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**RESEARCH AND DEVELOPMENT AS A PROGRAM  
OF THE ROMANIAN MINISTRY  
OF NATIONAL DEFENCE**

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**Abstract:**

Research and development discover solutions and creates knowledge. Security environment, policies and strategies were analysed in the paper, in order to identify factors that affect military R&D. The last five years of R&D Sectoral Plan were analysed in a thorough study, analysing also key players and mechanisms for financing the Romanian military R&D.

*Key words: Research and development, military planning, major programmes.*

**1. Introduction**

The broadest definition of what Research & Development (R&D) means is the one used in businesses dictionaries [1]:

*Research and Development is a systematic activity combining both basic and applied research, and aimed at discovering solutions to problems or creating new goods and knowledge.* Depending on the topic of research, but also on the people who delivers them, other definitions could be applied:

**“Research is formalized curiosity.** It is poking and prying with a purpose” - **Zora Neale Hurston** (African-American novelist and anthropologist) [2].

**“Research is what I’m doing when I don’t know what I’m doing”** - **Wernher von Braun** (leading figure in the development of rocket technology in Germany and the father of rocket technology and space science in the United States) [2].

New product design and development is more often a crucial factor in the survival of an organization. In an industry that is changing fast, companies must continually revise their design and range of products. This is necessary due to continuous technology change and development as well as other competitors and the changing preference of customers. Without an R&D program, an organization must rely only on strategic alliances, acquisitions, and networks to tap into the innovations of others.

In general, research and development activities are conducted by research organization, universities, state agencies specialized or specialized units or centres belonging to a company. Statistics on organizations devoted to "R&D" may express the state of an industry, the degree of competition or the lure of progress. In the United States, a typical ratio of research and development for an industrial company is about 3.5% of revenues; this measure is called "R&D intensity". A high technology company, such as a computer manufacturer, might spend 7% or a pharmaceutical companies 14-15%.

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Anything over 15% is remarkable, and usually gains a reputation for being a high technology company. [3].

## **2. Environment analyses**

### **2.1 Security environment**

At global level, the security environment is continuously transforming, which is reflected in high interdependencies of international relations and the difficulty of delineating between classic risks and threats and the asymmetric and hybrid ones [4].

According to advanced evaluations of National Defence Strategy for 2015-2019, global security environment is very dynamic, providing an actual security and defence paradigm of international relationships, characterized by interdependency, instability and unpredictability.

Presently, by its commitment to Euro-Atlantic values, Romania has the most powerful security guaranties in the entire history. The main guarantor of Romania's security is the North-Atlantic alliance, whose policies and capabilities are based on solidarity principles and US commitments in Europe.

Beyond these international "security assurance policies", one of the main objectives of national security policies is the maintenance and the development of high potential for research, expertise and technical and technological consultancy in the military area, as well as the development of testing and evaluation capabilities of the Ministry of the National Defence [4].

### **2.2 Doctrine papers related to R&D**

**2.2.1 *Wales summit declaration***, issued by the Heads of State and Government participating in the meeting of the North Atlantic Council in Wales, 4-5.09.2014.

This document stated, in para 14, related to a more balanced sharing of costs and responsibilities, that Allies who currently spend less than 20% of their annual defence spending on major new equipment, including related Research & Development, will aim, within a decade, to increase their annual investments to 20% or more of total defence expenditures.

**2.2.2 *The governing programme for 2017-2020*** stated, among other measures for developing Romania, two important measures related to R&D:

- the increase of the research budget with approximately 30% every year, providing an equilibrated budgetary distribution, in order to support both applicative research and innovation, fundamental and frontier research, especially based on smart specialization areas (among one is Information Technologies, Communications, Space and Security).
- the modernization of legal frame, in order to provide financing based on multiannual plans, adapted to the new challenges.

**2.2.3 *National Defence Strategy for 2015-2019*** which identified as a vulnerability related to the capacity of state institution to evaluate and mitigate the impact of risks and threats the absence of a real multiannual budgetary plans for "..., critical infrastructure, ..., health, education and scientific research". This lack of multiannual plans, which further determine the endorsement and the application of some investment plans, has negative effects, including on the increase of military capabilities and the military expenditures already committed.

