Project for the capitalization of expenditure on R & D in new systems of national accounts: estimating its impact on GDP and compilation of a satellite account of R & D

Alfredo Cristóbal Cristóbal, Mariano Gómez del Moral y Belén González Olmos

First draft: August 2013

This draft: August 2013

Project for the capitalization of expenditure on R & D in new systems of national accounts: estimating its impact on GDP and compilation of a satellite account of R & D

Abstract

The measurement of the variables and economic aggregates associated with R & D is a statistical challenge, especially as it relates to the integration and analysis of data from basic statistics of R & D within a conceptual framework enabling associate variables and key macroeconomic aggregates. Thus, it is necessary to develop a tool that integrates conceptual and economically the basic information available and to do so, moreover, in a consistent and comparable accounting framework at international level, such as the System of National Accounts.

The project for the capitalization of R & D, the methodology described in this document, is intended as a tool that allows to approach, quickly and opportune, the growing demand for complete and detailed information on the activities of R & D. Thus, this paper defines the scope of the activity from the internal expenditure on R & D performed by the different institutional sectors, a methodology for estimating the value of total output on R & D, both market and non-market, within the conceptual framework of the new System of National Accounts is proposed, a methodology to estimate the capitalization of R & D, and its impact on GDP is defined and, finally, the tables and accounts constituting the satellite account of R & D: supply and use tables; gross fixed capital formation tables, employment and compensation tables and funding tables are set.

Authors and Affiliations

Alfredo Cristóbal Cristóbal

Mariano Gómez del Moral

Belén González Olmos

Spain National Statistics Institute

Project for the capitalization of expenditure on R & D in new systems of national accounts: estimating its impact on GDP and compilation of a satellite account of R & D

CRISTOBAL CRISTOBAL, Alfredo; GOMEZ DEL MORAL, Mariano; GONZALEZ OLMOS, Belén
National Statistics Institute (INE)

Abstract

The measurement of the variables and economic aggregates associated with R & D is a statistical challenge, especially as it relates to the integration and analysis of data from basic statistics of R & D within a conceptual framework enabling associate variables and key macroeconomic aggregates. Thus, it is necessary to develop a tool that integrates conceptual and economically the basic information available and to do so, moreover, in a consistent and comparable accounting framework at international level, such as the System of National Accounts.

The project for the capitalization of R & D, the methodology described in this document, is intended as a tool that allows to approach, quickly and opportune, the growing demand for complete and detailed information on the activities of R & D. Thus, this paper defines the scope of the activity from the internal expenditure on R & D performed by the different institutional sectors, a methodology for estimating the value of total output on R & D, both market and non-market, within the conceptual framework of the new System of National Accounts is proposed, a methodology to estimate the capitalization of R & D, and its impact on GDP is defined and, finally, the tables and accounts constituting the satellite account of R & D: supply and use tables; gross fixed capital formation tables, employment and compensation tables and funding tables are set.

Introduction

There is general consensus regarding the relevance of the Research and Development (R & D) and innovation as drivers of economic development and their close correlation with the productivity of the economy.

The generation, use and transfer of knowledge is considered a key factor for economic growth and the welfare of nations, so that a better statistical measurement of research, development and innovation is crucial to know and boost the levels of these socio-economic variables in different countries.

To understand the R & D and quantify their effects on economic growth and social welfare, it is necessary to have data which accurately represent the resources devoted to the innovation process, the actors involved in them, and the resources obtained.

1

Most OECD member states, encouraged by the rapid growth of national resources devoted to research and experimental development (R & D), began, from 1960, to collect statistical data in this field. In this first stage were found theoretical difficulties and differences in scope, methods and concepts made international comparisons difficult. It seemed therefore necessary to harmonize concepts and definitions that were accepted by all OECD member states.

To this end, it was created a group of experts who met in Frascati (Italy), drafted and approved the document *Proposed Standard Practice for Surveys on Research and Experimental Development* (OECD, 1963), better known as the *Frascati Manual*. This manual, which is currently in its sixth edition, *Frascati Manual, 2002* (OECD, 2003; FECYT, 2003), is the methodological basis of the R & D statistics.

The first survey of scientific and technical research in Spain, extended to both public and private sectors, was made with reference to the year 1964 by a group of Spanish experts in collaboration with the OECD. Their results were published by the Ministry of Education and Science in 1966 in the so-called *Yellow Book*.

Later, the Planning Group of the Technical Office of the Board Juan de la Cierva, conducted a *Survey on scientific and technical research activities in Spain in 1967* where, in a systematic and comprehensive manner, scientific and technical research in the public and private sectors were studied. The directory of companies formed for this operation, was used as the starting point of the surveys entrusted to the National Statistics Institute (INE) since 1971, who has been carrying them every year until today.

At EU level this statistical operation is regulated by Commission Implementing Regulation (EU) No 995/2012 of 26 October 2012 laying down detailed rules for the implementation of Decision No 1608/2003/EC of the European Parliament and of the Council concerning the production and development of Community statistics on science and technology, and its concepts are based on the methodological recommendations of the *Frascati Manual* where R & D is defined as: *those creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock to devise new applications*.

The concept of R & D covers three activities:

- Basic R & D: Experimental or theoretical work undertaken to acquire new knowledge about the background of phenomena and observable facts, without thinking of any practical application.

- Applied R & D: Original work undertaken to acquire new knowledge that will lead to a specific practical objective.

Experimental development: systematic work grounded in existing knowledge gained from research or practical experience aimed at making new products or services, develop new processes or improving the existing ones.

The R & D Statistics produced in Spain investigates companies, government bodies, universities and non-profit private institutions performing scientific research and technological development in all fields of science and that are located in the

national territory. Its aim is to measure the national effort in R & D activities through financial and human resources (inputs) devoted to this activity.

Some key definitions, concepts and variables of the survey are summarized below.

As regards human data, measures the amount of human resources directly dedicated to R & D activities, while spending data measure the total execution cost of R & D, including the indirect support activities (auxiliary).

In this respect, all monetary amounts devoted to R & D activities, which are carried out within a unit or research department (**internal costs**) or out of these (**external costs**), regardless of the source of funds and nationality of the financier are considered expenses on R & D. Expenditure incurred outside the department but supporting internal tasks on R & D (purchase of supplies for R & D, for example) are also included as internal expenditure on R & D

The survey provides information of internal costs, broken down into current and capital expenditures. In addition, regarding current expenditure, **staff costs** are distinguished, comprising total staff wages including social insurance, and **other current expenses**, which contain spending on non inventory procurement and diverse supplies not considered as capital goods.

The salary costs of people providing indirect services (mainly security personnel and maintenance, catering, computer services, central library staff and office management) are excluded from the staff costs and are recorded as other current expenses. Opposite, wages/fellowships for post-graduate students are included in staff costs.

Meanwhile, capital expenditure in R & D are the gross investment in fixed capital used by the units in R & D programs, with the peculiarity that should be fully reported in the period in which they occurred and not considered as an element of depreciation.

Finally, the statistics of R & D provides the external costs of R & D activities, which include the amounts paid for the work on R & D specifically subcontracted by a unit to other units. Do not include institutional fees to finance other enterprises, research partnerships, etc.., other than direct purchases of R & D.

The other way to get the input in R & D is by the staff employed in R & D, which includes all workers employed directly in these activities regardless of their level of responsibility, as well as workers supplying services directly linked to the work on R & D, as managers, administrators or assistants. However, as mentioned above, does not include people performing indirect services (security, computer, catering, etc.).

The data of staff dedicated to R & D are estimated in two ways, individuals and full-time equivalent[1] (relevant concept to estimate the effort in R & D, since R & D is usually in many cases an activity partial or secondary).

---

[1] Staff employed in R & D full-time equivalent (FTE) is the sum of staff working full-time plus staff working part-time

In addition, the staff employed in R & D is presented grouped, according to their occupation and qualifications, according to the following categories:

- Occupation of R & D personnel: researchers (including research fellows) technicians, assistants.

- Degree of R & D staff: high level degree (doctors, graduates, architects, engineers and similar); medium level degree; high level and medium level vocational training, high school and other secondary studies; other studies (lower level of above).

