an exclusive duty of the MoD for military or dual research.

Secondly, a primary operational task of the MoD should be to integrate national military R&D activities with similar activities carried out at the international level. According to the Ministry of Research document, the MoD will have to consider not only international programmes developed by WEAG or OCCAR, but also all the activities carried out, for instance, within the EU Framework Programme which could be of interest to Italian defence.

The last point, but no less important, is the promotion of dual-use activities. As already mentioned in previous official documents, the Ministry of Research has pointed out once again the need for the MoD to exploit existing dual-use capabilities in the Italian research system.

Task 4: Defining the system boundary

It may be argued that the Italian defence system is delimited by two different kinds of boundaries: political boundaries and technological boundaries (the latter being largely less extended than the earlier).

This is easily shown by the extent to which Italy is involved in international organisations. It is a member of NATO as well as a founding member of the European Union and of the Western European Union. Italy has joined the German-French Procurement Agency and in addition is a founding member of OCCAR. In general, during recent decades Italy has been a very enthusiastic promoter of international collaboration including collaboration on defence and, more specifically, on military production and procurement.

On the other hand, the Italian defence firms have rarely been able to support such a strong effort of internationalisation with an adequate level of technological competence to be shared with their international partners. Often, the Italian defence firms have been forced to play a minor role in international collaborations because of their poor contribution in technological terms.

The table below has been assembled integrating updated information in a scheme proposed by Skons (1993) and Weidacher (1998). The degree of internationalisation of Italy in the defence field is briefly described by topic.

Table 7. The internationalisation of Italian defence

<p>1. <i>International trade</i> In Italy military exports have been relevant in the period 1975-1985, when the Italian industry played a role of “newcomer” in the arms market, providing States outside the direct influence of the two Superpowers with medium-tech weapons systems (according to SIPRI Italy became in 1982 the sixth largest supplier of major weapons systems). After a severe decline in the ‘90s, the Italian military export is now mainly oriented to supplying components or sub-systems to the US or other European countries. The Italian Law on arms export (Law no.185/1990) is probably one of strictest in the European Union.</p>
<p>2. <i>Foreign investments</i> In general, the Italian industry shows a limited ability in taking over minority shares in foreign companies. The defence industry follows such trend: no relevant participation in military firms abroad have been reported over the last years by Italian defence firms. It has been more common to establish subsidiaries in countries where commercial penetration was expected. Some instances: Beretta and Intermarine in the US, Elettronica in Germany and Spain.</p>
<p>3. <i>International sub-contracting</i> Several high-tech industries related to military production are characterised in Italy by sub-contracting activity. In the aerospace sector, Alenia is mainly a subcontractor of Airbus and Boeing-MDD and Fiat Avio produces parts for civilian and military engines designed by General Electric. Lacking specific systemic competencies, the most advanced Italian defence firms are involved in subcontracting for the US and European primes.</p>
<p>4. <i>International licensing</i> Several key technological assets of the Italian defence industry have come from licensing activity during the ‘60s and the ‘70s. Aircraft, guns, missiles, radars and helicopters were built in Italy under license from the US or other European countries. Due to the strong limitations for exporting to third countries the items produced under license, the first experiences of indigenous development of weapons systems were attempts to design downgraded copies of such items for export.</p>
<p>5. <i>Cross-border merging and acquisitions</i> While M&A are not relevant for Italian defence firms, important acquisitions of Italian military firms have been carried out by foreign groups. The British group GEC, at the end of a long standing process of consolidation, is one of the largest defence groups in Italy. Other foreign groups or multinational enterprises are currently controlling Italian military firms, including: Thomson of France, United Technologies and Litton of the US, Contraves of Switzerland.</p>
<p>6. <i>International joint ventures</i> Italian defence firms are willing to join international joint ventures aimed at developing new weapons systems or “families” of weapons. With some relevant exceptions, the Italian contribution in such joint ventures is more “commercial” (i.e. opening the Italian domestic market) than technological.</p>
<p>7. <i>International inter-firm agreements including management consortia, teaming arrangements</i> The largest defence groups in Italy are increasingly attempting at defining “strategic alliances” in order to play - mainly in collaboration with other European firms - a role in the future “common” European arms market, as well as, in the “global” market for weapons.</p>

Table 7 shows a quite relevant level of internationalisation of the Italian defence system but it seems to be more the result of a “defensive” attitude of both the MoD and the Italian firms towards a fast process of globalisation, than a strategic choice. It seems difficult for Italy to play a major role, for instance, in the process of European arms market integration. This is mainly due to the common feeling of Italian military officers and industrialists about the need to “defend” the existing structure of the domestic defence system against too rapid market development. Domestic concerns appear to be often too relevant in shaping the Italian official position in several international fora.