**2.2.4 *White book of the Defence - 2015***, which has some very interesting commitments towards R&D:

- R&D and innovation in military area provides the scientific and technological support in order to fulfil the missions of the Romanian Army, by developing and using our own scientific and technological potential;

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- R&D is performed by specialized institutions of MoND, military academies and other structures nominated by norms and regulations;
- the objectives of R&D and innovation for military purposes are
- increased performance, by:
  - achieving operational capabilities' objectives and priorities
  - maintaining and development of military scientific and technological competency
  - allocation of own resources for:
    - increased funding for scientific research in the frame of MoND major programs
    - R&D infrastructure development, including by accessing EU funds
    - development of human resources involved in R&D and improvement of young specialist entries in the R&D system
  - increased use of R&D results, by collaborating with companies from national security industry
  - involvement of private sector in military projects, financed by own budget.

### ***2.2.5 National Strategy for Research, Development and Innovation 2014 - 2020 (Government Decision 929/2014)***

The elaboration of this strategic document considers the strategy *Europa 2020*[9], especially the initiative *Innovation Union* [10] and the main implementation instrument of EU R&D policy, *Horizon 2020* [11], and also the cohesion public policies.

The vision of this document stated that:

***In 2020, Romania will become competitive at regional and global level, by innovation fed with research and development, generating welfare for citizens.***

The general objectives of the strategies consists in:

**OG1. Increase of Romanian economy competitiveness by innovation.** The strategy supports the transition from cost-based competitiveness to innovation-based competitiveness.

**OG2. Increase of Romanian contribution to frontier knowledge progress..** The strategy supports the increase of international visibility of Romanian experimental research and development.

**OG3. Increase of science's role in the society.** Science and technology become relevant to society when their effects are felt in the daily life of the citizen. In this respect, research and innovation respond the concrete needs of economic and public environment, especially those related with the increase of quality of services provided (such as health and **security**).

One of the specific objective of the strategy is OS6, related to the **Development of some high performance research organizations**, able to become regional and global operators, by stimulation of R&D system defragmentation, by concentration of resources based on priorities, by encouraging public-public and public-private partnerships, by evaluating the science's impact, by new models of financing, in order to facilitate innovation.

Based on a thorough survey for scientific and commercial potential of research areas, for 2014-2020 were identified 4 smart specialization areas:

**a. Bioeconomy.** This area wants to utilize the huge potential of Romanian agriculture, including fruit trees, forests, animal and fish farming, and also the experience in biomass and biofuels production.

**b. Information and communications technology, space and security.** This is one of the most dynamic research area in the country, built based on the past decades of entrepreneurial experience, on high quality of higher education and on the presence of

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some important multinational corporations. **Society's security** is based on the development of technologies, products, R&D infrastructure and systems for local and regional security, critical infrastructure protection, intelligence, cyber security, citizen's security, emergency situations management, counter terrorism, trans border threats, organized crime, illegal traffic.

*c. Energy, environment and climatic changes.* The R&D will focus on smart grids, environment preservation, water sources and wet areas administration, but also on smart cities.

*d. Eco-nano-technologies and advanced materials.* This is an area belonging to Generic Essential Technologies (GET), top priority at European level.

## **2.3 Overview of R&D in Romania**

### ***2.3.1 The national R&D establishment***

**The national R&D network** consist of all public and private establishments and institutions that perform R&D according with their registered domain of activity.

The national R&D network includes the following categories of establishments and institutions:

#### **A. Public organizations:**

- a) R&D institutes, centres or stations organized as public institutions;
- b) R&D institutions or research centres organized within national societies, national companies and autonomous bodies under central or local administration (including military research organizations);
- c) international R&D centres, established under international agreements;
- d) other public organizations, which provide R&D in their activities.

#### **B. Private organizations:**

- a) R&D entities, organized as companies;
- b) companies or their departments which provide R&D in their activities;
- c) private accredited higher education institutions or their departments.

### ***2.3.2. Civilian authorities***

Ministry of Research and Innovation (MRI) is the top-level governmental authority that organizes and leads the national scientific research, technological development and innovation system [12]. Its responsibilities are derived from laws and regulation and it is responsible for elaborating the public policies for R&D.