The latest data available regarding domestic expenditure for R & D in Spain is of the year 2011, which amounted to 14.184 million euro, falling a 2.8% compared to the precedent year. This expenditure represented 1.33% of GDP and its evolution over the last decade is shown in the following graph:

Percentage of expenditure on R & D relative to GDP (Spain)
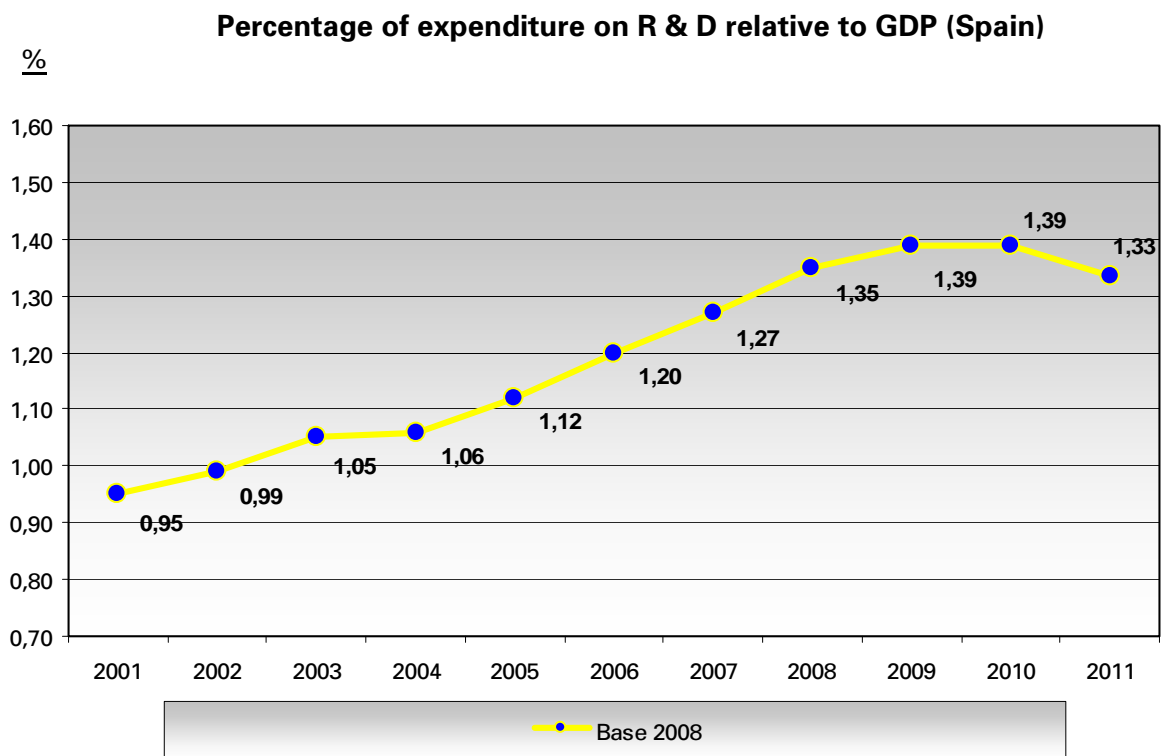
The behavior of this indicator (R & D expenditure/GDP, in percentage) by different countries can be seen in the graph below.

Percentage of expenditure in R & D/PIB, by countries (2011)
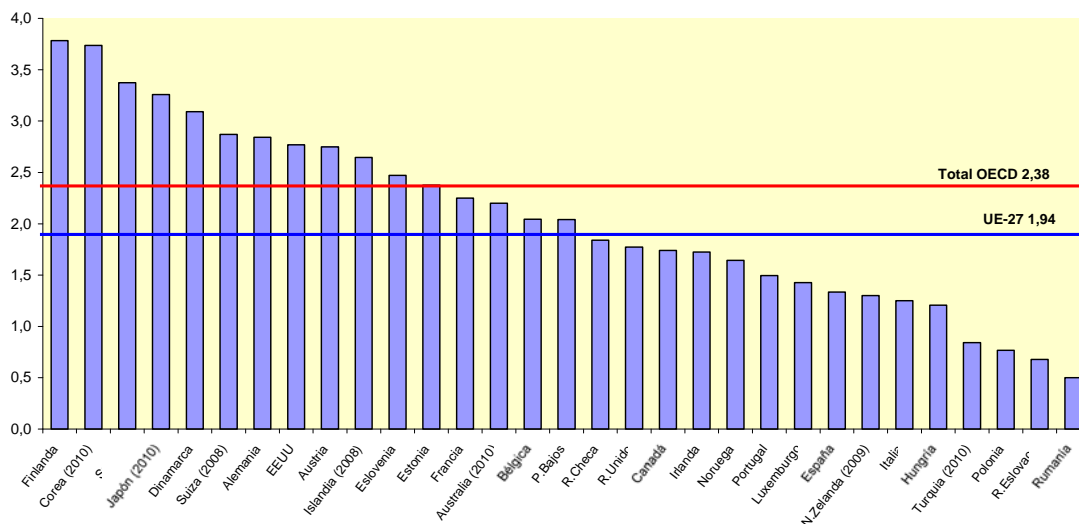
Fuente: OECD, Main Science and Technology Indicators, January 2013.

Despite the efforts made, the estimation of variables and economic aggregates associated with R & D remains a statistical challenge, especially in regard to the integration and analysis of data from basic statistics of R & D within a conceptual framework that allows relate those data with the variables and key macroeconomic aggregates. In this regard, it is necessary to have a tool that integrates conceptual and economically all the available basic information within a consistent and comparable accounting framework on an international scale, such as the System of National Accounts and in particular input-output framework.

Indeed, the supply and use tables and input-output tables are a consistent and systematic basis that allow, among other operations: assess the role of R & D in the economy, both in terms of industries and products; analyze the differences in expenditure on R & D by industry and examine the impact of such costs on the Gross Value Added (GVA) by industry and on GDP of the economy.

However, this accounting tool currently presents a number of significant limitations in relation to the R & D, which must be overcome before its use as an element of analysis and integration.

The first limitation is conceptual and is that the national accounts have been considering spending on R & D as consumption expenditure rather than an investment, so that the effect on GDP has been zero. This rule excludes costs incurred by the general government and the private non-profit institutions serving households sectors, since their non-market production are valued at the cost incurred and the use of these productions is the final consumption expenditure made by these sectors. Similarly, imports and exports of services in R & D are included in the international trade in services and as such affect the value of GDP.

In the new accounting systems (United Nations System, SNA-2008, European System, ESA-2010) has been proposed to modify the accounting treatment of R & D expenses, which would then capitalized as Gross Capital Formation (FBK), thereby affecting GDP and total stocks of assets of the economy.

The second limitation of the national accounts to integrate and analyze data from R & D activity, is concerning the highly aggregated form in which data are available, which does not allow for detailed analysis of the activity. Therefore, the classifications, accounts and tables used in the input-output framework of the core national accounts are not designed to provide explicit and isolated information on R & D activity, but very global information implicitly included in the key aggregates of the system.

However, it is the own System of National Accounts who offers an alternative to overcome this limitation: the so-called Satellite Accounts for R & D (SAR&D).

These satellite accounts involve the expansion and re-classification of accounting elements, notably the activities and products R & D, with the detail that basic information allows. Explicitly, they describe the origin of the R & D production, the value added generated and the final use of their products, all within the framework of the national accounts, but allowing some differences in relation of some aspects of its core. Thus, the comparability and consistency with the main aggregates of the economy (GVA, GDP, gross capital formation, etc.) is assured, while facilitate complementary analyzes such as the calculation of the direct and indirect effects that R & D has on economic growth and productivity of other industries and the total economy.

At international level, there are several experiences in the compilation of satellite accounts for R & D and in each one of them has been applied a different methodology for the capitalization of R & D services. Some of the most relevant are of U.S., Canada, the Netherlands and Finland. In addition, Eurostat has set up a working group to analyze the implementation of the capitalization of R & D in the European national accounts.