A key concept here it could be “setting priorities”. Considering the Italian activities related to international collaborations in military R&D or production, priorities are almost always lacking. In table 8 several international agreements for arms production involving Italian firms (as well as the MoD) are listed. But no clear information emerges about what have been the priorities of Italy in pursuing such international collaborations.

Table 8. Italian participation in international collaborations

Programme/Joint venture (initial year)	Partners' countries	Notes
MRCA Tornado (1969)	UK, Germany	Fighter-bomber aircraft; International collaboration within NATO
AM-X (1980)	Brasil	Combat aircraft; Italian-led bilateral collaboration
EF 2000 (1985)	UK, Germany, Spain	Fighter aircraft; International collaboration within NATO
FLA (1985)	UK, France, Germany, Spain	Transport aircraft; International collaboration
Yak/AEM-130 (1993)	Russia	Trainer aircraft; Bilateral collaboration
LMATTS (1996)	USA	Transport aircraft; Commercial agreement to market the Alenia G-222.
EH-101 (1980)	UK	Helicopter; Bilateral collaboration
NH-90 (1985)	France, Germany, Netherlands	Helicopter; International collaboration within NATO
Horizon (1995)	UK, France	Frigate; International collaboration
U 212 A (1996)	Germany	Submarine; Bilateral collaboration
HELIOS 1 (1987)	France, Spain	Satellite; International collaboration
AV-90 APC (1986)	Germany	Armoured Personnel Carrier; Bilateral collaboration
SP-2000 (1995)	Germany	Howitzer Bilateral collaboration
OTOMAT (1968)	France	Anti-ship missile Bilateral collaboration
MLRS (1983)	UK, France, Germany	Multi-launch rocket system International collaboration within NATO
FSAF (1989)	France	Anti-air missiles family Bilateral collaboration
DM2 A3 (1989)	Germany (later France)	Heavy torpedo International collaboration
EUROTORP (1990)	France	Lightweight torpedo Bilateral collaboration
Polypheme (1994)	France, Germany	Anti-ship missile International collaboration
MILAS (1994)	France	Anti-sub missile
MEADS (1995)	USA, Germany	Air defence system International collaboration
SLAT (1996)	France	Anti torpedo defence system Bilateral collaboration
Meteor (1996)	UK, France, Germany, Sweden	Air-to-air missile International collaboration
IRIS-T (1996)	Germany, Sweden, Greece, Canada, Norway	Air-to-air missile control system International collaboration within NATO

Turbo Union (1969)	UK, Germany	Aircraft engine International collaboration within NATO
Eurojet 2000 (1985)	UK, Germany, Spain	Aircraft engine International collaboration within NATO
Euroradar	UK, Germany, Spain	Airborne radar International collaboration within NATO
Eurofirst	UK	Airborne infrared tracking system International collaboration within NATO
EMPAR (1986)	UK	Phased array radar Bilateral collaboration
ACCSCO (1984)	USA, UK, Germany	Command and control system International collaboration
Eurodass	UK	Airborne electr. Defence suite International collaboration within NATO
MIDS/LVT	UK, France, Germany, Spain	Airborne information system International collaboration

Source: Weidacher, 1998.

Several kinds of international agreements have been experienced by Italian firms and several different partners have been involved in collaborations and consortia. It is hardly possible to describe a unique pattern of collaboration for the Italian defence system. Moreover, it is not possible to identify companies' priorities neither in identifying partners for strategic alliances or choosing a preferred model of international collaboration.

This attitude of the Italian defence system aimed at exploit opportunities offered by the process of internationalisation, while preserving the existing institutional and industrial structure at home (whatever its levels of efficiency and effectiveness), has made the Italian system particularly "open" to external collaborations. On the other hand, often the opportunities offered by international collaborations for improving the economic and technological capabilities of the Italian defence companies have not been taken and this has been one of the main shortcomings of the Italian defence system.

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