As state authority for research and development, MRI provides, on the one hand, design, implementation, monitoring and evaluation in scientific research, technological development and innovation, and on the other hand, coordinates the development, implementation, monitoring and evaluation of policies for expanding national and international heritage of research, technology and innovation, sustainable economic development, access to research results and technologies developed domestic and international customer satisfaction and quality of life.

**Intermediary Organism for Research** is subordinated to MRI and acts as Management Authority for Operational Programme Competitiveness (POC 2014-2020).

**Executive Unit for Financing Higher Education, Research, Development and Innovation** acts as administrator of National Plan for Research, Development and Innovation and as Management Authority for some programmes in this national plan.

### ***2.3.3 Military authorities***

The highest military authority involved in managing R&D activities is **Department for Armaments (DA)**, one of the three departments directly subordinated to minister of defence.

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Among other responsibilities, DA provide the management of armaments systems and major equipment acquisition programmes, as well as the management of R&D activities, related to major programmes [13, 14].

**Endowment Programmes and Technical Directorate** is subordinated to Department for Armaments and its responsibilities related to R&D consists in the coordination of all R&D activities performed in the Ministry of National Defence, but also the coordination of all testing and evaluation, audits and analyses activities, related to endowment with new military systems and equipment [15].

**Military Equipment and Technologies Research Agency (METRA)** is subordinated also to Department for Armaments and its primary mission is to perform basic oriented and applied research, technological development activities, for continuous input of technical progress to military, design of new military technology with higher performances and modernization of fielded technology, at low resource investments [16].

METRA subordinates 5 scientific research centres, which are organized on departments and laboratories with distinct profile, according to specific research areas:

- Information Systems And Communications Test & Evaluation Scientific Research Center

- Scientific Research Center for CBRN Defense and Ecology

- Scientific Research Center for Navy

- Flight Research and Tests Center

- Test, Evaluation and Scientific Research for Weapon Systems Center

### **2.3.4 Tools to fulfil military R&D goals**

There are three tools for achieving R&D goals for military purposes, the endowment with new and modern military equipment or technologies:

a. **MoND R&D Sectoral Plan** for military equipment and technologies, funded entirely by MoND based on Governmental Decision no. 1266/2004.

b. **National Plan for Research, Development and Innovation**, funded by Ministry of Research and Innovation based on Governmental Decision no. 583/2015.

c. **Internal R&D Plan** of each research organization within the MoND.

## **3. Current status of R&D in the Romanian military**

### **3.1 Inputs**

a. NATO documents:

- *Wales summit declaration: "Allies ... to spend a minimum of 2% of their Gross Domestic Product (GDP) on defence .... Likewise, Allies should spend more than 20% of their defence budgets on major equipment, including related Research & Development"*

b. National policies and strategies:

- *The governing programme for 2017-2020: the increase of the research budget with approximately 30% every year, providing an equilibrated budgetary distribution, in order to support both applicative research and innovation, fundamental and frontier research, especially based on smart specialization areas (among one is Information Technologies, Communications, Space and Security).*

- *National Strategy for Research, Development and Innovation 2014 - 2020: "In 2020, Romania will become competitive at regional and global level, by innovation fed with research and development, generating welfare for citizens"*

c. National military strategy documents:

- *National Defence Strategy for 2015-2019 identified as a vulnerability related to the capacity of state institution to evaluate and mitigate the impact of risks and threats the absence of a real multiannual budgetary plans for "..., critical infrastructure, ..., health, education and scientific research".*

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- *White book of the Defence - 2015: "R&D and innovation in military area provides the scientific and technological support in order to fulfil the missions of the Romanian Army"*

### **3.2. Current status analyses**

The current status analyses are based on the data available for the last 5 years.

Despite all policies and strategies, the R&D expenditures are far away that the presumed ones, and are presented in table 1.

<b>Year</b>	<b>Total MoND budget</b>	<b>R&amp;D Budget</b>	<b>R&amp;D %</b>
2016	10.348.097	1.144	<b>0,011</b>
2015	6.279.080	2.646	<b>0,042</b>
2014	5.843.745	1.287	<b>0,022</b>
2013	5.194.905	1.158	<b>0,022</b>
2012	4.815.161	2.927	<b>0,061</b>

**Table 1.** R&D expenditures, compared with MoND expenditures (K RON)

It could be only one explanation that, despite all the commitments, R&D funds are far less that the desired one. The new security environment and endowment status with old military equipment forced the MoND to focus on acquisition.