The tasks undertaken by this working group have included a first and very basic approach to calculate the impact of the capitalization of R & D on GDP in different EU countries. The results allow to observe the strong and positive correlation between R & D expenditure and the impact of the capitalization of R & D on GDP and can be seen in the graph below (the reference periods are not identical in all countries and, in some cases like Spain, the period back to 2006):

Correlation between expenditure in R & D and the impact of the capitalization of R & D on GDP:
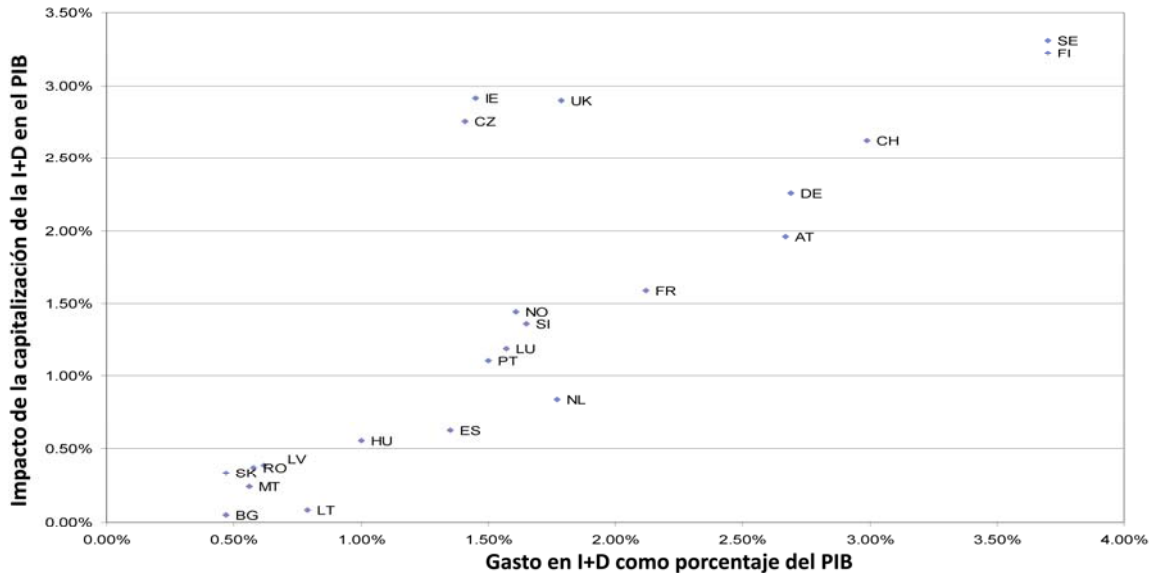
1 Project for the capitalization of expenditure on R & D in the new systems of national accounts: description and objectives

The project for the capitalization of R & D, the methodology described in this document, is intended as a tool that allows to approach, quickly and opportune, the growing demand for complete and detailed information on the activities of R & D. To this general demand, formulated primarily by the authorities responsible for the design of public policies for science and technology, we must add, in this case, other purely statistical, such as the obligation to fulfill one of the requirements most important, which is the implementation of the new ESA-2010.

1.1. Description of the project

The project aims to present a methodology for obtaining estimates of the overall impact of the capitalization of R & D expenditure on GDP, taking as its starting point the data of gross domestic expenditure on R & D provided by the basic statistics on I + D of the recent years.

The new accounting treatment (capitalization) of the R & D expenditure proposed, is adapted to the methodological recommendations of international statistical organizations (Eurostat, OECD, UN), which will facilitate international comparisons with countries of the European Union and other statistically developed that have already implemented, or are about to do, the new methodology.

Moreover, it is likely that the practical application of the new accounting treatment reveals certain shortcomings and statistical problems, especially in regard to the

availability of basic information and the development of methods and estimation procedures to ensure the reliability and comparability of the estimates.

The solutions to be adopted to solve the above problems will facilitate the design (levels of breakdown of the industries intensive in R & D, variables and aggregates to be estimated, etc.) and subsequent compilation of the Satellite Account of R & D (SAR&D), whose methodology is also described herein. In this regard and in summary, the SAR&D can be defined as a set of accounts and tables based on the methodological principles of national accounts, which presents in an interrelated and integrated way, the main economic variables and aggregates of the *R & D activities*, for a specific year.

1.2. Project Objectives

According to the comments made in the previous sections on the conceptual complexity of such activities and their corresponding products, the specificity of their basic statistical sources and, finally, the historical fact of the accounting treatment of R & D expenses in the systems of national accounts, the project has the following specific objectives:

● Define the scope of the activity from domestic expenditures on R & D carried out by each institutional sector (non-financial corporations, financial institutions, general government, households and non-profit institutions serving households) and propose a methodology for estimating the value of total output in R & D, both market and non-market, within the conceptual framework of the new System of National Accounts.

● Define a methodology for estimation of Gross Fixed Capital Formation in R & D (capitalization of R & D) and its impact on GDP defined from supply, demand and income sides.

● Set the tables and accounts that make up the SAR&D: Supply and Use Tables; GFCF Tables, Tables of employment and compensation; funding tables.

This set of accounting information, in addition to provide full and detailed measurement of the activity and its economic importance in the overall economy, will provide data on its importance in generating employment, on foreign sector's dependence, on the financing and on the role of general government, etc. It will also provide a solid basis for optimizing the quality of statistical information on the R & D activities, indicating major gaps and shortcomings.

● Define an accounting framework that facilitates the use of input-output models of economic impact simulation to design, evaluate and monitor public policies for science and technology.

1.3. Project Development

The objectives of this research, together with the aforementioned conceptual and practical restrictions of the R & D activity, have been determining factors in setting the stages for the implementation of the project, which will be developed in two phases. The first one, designed to solve the problem of capitalizing R & D expenses and the second one, focusing on the methodological development and subsequent compilation of a SAR&D.

Next, a detailed description of each of the two phases mentioned is made.

2 Capitalization of R & D expenditure

2.1. Background

In previous systems of accounts (SNA-93, ESA-95, etc.) expenditure on R & D performed by statistical units was treated as intermediate consumption, i.e. as expenditure that benefit the output only in the current period. This approach is contrary to the nature of R & D, whose fundamental purpose is precisely to improve the production of future periods.

Among the reasons justifying this treatment could be cited: the vagueness of the concept of R & D, the difficulty of its measurement in nominal terms and in real terms, since they are activities carried out, mainly, within individual statistical units investigated; problems in relation to the calculation of consumption of fixed capital (depreciation) of these assets also, on the other hand, companies often do not activate, considering them as current expenses, etc.

In the current system of national accounts (SCN-2008 and ESA 2010) R & D is defined as *creative work undertaken on a systematic basis to increase the stock of knowledge, and use of this stock of knowledge for the purpose of discovering or developing new products, including improved versions or qualities of -existing products, or discovering or developing new or more efficient processes of production*.

They also provide that the value of the production of R & D should be determined in terms of the benefits (returns) which are expected to provide in the future, which theoretically would include the provision of public services in the case of R & D acquired by the general government. In general, with respect to valuation, they point out a set of practical rules to apply in the case of the production and use of R & D, as by market, non-market or by own account producers.

Finally, they indicate that the most appropriate recording is that R & D expenditures are included as part of Fixed Capital Formation, while recognizing the difficulties, in terms of reliability and comparability of the estimates, to be found to achieve this goal . For this reason, previous exercises and methods that allow obtain robust and comparable estimates are recommended. Subsequently, the capitalization of R & D in the core national accounts would be included.

Following these recommendations, Eurostat organized two task forces (TF) on the study of the implementation of the capitalization of R & D in the national accounts. As a result of the meetings of these groups, it has agreed to a set of tables and a list of technical recommendations. The description and detailed analysis of these is the subject of the first phase of the project.

2.2 Work to be done

Basically, the aim is to study and propose a methodology for the implementation of the six tables described below, recommended by the TF, which they are configured as a bridge between existing sources of data on R & D and national accounts.

In this regard, it should make it clear that whatever the methods proposed for the capitalization of R & D, they will be restricted to the limitations of available information sources, a list of which can be found in paragraph 2.4 of this document.

Tables 1 and 2 are related to the calculation of the value of output in R & D, as defined in the scope of national accounting.