It is easier to buy on the shelf military equipment and train the personnel to work with it than waiting for a R&D solution and hoping that Romanian defence industry will produce it to a rate and to the desired quality as expected from the R&D project. Generally, if a major acquisition program can be started in 2 years, and completed in another two years, an endowment programme started with R&D will take at least 7 years (3 years for R&D, 2 years for industrial preparation and another 2 years for production and acquisition).

In normal situation, even it's take longer periods until completed, an endowment programme is to be desirable, because the end user will have full control of the military requirements, but also the results can be finely tuned during the development phase, in terms of capabilities delivered.

In nowadays situation, when there is great need of modern equipment in short time, the acquisition of on the shelf equipment solve the needs of the army. A big disadvantage of this approach is that the end user can't control entirely the technical requirements of the military equipment. Usually, the technical requirement arise from the existing pool of equipment, form where the end user extract the best solution, depending on the allocated budgets.

Because the funds allocation in the Ministry of National Defence is based on major programmes (MjPs), the current analysis is based on R&D Sectoral Plan (RDSP) for military equipment and technologies, funded entirely by MoND.

As Department for Armaments, as the highest military authority which coordinates the R&D in the minister, is funded from Central Administration MjP, all the financial resources necessary to perform R&D in the military are traditionally allocated from this MjP.

The process of providing military equipment R&D starts with a requirement (either in terms of mission needs, or in terms of research needs) of an end-user, analysed by R&D organizations within MoND, which translate the needs in terms of resources (workpower, budget, time) necessary to complete the projects.

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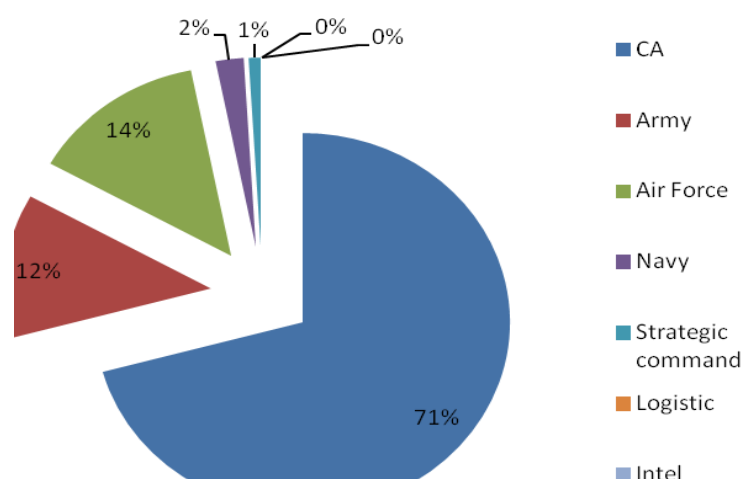
Usually the end-user for the R&D projects are the services (Army, Air Force, Navy, Logistic Command), but also General Staff and Military Intelligence Directorate. These end-users are also the structures that run a MjP in Romanian military planning, based on force structure.

As a result of increasing need for R&D projects coming from various end-users, they started recently to add some funds from their MjPs to the common pool of RDSP.

The allocation of funds on RDSP for the last five years (including the funding MjP) is presented in table 2 and figure 1.

Year	R&D Budget	CA	Army	Air Force	Navy	Strategic command	Logistic	Intel
2016	1.144	745	0	295	18	86	0	0
2015	2.646	974	1.130	470	72	0	0	0
2014	1.287	957	0	280	50	0	0	0
2013	1.158	1.009	0	130	19	0	0	0
2012	2.927	2.800	0	86	41	0	0	0
<b>Total</b>	<b>9.162</b>	<b>6.485</b>	<b>1.130</b>	<b>1261</b>	<b>200</b>	<b>86</b>	<b>0</b>	<b>0</b>

**Table 2.** R&D budgets, 2012-2016 (K RON)



**Fig. 1** Budget allocation for RDSP, 2012-2106

The interesting part with this figure is that the end-user found insufficient the R&D budget for this period and choose to supplement it with funds from their own budgets. But not every MjP manager free some funds for common R&D pool, even if they have projects in RDSP. The expenditures for R&D projects in the benefit of specific end-users for this period (2012-2016) are presented in table 3 and figure 2.