Table 1

Output in R & D

	Year:	S.11	S.12	S.13	S.14	S.15	TOTAL
1	Intermediate consumption						
2	Compensation of employees						
3	Other taxes on production						
4	Other subsidies on production						
5	Gross operating surplus						
6	Adjustment for exhaustiveness						
7	Other adjustments						
8	TOTAL= OUTPUT						

S.11 : Non-financial companies institutional sector

S.12 : Financial Institutions institutional sector

S.13 : General Government institutional sector

S.14 : Households institutional sector

S.15 : Non-profit institutions serving households institutional sector

Table 1 can only be completed for those institutional sectors for which sufficient information is available from sources other than statistical surveys made from the Frascati Manual. Probably, this can be made, at most, for the institutional sector of general government (S.13). It would be necessary to determine

whether it can be extended to other sectors. In the event that could not be applicable to any institutional sector, it would be necessary go to Table 2 as a tool for the calculation of the value of production.

Table 2

Output in R & D

	Year:	S.11		S.12		S.13		S.14		S.15		TOTAL	
		+	-	+	-	+	-	+	-	+	-	+	-
1	Frascati Manual Intramural expenditures on R&D												
2	Subtract payments for licences to use intellectual products (principally R&D assets, such as patents) that should be recorded as GFCF												
3	Subtract expenditure on own-account production of software												
4	Add payments to postgraduate students not included in FM data												
5	Subtract capital expenditures												
6	Add other taxes on production not included in FM data												
7	Subtract other subsidies on production												
8	Add extramural purchases of R&D that should be recorded as intermediate consumption. Applies only to R&D industry												
9	Sub-Total (1 to 8): current expenditures												
10	Add estimate of consumption of fixed capital plus a return to capital (for non market producers only consumption of fixed capital):												
11	Adjustment for exhaustiveness												
12	Other adjustments												
13	Balance : Output of R&D												

This table is based on Frascati surveys data and will be used either in addition to the data of Table 1, or as a sole source in those cases for which no further information is available.

To pass from the value of Intramural expenditure on R & D by sector, according to the Frascati Manual, to the value of R & D output of national accounts, it is necessary to make a number of adjustments related to the treatment of certain transactions in both systems.

Specifically, ESA-2010 states that the output in R & D should be measured as follows:

The R&D by specialized commercial research laboratories or institutes is valued at the revenues from sales, contracts, commissions, fees, etc. in the usual way.

The output of R&D for use within the same enterprise is valued on the basis of the estimated basic prices that would be paid if the research were subcontracted. In the absence of a market for subcontracting R&D of a similar nature, it is valued as the sum of production costs plus a mark-up (except for non-market producers) for NOS or mixed income.

R&D by government units, universities and non-profit research institutes is valued as the sum of the costs of production. Revenues from the sale of R&D by non-market producers of R&D are to be recorded as revenues from secondary market output.

Expenditure on R&D is distinguished from that on education and training. Expenditure on R&D does not include the costs of developing software as a principal or secondary activity.

According to these definitions, the adjustments to be carried out in Table 2 are as follows:

● Payment for licenses allowing the use of certain intellectual property products, such as patent payment, must be subtracted from total intramural expenditure, since it is an amount that should be recorded in the system as GFCF.

● Subtract the expenses incurred in the production of own-account software, which, as is the case with patents mentioned in the previous bullet, are already recorded as GFCF so they could be duplicated.

● In the case of post-graduate students, where are a standard category, it is very difficult to define the boundaries between R & D activities they perform and education and training. For this reason, it may require an adjustment to include all those payments made to these students that have not been included in the expenditure data according to the Frascati Manual.

● Capital expenditures (land and buildings, equipment and instruments, software, etc.) as such, are not current expenditure, so they should be subtracted, obviously.

● It should be added and subtracted, respectively, taxes and subsidies on production recorded in the Frascati Manual data. Indeed, the subsidies received by the production units from general government to finance current expenditure must be subtracted. It should be added all those compulsory, unrequited payments that production units make to general government as taxes on the production of R & D services, on the use of labor, on the ownership or use of assets, etc.

● Last adjustment before obtaining the total current expenditure corresponds to the addition of the value of all external purchases of R & D, to be recorded as intermediate consumption, i.e., all R & D services subcontracted by one institutional unit to another, both producers of R & D. By convention, these purchases should be considered as intermediate consumption, but if there is a particular difficulty in obtaining this gross recording, production of R & D of

the relevant units/institutional sectors can be presented on a net basis of the R & D outsourced.

Once the subtotal for current expenditure (row 9 of Table 2) has been obtained, the value of output in R & D can be estimated. For this, it is necessary to add the value of net operating surplus / mixed income plus an estimate of the consumption of fixed capital. In estimating each of these aggregates, it is necessary to consider the following recommendations of the TF:

● First recommendation: if the stock of R & D assets is not available, consumption of fixed capital of these assets used in the production of R & D services can be ignored when calculating the total consumption of fixed capital.

The reason is as follows. If the Perpetual Inventory Method (PIM) is used to estimate the total consumption of fixed capital, this method requires an estimate of all assets used in the production of new R & D services, including existing R & D assets.

In the event that the value of the stocks of R & D assets is available, the use of a geometric function for the depreciation of these assets is recommended, when calculating consumption of fixed capital by PIM. Similarly, it is recommended, in the absence of other information, the use of an average lifespan of 10 years for the assets of R & D.

● Second recommendation: The estimation of the net operating surplus/mixed income of market producers of R & D (which would be an approximation of their returns of capital) will be obtained by a factor (mark up) applied to total expenditures, including the expend in R & D fruitless. This mark up may be specific to a particular industry or may be common to all industries. Stability thereof over time would be recommended using, for example, moving average procedures consistent with the parameters used in calculating the consumption of fixed capital.

In any case, if PIM cannot be used, the value of net operating surplus / mixed income can be obtained as a percentage of either the total current expenditure or the compensation of employees included in them.

Finally, adjustment of the rows 11 and 12 of Table 2 should be carried out if discrepancies between the data provided by the statistical sources used to estimate the values of Tables 1, 2 or even the Table 3 described below, were observed.

In short, the purpose of Table 2 is to estimate the value of output in R & D as the sum of: the current costs incurred to perform this (compensation of employees plus intermediate consumption); net payments made to or received from government as taxes and subsidies on production; and the estimation of a mark-up associated with the return gross / net of capital used in production, from the information provided by the Frascati surveys.

Output in R & D =	Intermediate consumption + Compensation of employees + Taxes less subsidies on production + Operating surplus/Mixed income (Gross/Net of Consumption of fixed capital).

Next, **Table 3** is described, with the aim of estimating the value of Gross Fixed Capital Formation (GFCF) on R & D, taking as reference the value of output in R & D obtained in Table 2, more/less the imports/exports estimated from the balance of payments and the corresponding surveys if any, making finally the adjustments related to the definitions of the accounting aggregates.

Tabla 3

Gross Fixed Capital Formation (GFCF) in R & D

Year:	S.11		S.12		S.13		S.14		S.15		TOTAL	
	-	+	-	+	-	+	-	+	-	+	-	+
1 R & D output	▓		▓		▓		▓		▓		▓	
2 Add imports of R & D	▓		▓		▓		▓		▓		▓	
3 Add trade margins	▓		▓		▓		▓		▓		▓	▓
4 Add taxes on products	▓		▓		▓		▓		▓		▓	▓
5 Substract subsidies on products		▓		▓		▓		▓		▓	▓	▓
6 Subtract extramural purchases of R & D that should be recorded as intermediate consumption. Applies only to R & D industry		▓		▓		▓		▓		▓	▓	▓
7 Subtract Acquisitions of R & D not expected to provide a benefit		▓		▓		▓		▓		▓	▓	▓
8 Subtract changes in inventories of finished R & D		▓		▓		▓		▓		▓	▓	▓
9 Subtract Exports of R & D		▓		▓		▓		▓		▓	▓	▓
10 Add Net purchases of R & D between domestic sectors	▓		▓		▓		▓		▓		▓	▓
11 Sub-total												
12 Balance: Total GFCF of R & D		▓		▓		▓		▓		▓		▓

In this case, the adjustments made are of two types: those strictly conceptual, according to the criteria/conventions adopted in the field of national accounts, and adjustments made to make the estimates consistent with decisions taken to fill in Tables 1 and 2.