Year	R&D expenditures	CA	Army	Air Force	Navy	Strategic command	Logistic	Intel
2016	1.144	12	165	465	231	129	103	29
2015	2.646	17	1.228	690	205	172	113	220
2014	1.287	39	300	385	316	57	75	115
2013*	1.158	3	9	180	43	1	13	10
2012	2.927	870	320	661	243	156	79	598

**Table 3.** R&D expenditures, 2012-2016 (K RON)

\* from R&D Budget for 2013, 950 K RON were used to pay past debts.

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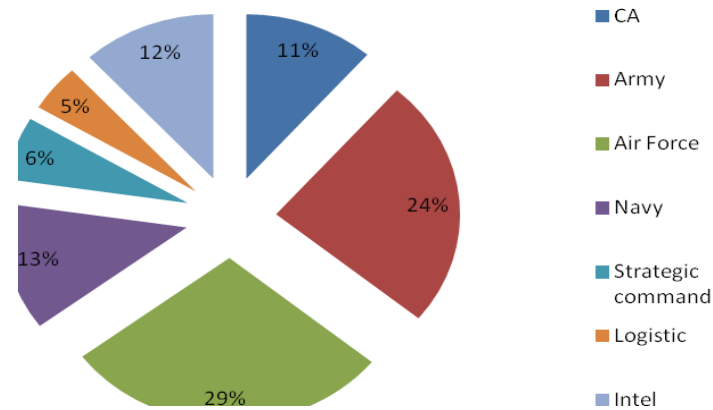


Fig. 2 RDSP expenditures, 2012-2106

Although some MjPs don't contribute with budgets for RDSP, their expenditures on R&D are quite significant.

For a thorough understanding of the allocating funds process for R&D, I will consider each end-user situation.

### **3.2.1 General Staff and Army**

The R&D budgets for General Staff and the Army (land forces) in the analysed period are presented in figure 3 and 4.

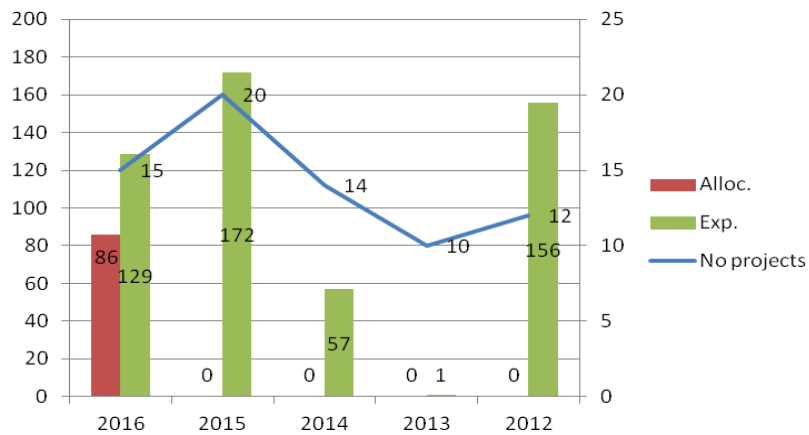


Fig. 3 General Staff own allocations and expenditures for R&D, 2012-2016

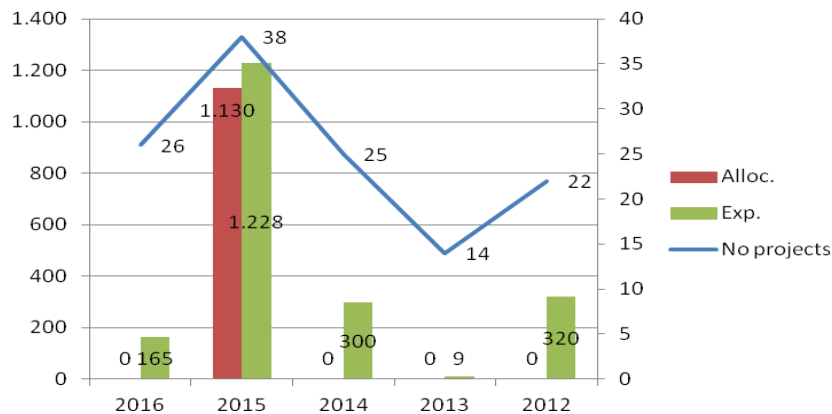


Fig. 4 Army own allocations and expenditures for R&D, 2012-2016



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These two figures proved that when there is interest for specific R&D projects, MjP managers can identify the necessary funds. Even if the number of project is relatively the same (around 25 each year for the Army), when the number of project increase suddenly, based on end-user needs, MjP can supplement the R&D budget with funds dedicated for specific projects.

The same conclusion is valid for General Staff, except that the allocation is not driven by the number of projects, but rather by their importance.

### **3.2.2 Air Force and Navy**

The R&D budget for the Air Force and the Navy in the analysed period are presented in figure 5 and 6.

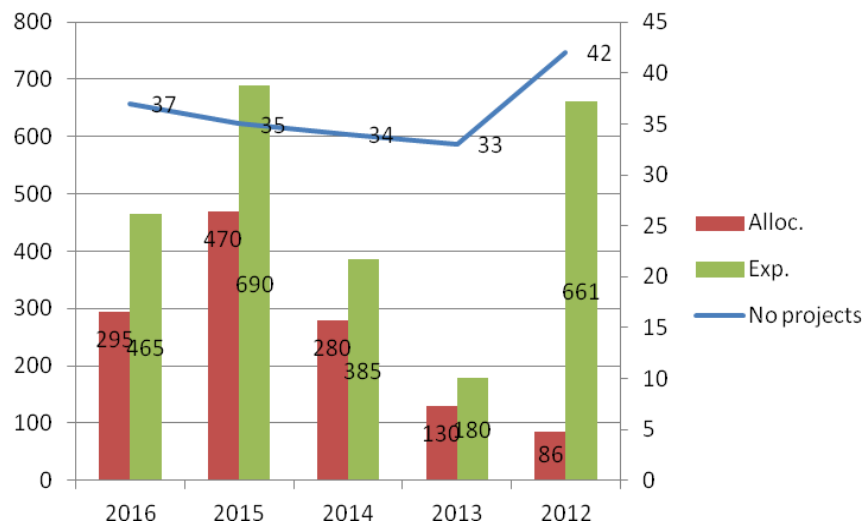


Fig. 5 Air Force own allocations and expenditures for R&D, 2012-2016

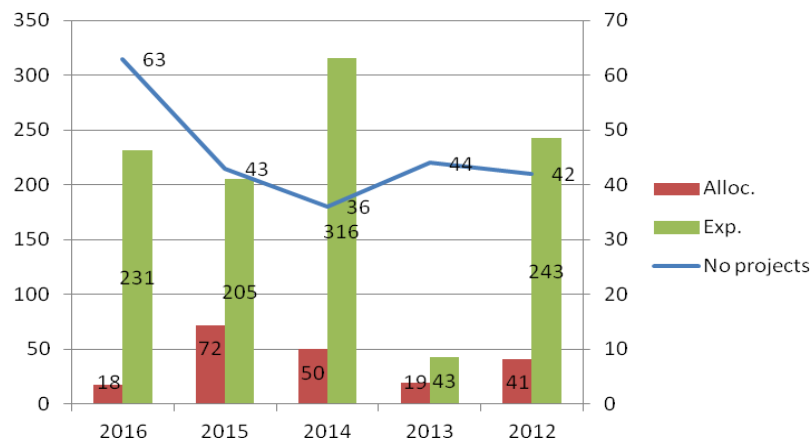


Fig. 6 Navy own allocations and expenditures for R&D, 2012-2016

These two figures showed that some MjPs managers plan some money every year for R&D, independent from the number or the importance of the projects, and redirect them to some specific projects.

### **3.2.3 Logistic Command and Military Intelligence**

The R&D budget for the Logistic Command and the Military Intelligence Directorate in the analysed period are presented in figure 7 and 8.