● As regards conceptual adjustments, it can be found, first, those that aim to transform the valuation of output at basic prices in the valuation at purchases prices that characterizes all aggregates of demand, like GFCF.

Thus, the value of trade margins, if any, applicable to R & D products produced within the Spanish economy or imported, must be added

There will also be necessary to add or subtract, respectively, taxes and subsidies on products, i.e. those paid/received per unit of R & D service produced or traded. (These taxes include VAT, taxes on products including imports, etc., and subsidies received per quantity unit or as a percentage of the price per unit of service).

● The other two entries, whose amounts, due to conceptual reasons, it is necessary to subtract from the value of total resources in R & D are: first, the acquisition of R & D which are not expected to provide any benefit (GFCF only includes those produced fixed assets used in production for several years), and secondly, the change in inventories of finished R & D products that, by definition, are part of the transaction changes in inventories and not of the GFCF, which is the aggregate estimated in the Table.

● As regards to the adjustments made to make this Table consistent with the above ones, it is necessary to refer only to subtract extramural purchases of R & D, to be recorded as intermediate consumption. This adjustment only applies to the R & D industry and corresponds to own consumptions of that industry.

● Finally, there is an adjustment, shown in row 10 of the Table 3, aiming simply to reflect the net purchases of R & D between the different domestic institutional sectors.

As a result of this process, the value of GFCF in R & D performed by each sector will be obtained and, given the way it has been reached, it will include all R & D products produced or imported, net of the respective exports, whose destination is neither own consumption of R & D industry nor changes in inventories. Implicitly, it will include all expenses incurred by general government in Intellectual Property Products, which are included in the R & D of free access (free of charge), when intended for production for over a year.

Next, **Tables 4 and 5** are presented. The first one is intended to measure the impact in terms of value of the capitalization of R & D on the value added of the various industries that make up the Spanish economy, distinguishing only between market and non-market producers of R & D.

The second one will present the overall impact of the reclassification of R & D on GDP, defined from supply, demand and income sides.

Table 4

Impact of reclassification of R & D on the Value Added by industries

Year:		Market producers of R&D (by NACE)	Non-market producers of R&D (by NACE)	TOTAL
1	Output before R & D capitalisation			
2	Changes in output because of own account production of R & D			
3	Changes in output because of the new definition of intermediate consumption and the consumption of fixed capital of R & D in general government and non-profit institutions serving households			
4	Output after R & D capitalisation			
5	Intermediate consumption before R & D capitalisation			
6	Changes in intermediate consumption because of capitalisation of R & D purchases previously included in intermediate consumption			
7	Intermediate consumption after R & D capitalisation			
8	Value added before R & D capitalisation			
9	Changes in value added			
10	Value added after R & D capitalisation			

Table 4 defines the impact, in monetary terms, of the capitalization of R & D on output and intermediate consumption of market and non-market producers. From the definition of value added as the difference between the two transactions, it allows to calculate the impact of this reclassification on the added value of such producers.

● Changes affecting the production of R & D are determined by two types of modifications and, depending on how they were implemented, may have a greater or lesser impact. In theory, it refers to: changes caused by modifications in the value of output in R & D by own account[2] and changes due to modifications in the value of output of general government and non-profit institutions serving households.

As regards changes in the valuation of output on R & D by own account (row 2 of Table), both SNA 2008 and ESA 2010 states that the sum of the production costs, initially the formula for valuate that output, should be increased by a

---

[2] The assumption that these would be the only changes assumes that the production of market R & D is valued by sales revenue and already includes obtaining an operating surplus/mixed income (gross) for the unit in question. Consequently, the increase in consumption of fixed capital by the capitalization of R & D only imply a decrease in operating surplus/mixed income (net)

'mark up' to obtain a net operating surplus/mixed income and the value of the capitalization of the consumption of fixed capital of new assets of R & D.

Concerning the second category of changes (row 3 of Table), they will be determined by modifications in total production costs due to both, the reduction of intermediate consumption (some of which could be treated as GFCF, as expenditures in Intellectual Property Products, including R & D free access, used in the production of more than one year) and consumption of fixed capital (which would increase by considering the corresponding to the new R & D assets).

● On the other hand, changes in intermediate consumption of market and non-market producers of R & D come from the purchases of R & D that, before to be capitalized, were included as intermediate consumption.

The combined outcome of these categories of changes, will determine, a priori, an increase in value added as a result of capitalization. Market producers would increase production, by the combined effect of the 'mark up' and the consumption of fixed capital included in the new value of output in R & D by own account, and the decrease of its intermediate consumption whereas in non-market producers would increase production by the way of the increasing of the consumption of fixed capital, offset, in part or totally, by the decreasing of the value of output regarding the decline of intermediate consumption in R & D because of its capitalization.

Last table, **Table 5**, will allow to know, first, the overall impact of the capitalization of R & D on GDP, and secondly, using together the results in Tables 4 and 5, the impact of the R & D activity on this aggregate.

Table 5

Impact of reclassification of R & D on the Gross Domestic Product
Year:

	Before R & D capitalisation	After R & D capitalisation
FROM THE OUTPUT (SUPPLY SIDE)		
Output (basic prices)		
(-) Intermediate consumption (excl. deductible VAT)		
Gross Value added (basic prices)		
Taxes less subsidies on products		
Taxes on products		
(-) Subsidies on products		
Gross Domestic product (market prices)		
FROM THE GENERATION OF INCOME		
Compensation of employees		
Wages and salaries		
Employers' social contributions		
Taxes on production and imports less subsidies		
Taxes on production and imports		
(-) Subsidies		
Operating surplus/mixed income (gross)		
Consumption of fixed capital		
Operating surplus/mixed income (net)		
Gross Domestic product (market prices)		
FROM THE DEMAND SIDE		
Final consumption expenditure		
Fixed capital formation (gross)		
Changes in inventories		
Acquisitions less disposals of valuables		
Exports of goods and services		
Imports of goods and services (-)		
Domestic product (gross, market prices)		

Under the assumption of stability of the total taxes less subsidies on production and imports, the expected effects of the capitalization of R & D on GDP would be:

From the supply side, an increase in value added (VA) generated by the R & D activities, previously discussed, will be observed

This increase in GVA will be distributed[3], from the side of the income generated in the production process, in the balancing item operating surplus/mixed income (gross), with an increase of its two components: operating surplus/mixed income (net) and consumption of fixed capital.

From the demand side, a decrease in the final consumption expenditure of general government and non-profit institutions serving households and an increase in GFCF will be observed.

Finally, once known the respective amounts of the GVA of the industries producing R & D both market and non-market, before and after capitalization (data from Table 4), the weight relative to the gross value added (GVA) and total GDP of the economy, before and after capitalization, may be obtained.

2.3 Reference Periods

The tables described in the previous section could be filled, in principle, for any years for which sufficient information is available. In this sense, considering that the latest data published in the 'Statistics of R & D' refer to 2011 and the last supply and use tables released correspond to the accounting year 2009, you could choose the period 2008-2011 to perform a practical exercise and apply the methodology described (or even 2012 when survey information is available).

2.4 Statistical sources of information

To fill in the tables included in the first phase of this project, you need to have structural statistical sources, both in terms of the National Accounts of Spain (CNE) as basic statistics on R & D.

In the case of the CNE, the latest information provided by its input-output framework, including the supply and use tables and the so-called supplementary tables would be necessary. As previously mentioned, this information should be used more as a reference for obtaining productive structures, weights, etc. that for determinate the levels of the various transactions estimated.

---

[3] There could be an increase in the compensation of employees due to the increased payments to post-graduate students not considered in the Frascati Manual.

With respect to basic statistics, should be viewed all those of a structural nature that allow complete the different sections and transactions described above. Thus:

● Surveys to companies and products, especially all specific to R & D activity

● Surveys on the labor market

● Foreign trade statistics of goods (Customs) and services (Balance of Payments)

● Statistics of financial institutions, including insurance companies

● General Government statistics

Of these five blocks of information, the first two correspond to statistical products produced by the INE and the other three are operations performed by other bodies: Bank of Spain, Direction General for Insurance, Tax Agency, Audit Office of the Ministry of Finance, Fiscal Studies Institute, etc.

Of course, any other sources providing data on R & D sector, especially those developed by agencies and public and private institutions involved in this sector will also be used.

Finally, this paper will allow identify the main gaps of information with coverage at least partially, could be crucial to undertake, with guarantees, the second phase of the project: Compiling a Satellite Account of R & D (SAR&D).

3. Compilation of a Satellite Account of R & D (SAR&D)

3.1 Background

As discussed in the Introduction, the great advantage of the Systems of National Accounts is to provide accounting measurements based on concepts and homogeneous statistical systems and therefore internationally comparable. Given this advantage, they show limited when studying specific aspects of economic reality.

To solve this problem, it has been developed the so-called satellite frame, more flexible and characterized, either by conceptual and methodological principles different from those used in the core national accounts, either by providing greater detail in the study of the activities and products (certain aspects that collects national accounting globally or in aggregate way or even implicitly, are expanded in the satellite accounting).

In the case of the R & D activities, the satellite account proposed has both singularities: a selection of characteristic products of R & D and of industries producing them, and a conceptual change on the use of those products that, instead of being recorded as intermediate consumption (or final consumption in

the case of those produced by non-market activities), must to be capitalized, i.e., to be used as Gross Fixed Capital Formation.

In response to the first singularity (satellite account by industries and products), the reference of the Satellite Account of R & D (SAR&D) will be the accounting framework defined by the Input-Output tables (in particular Tables Supply and Use Tables, SUT) of the Spanish National Accounts (CNE). These tables are adapted to focus attention and detail in the R & D products and in the industries that produce, import or export them and, where appropriate, trade them.

The Supply Table (offer) will show the structure of production and costs of R & D activities, their production by product, intermediate inputs and labor, investment in productive capital (including investment in R & D), etc.

Also, the Use Table (demand) will provide details about users (institutional sectors) of the R & D products, as well as how they use them (intermediate demand and final demand).

As regards the other singularity (capitalization of R & D), the SAR&D must take into consideration all the work and results developed in Phase 1 of this same project, with the exception of changes due to the update of the estimates of the different statistics, both basic and CNE.

3.2 Work to be done

In general the compilation of the SAR&D involves the development of the following three steps:

● Determine the classification of characteristic products of R & D, i.e. those who are by nature.

● Determining the characteristic activities and expand the core of the SUT, in order to facilitate a more detailed information for such activities.

● Compile the SUT of the SAR&D and a set of supplementary tables, according to the above classifications of products and activities, providing information on aggregates and variables not included in the current Spanish National Accounts.

3.2.1 CLASSIFICATION OF R & D PRODUCTS

The only classification of products currently available in the field of statistics is the official classification products of United Nations (CPC) and its adaptation to the European Union (CPA-2008, in his final Spanish version). These classifications are used within the CNE; however, they are not considered suitable for the purposes of this work. Due to the characteristics described above, this work requires a classification of products that meets a number of conditions:

First, the classification must be adapted to the way in which the production of R + D services is performed. These products are cross-cutting and can be obtained from companies/production units of numerous industries (agriculture; mining; manufacturing; energy and water; construction; trade; transport, storage and communications; financial intermediation; software and related activities; R & D services; architectural, engineering and other technical activities; general government, etc.). In some of these industries, R & D services can be part of their primary production, but in most of them, they shall constitute a secondary production. In addition, R & D activity can be carried out in units intended exclusively to production or in central units serving the entire company.

Second, the classification to be used must be able to provide a breakdown of the use of production, taking into account that a very important part of it will be sold in the market, but also a very significant part would be destined to be used by the own unit that produces it (the so-called production for own final use).

Finally, the classification used must conform to the conditions under which the information on these products is available, both in the basic structural and sectoral statistics and also in national accounting statistics.

Under these assumptions, the classification of characteristic products of R & D proposed to compile the SAR&D is:

- Market R & D services

- R & D services for own final use

- Non-market R & D services

All of them can be grouped into the category coded 72 (Scientific R & D Services) of CPA-2008, cited above.

3.2.2 R & D ACTIVITIES

The 'R & D activity' defined from the perspective of supply consists of the industries[4] that are intensive in the production of characteristic products of R & D. This will include characteristics industries, which are producing a product R & D as primary production (which generates higher value added) and those in which, another product is determining the primary production but, the weight of the production (secondary) in R & D products is significant.

The following scheme summarizes the above:

[4] In National Accounts, an industry defined by aggregation of Local economic Kind-of-Activity Units (Local KAU), also known as establishments: groups all the parts of an institutional unit (for instance, a company) in its capacity as producer which are located in a single site or in closely located sites, and which contribute to the performance of an activity, defined according to a standard classification (in our case the CNAE-2009)

Activities R & D-intensive	
CHARACTERISTIC INDUSTRIES	OTHER INDUSTRIES
Primary output: *Characteristic R & D products*	Secondary output: *Characteristic R & D products*
Secondary output: *Other products*	Primary output: *Other products*

A priori, most of the major groups of industries (agriculture, manufacturing, construction, services, etc.) will have R & D products as one of its secondary output. Therefore, it is not offered in this proposal a specific relationship of the activities to be included in the SAR&D. The development of the work itself will indicate what should be the level of breakdown to present the results (tables) described below. However, whatever the breakdown, they should always separately developed two industries for R & D: market and non-market.

Finally, a simple scheme of work would be:

INDUSTRIES	MARKET GOODS						MARKET SERVICES						MARKET R & D	NON MARKET R & D	NON-MARKET SERVICES			
	Agriculture	Mining	Manufactured products	Energy	Construction	Other goods	Trade	Transport	Telecommunica-tions	Financial interme-diaries	Engineering, software services, etc.	Other services			General Govern-ment	Education	Health	Other services

3.2.3 RESULTS TABLES

The SAR&D will include, at least, the supply (offer) and use (demand) tables described below, with the breakdown of activities and products previously discussed. Moreover, if the available information allows it, it could be presented a table of employment and compensation integrated with the previous two ones and, additionally, two tables more: one concerning flows and the other relating to capital stocks. In the next section, the layout of the first two tables is shown and also it is made a draft of what could be the layout of the other three.

3.2.3.1 Supply Table of the SAR&D

This table records the total supply of products in the Spanish economy. The supply of each product is made by:

-Domestic output by industry, valued at basic prices and calculated as the sum of the primary output and the secondary outputs (by products).

-Imports, valued c.i.f. for each product and f.o.b. for the total.

-Distribution margins (transport and wholesale and retail trade).

-Taxes less subsidies on products paid to/received from general government[5].

---

[5] To take into account the distribution margins, and taxes and subsidies on products is only due to methodological reasons. These are the transactions that allow the passage of the valuation of output at basic prices (as perceived by the producer) to purchase prices (which is perceived by the user of the products in question).

Supply Table (matrix) of SAR&D

	Output at basic prices by industry (1)			Imports (2)	Total supply at basic prices (3)= (1)+(2)	Distribution margins (4)	Taxes less subsidies on products (5)	Total supply at purchasers prices (6)=(3)+(4)+(5)
	Agriculture,etc.	R&D	Services, etc.					
Product[1] R&D 1								
Product[2] R&D 2								
Product[3] R&D 3								
Other Products than R&D								
Total								

―――――――
1. *Market R&D Services*
2. *R&D Services for own final use*
3. *Non-market R&D Services*

In the column of products, all detailed products, including obviously the three characteristic products previously defined will be included.

In the sub-matrix of activities, the detailed list of activities, according to the scheme described in section devoted to 'R & D activities' (section 3.2.2), will be included.

3.2.3.2 Use Table of SAR&D

This table includes all possible uses of each product of the economy, including exports.

The uses of each product could be:

-Intermediate uses:

- Intermediate consumption (products) by industry, i.e., the products they use in production processes.