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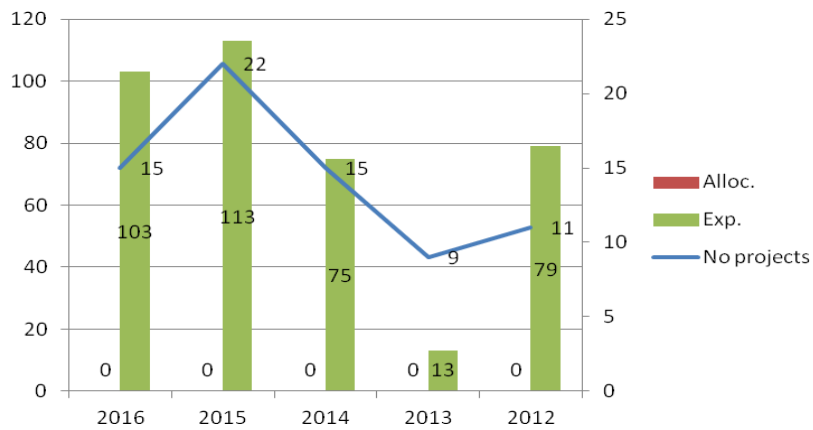


Fig. 7 Logistic Command own allocations and expenditures for R&D, 2012-2016

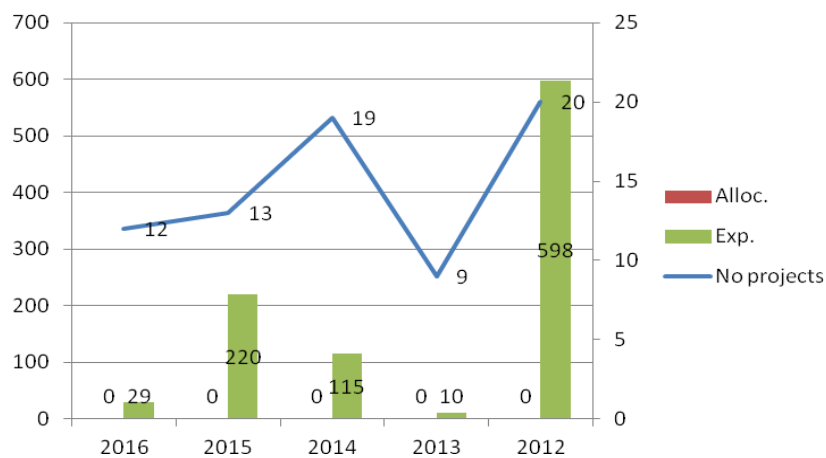


Fig. 8 Military Intelligence Directorate own allocations and expenditures for R&D, 2012-2016

These two figures led us to the conclusion that some MjPs managers don't consider to plan some R&D activities in their programmes, relying entirely on the common R&D pool, financed by Central Administration MjP. Their R&D projects seems to be very important (Intel in 2012), important part of this common budget being redirected to specific projects.

### **4. Conclusions**

Even if I started with the idea of finding pros and cons for proposing Research& Development as a separate Major Program of the Romanian MoND, after data processing and considering the actual security environment, my opinion is that this proposal should be postponed until the initial phase of endowment with modern military equipment is completed.

Nowadays, acting in such complex environment, nobody can afford to spend time for uncertain results (yes, R&D projects could fail).

Still, I have some comments and proposals to improve the current status of military R&D.

#### **4.1 Comments:**

1. Policies and doctrines, both international and national, have only limited provisions about R&D;

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2. When they have provisions for R&D, the identified policies and doctrines are very ambitious, and there are not measures to support these ambitions;

3. National policies and doctrines should be less ambitious, in order to facilitate accountable objectives for R&D;

4. Current security environment doesn't support the R&D as a major programme for Romanian MoND;

5. The actual financing mechanism for R&D is not a sustainable one. The funding MjP (Central Administration) is not an end-user for the R&D results, placing in the R&D common pool only what is left from other subprogrammes. The R&D results are not interesting for CA MjP, further implementation of the R&D projects being responsibility of end-users.

6. End-users, even if they run MjPs, are not interested in financing R&D, unless a specific interest occur. Exceptions from this situation are Air Force and Navy MjPs, which contribute yearly to RDSP with limited amounts of money.

### **4.2 Proposals:**

1. Entire RDSP should be financed from MjPs. In this situation, end-users will initiate only needs relevant for them. Placing money on a specific need will make them more aware of the R&D results and will force the projects' implementation until the final endowment. Current situation, when funds come from CA MjP allow to postpone some R&D projects due to money shortage.

2. Department for Armaments should manage the distribution of the end-users needs toward the proper military R&D organization, and also the whole process (projects proposals, project management, project ending, audits, homologations and so on). Funds allocation should be a negotiation between the end-user and the R&D organization.

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