-Final uses by type of expenditure:

- Final consumption expenditure of households, of general government (GG) and non-profit institutions serving households (NPISH).
- Gross Fixed Capital Formation and Changes in inventories.
- Exports

Consequently, the use matrix has the layout indicated in the next figure. As it can be observed, it also includes a breakdown of the primary inputs used in the production: compensation of employees; operating surplus (of companies) and mixed income (unincorporated enterprises owned by households) and taxes less subsidies on production; i.e., the Gross Value Added valued at basic prices, by industry.

In one scheme, the information provided by the use matrix is the following:

Use Table (matrix) of SAR&D

	Intermediate demand by industry (7)			Total intermediate demand (8)	Final consumption expenditure (9)			Gross Capital Formation (10)		Exports (11)	Total uses at purchasers prices (12) = sum(7..11)
	Agriculture,etc.	R&D	Services, etc.		Households	GG	NPISH	Fixed	Changes in inventories		
Product[1] R&D 1											
Product[2] R&D 2											
Product[3] R&D 3											
Other products than R&D											
Total											

Gross Value Added at basic prices			
Compensation of employees			
Operating surplus/Mixed income			
Taxes less subsidies			

_____

1. *Market R&D Services*
2. *R&D Services for own final use*
3. *Non-market R&D Services*

Although it has not drawn, if the basic information allows it, use table could provide a breakdown of gross fixed capital formation (column 10) by institutional sector owner (non-financial corporations, financial institutions, general government, households and non-profit institutions serving households).

Regarding the relationship between both supply and use tables, it is enough to say that their methodology is based on the fundamental identity of accounting: the total supply of each product, valued at purchasers prices, is equal to its demand (total uses valued at purchasers prices).

3.2.3.3 Other tables

As indicated, the tables that are discussed below are a mere descriptive attempt, since its completion will depend on the degree of development of basic statistical information available when compiling the SAR&D.

Employment and labor costs matrix: This matrix shows the supply of labor used in the production of R & D and labor costs associated with it. In regard to the R & D activities and products considered, they will be the same as those in the supply and use tables described. This matrix includes information on the different categories of occupations of R & D activities (scientists, engineers, doctors, other professionals, management and administrative staff, etc.).

Gross Fixed Capital Formation and Capital Stocks matrices by industry owner:

The first of these matrices show the structure of the flows of Gross Fixed Capital Formation (GFCF) used by each industry, disaggregated by classic asset categories (equipment, construction assets, software, etc.) and also the new categories arising from the capitalization of R & D products.

EMPLOYMENT AND LABOR COSTS MATRIX

Industries	Employment															Labor costs														
	Market R&D				R&D for own final use				Non-market R&D				No R&D	Total	Market R&D				R&D for own final use				Non-market R&D				No R&D	Total
	Scientists	*Engineers*	*Others*	*Total*	*Scientists*	*Engineers*	*Others*	*Total*	*Scientists*	*Engineers*	*Others*	*Total*			*Scientists*	*Engineers*	*Others*	*Total*	*Scientists*	*Engineers*	*Others*	*Total*	*Scientists*	*Engineers*	*Others*	*Total*		
Agriculture																												
Mining																												
Manufacturing																												
Energy																												
Construction																												
Trade																												
Transport																												
Telecommunications																												
Financial intermediaries																												
Engineering, software, etc. services																												
Market R&D																												
Non-market R&D																												
General Government																												
Education																												
Health																												
Others																												
TOTAL																												

GROSS FIXED CAPITAL FORMATION (GFCF) BY INDUSTRY OWNER

| | Industries | | | | | | | | | | Market R&D | Non-market R&D | General Government | Education | Health | Others | TOTAL |
	Agriculture	Mining	Manufacturing	Energy	Construction	Trade	Transport	Telecommunications	Financial intermediaries	Engineering, software, etc. services							
R&D Products																	
Market R&D																	
R&D for own final use																	
Non-market R&D																	
TOTAL R&D PRODUCTS																	
Other assets																	
Equipment																	
Construction assets																	
Services																	
Software																	
TOTAL OTHER PRODUCTS																	
TOTAL GFCF																	

The second matrix will record GFCF expenditure of the current period and also the accumulated over the past years, resulting in the total stock of fixed assets (equipment, construction, services, software and R & D). Obviously the stocks of assets of previous years shall be calculated net of the corresponding consumption of fixed capital.

| **Industries** | **Assets** | | | | **TOTAL** | |
| | R&D | | Other assets than R&D | | | |
	GFCF	Stocks	GFCF	Stocks	GFCF	Stocks
Agriculture						
Mining						
Manufacturing						
Energy						
Construction						
Trade						
Transport						
Telecommunications						
Financial intermediaries						
Engineering, software, etc. services						
Market R&D						
Non-market R&D						
General Government						
Education						
Health						
Others						
TOTAL						

3.2.3.4 Other results: analysis of the direct and indirect effects of the R & D activities on the economy

The starting point for this analysis is the so-called symmetric input-output table, which is a derivative of the SUT tables described above.

The symmetric input-output table records all flows related to products or homogeneous industries, which cannot be obtained directly from the information provided by the statistical system. Its compilation is a laboratory exercise and requires working assumptions (assumption on industry technology or product technology) for transferring the outputs and inputs associated with them to get what is called homogeneous industries (homogeneous products).

Symmetric input-output tables record in the columns the functions/production costs for different products and facilitate the development of technical coefficients matrices and the matrix of Leontieff, underlying all input-output models, which are used to measure direct and indirect effects of R & D activities on the different sectors of the economy, employment, etc.

3.3 Reference period

The reference for the first version of the SAR&D, whose tables have been described in the previous sections, is the same as of the latest SUT published by INE. According to the timetable for the implementation of ESA 2010, in the last quarter of 2014, a new series of the CNE will be released. In this regard, it should be appropriate that the SUT reference for SAR&D was prepared with the new methodology, a factor which should be added the fact that the new SUT will use as inputs the results of the capitalization of R & D described above.

Once compiled the first SAR&D, it may be possible to build a system of indicators and periodic updating algorithms, reserving the compilation of a new SAR&D for those years in which they are observed, either substantial modifications of the basic statistical sources, or modifications in the benchmark methodology and estimation procedures for the aggregates and variables included in the satellite account.

3.4 Statistical sources of information

These sources are the same as described for the first phase of the project (section 2.4) appropriately updated.

In the case of the CNE, the information currently available is made according to current accounting methodology (ESA-1995). Therefore, the new ESA-2010 system has not been introduced yet. For this reason, the information provided by the work of the first phase of this project is of great interest, both in terms of conceptual change (capitalization of R & D), and also due to the incorporation of new data sources and new estimates that complement the vision, admittedly limited, that current accounting systems, and including the CNE, offer of R & D activities.

Moreover, as stated in paragraph 3.2 (Work to be done), some of the tables proposed require some information to be compiled that, at the time, are not yet available. Because of this, their compilation should be deferred. In this respect, it is worth to emphasize the enormous ability of the project to identify key information gaps facing the sector, and this, together with the study of the direct and indirect effects, could be one of the most valuable elements of this project beyond the sector information itself that forms the basis of the proposed work, of course.

4. References

Cañada, A. 2010. "Efectos de la Capitalización de los gastos en I+D sobre las mediciones de la Contabilidad Nacional: aproximación a una Cuenta Satélite de I+D para España". Tribuna de Economía. ICE, Marzo - Abril 2010.

EUROSTAT (1996). "Sistema Europeo de Cuentas. SEC-1995". Luxemburgo, Oficina de Publicaciones Oficiales de las Comunidades Europeas, 1996.

EUROSTAT (2012). "Final Report Second Task Force on the Capitalization of Research and Development in National Accounts". Luxemburgo, Eurostat, 2012.

EUROSTAT (2013). "Sistema Europeo de Cuentas Nacionales y Regionales de la Unión Europea. SEC 2010". En fase de aprobación por el Consejo y el Parlamento Europeo.

Naciones Unidas (1993). "Sistema de Cuentas Nacionales 1993". Nueva York, Naciones Unidas, 1993.

Naciones Unidas (2008). "System of Nacional Accounts 2008". Nueva York, Naciones Unidas, 2008.

OCDE (2003). "Manual de Frascati 2002. Propuesta de Norma Práctica para Encuestas de Investigación y Desarrollo Experimental". OCDE, Paris, 2003.

Okubo, S. (2007)."Framework for and Industry-based R&D Satellite Account". Bureau of Economic Analysis/National Science Foundation. 2007 R&D Satellite Account Background Paper.

Unión Europea (2012). "Reglamento de ejecución de la Unión Europea, Nº 995/2012 de la Comisión del 26 de octubre de 2012, por el que se establecen disposiciones de ejecución de la Decisión Nº 1608/2003/CE del Parlamento Europeo y el Consejo relativa a la producción y desarrollo de estadísticas comunitarias en materia de ciencia y tecnología. Bruselas", Unión Europea, 2012.

ANNEX I

Glossary of terms related to the Satellite Account of R&D

Actual final consumption
Value of the goods or services that are acquired by resident institutional units (households and general government) for the direct satisfaction of human needs, whether individual or collective.

Basic prices
It is the price receivable by the producers from the purchaser for a unit of a good or service produced as output minus any tax payable on that unit (plus any subsidy receivable) as a consequence of its production or sale of that unit. It excludes any transport charges invoiced separately by the producer.

Changes in inventories
Value of the entries into inventories less the value of withdrawals and the value of any recurrent losses of goods held in inventories.

Characteristic products of R & D activity
They include R & D products grouped into three categories: market R & D, R & D for their own use, not-market R & D.

Compensation of employees
Total remuneration, in cash or in kind, payable by an employer to an employee in return for work done by the latter during an accounting period. It does include wages, salaries and employers' social contributions

Consumption of fixed capital
Total amount of the reduction in value of fixed assets used in production during the accounting period, as a result of physical wear and foreseeable obsolescence and insurable accidental damage. Does not include, neither unpredictable obsolescence nor major disasters, nor the depletion of natural resources.

Employment
Employment covers all persons, both employees and self-employed, engaged in productive activity that falls within the production boundary of the national accounts. Does not include volunteer activities resulting in services but includes persons in volunteer activities resulting in goods.

Exports
Value of goods and services provided by residents to non-residents by operations of sales, barter, gifts or grants.

Final consumption expenditure
Expenditure made by resident units (households, general government and non-profit institutions serving households) on goods and services used to satisfy individual and collective needs or wants.

Fixed assets	*Tangible or intangible assets obtained from production processes that are used repeatedly or continuously in other processes of production for more than a year.*
Gross Domestic Product (GDP)	*It is the market value of all of goods and services produced on an economic territory during a period of time, once deducted the cost of goods and services used in the production process (therefore, it does include taxes less subsidies on products). By deducting consumption of fixed capital from GDP, Net Domestic Product (NDP) is obtained.*
Gross fixed capital formation	*Consists of resident producers' acquisitions, less disposals, of fixed assets (machinery and equipment, residential and non-residential buildings and civil engineering works, cultivated and livestock assets, intangible fixed assets and the cost of transfer of ownership of all of them) during a given period, plus certain additions to the value of non-produced assets (major improvements to land, etc.). In the case of the capitalization of R & D expenses, these expenses are considered investment.*
Gross operating surplus	*Operating surplus accrued by all corporations and quasi-corporations resident in the economic territory. Is the balance of the generation of income account of those, and is equal to the difference between gross value added and the value of the compensation of employees and taxes less subsidies on production and imports. It is calculated before deducting consumption of fixed capital, the property income (interest, dividends, etc.) and taxes on income and wealth. By convention, in the case of non-market producers of general government and nonprofit institutions serving households, gross operating surplus is equivalent to the consumption of fixed capital of the sector. However, in the case of production for own final use, it should be appropriate to add a factor (mark up) to record the effects of returns of capital used in production.*
Gross Value Added	*Value of output valued at basic prices less intermediate consumption valued at purchasers' prices. It can be calculated for industries and institutional sectors. Using the basic price valuation, the distortion caused on the production of the industries due to taxes on products (and subsidies) is eliminated.*
Gross Value Added of R & D activity	*Value of output of characteristic products on R & D, valued at basic prices, less the value of intermediate consumption valued at purchasers' prices, used in the production of the R & D products.*
Homogeneous branch	*Grouping of local kind-of-activity units (local KAUs) developing same or similar economic activities. At the most detailed level of the classification, a branch includes all local KAUs corresponding to the same class of the NACE.*
Imports	*Value of goods and services provided by non-residents to residents by operations of sales, barter, gifts or grants.*

Industries	*Grouping of local kind-of-activity units (local KAUs) developing an activity.*
Institutional sector	*Grouping of institutional units with similar economic behavior (type of producer and principal activity and function). The sectors distinguished in the system are non-financial companies and financial institutions (producing goods and financial and non-financial market services), general government (producing individual and collective non-market services and redistributing national income and wealth), households (in their capacity as consumers and market producers and producers for own final use), and non-profit institutions serving households (private non-market producers).*
	Furthermore, the sector Rest of the World is taken into account, which receives this treatment but does not meet the characteristics of a sector, and which groups the non-resident units engaged in transactions with resident units.
Institutional unit	*It is an economic entity characterized by an economic behavior and a decision-making autonomy in the exercise of its principal function (to produce, consume, redistribute, etc.).*
	A resident unit (which has a center of economic interest in a given economic territory), is said to be an institutional unit if it has decision-making autonomy (entitled to own goods and assets, able to take economic decisions and engage in economic activities and able to incur liabilities) and has a complete set of accounts (e.g. a company, a household, a government unit, etc.).
Intermediate consumption	*Value of goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. For capitalization of expenditure on R & D, these costs are not considered intermediate consumption but investment costs.*
Inventories	*They are stocks of products held by producing units at the end of an accounting period before undergoing further processing, to sell them, or supply them to other units. They consist of materials and supplies, work in progress, finished goods and goods for resale.*
Local Kind-of-Activity Unit (establishment)	*It is an institutional unit or part of an institutional unit producing goods and services, located in a geographically identified place. It can produce goods and services for the main activity and for one or more secondary activities.*
Mixed income	*The surplus generated by the production of unincorporated enterprises and individual entrepreneurs. It does include elements of both compensation of employees (remuneration of labor) and operating surplus (remuneration of capital).*

Other subsidies on production	*Consist of subsidies which resident producer units may receive as a consequence of engaging in production. (Example: subsidies on work force, to reduce pollution, grants for interest relief, etc.).*
Other taxes on production	*All taxes that enterprises incur as a result of engaging in production, independent of the quantity or value of the goods and services produced or sold. (Example: taxes on the ownership and on the use of fixed assets, on the total wage bill, on pollution, etc.).*
Production	*Value of goods and services produced in a local kind-of-economic activity unit (local KAU) or establishment and that it makes available for use outside it, plus any goods and services produced for own final use. It is necessary to distinguish between market production (which is sold or otherwise available in the market), non-market production (which is supplied to other units for free or at not economically significant prices), and production to own final use (value of goods and services produced by a unit and that it uses for its own consumption or investment within the same unit), valued at basic prices of similar products sold on the market or, by costs of production it has basic prices are not available).*
Purchasers' prices	*It is the price actually paid by the purchaser to take delivery the products at the required time and place. It includes transport charges paid separately by the purchaser. It excludes any deductible tax, deductions for any discounts for bulk or off-peak-purchases from standard prices or charges and extra charges for breach of the conditions of supply.*
R & D activities "sector"	*It consists of the industries associated with characteristic products of R & D.*
Satellite account	*Account that provides an accounting framework linked to the central core of the national accounts, which allows focus the attention on a specific socio-economic field, in the context of national accounts.*
Subsidies on products	*Subsidies payable per unit of a good or service produced or imported. Consist in a specific amount of money per unit of quantity of a good or service or in a specified percentage of the price per unit. They also may be calculated as the difference between a specified target price and the market price actually paid. A subsidy on a product usually becomes payable when the good is produced, sold or imported (Examples: subsidies to offset continued losses as a result of economic or social policies of the general government, etc.).*
Systems of national accounts	*They consist of a set of macroeconomic accounts coherent, consistent and integrated, based on a set of concepts, definitions, classifications and accounting rules internationally agreed. This allows describe the economy of a given economic territory referred to a certain period of time.*

Taxes on production and imports	*Consist of compulsory, unrequited payments, which are levied by in respect of the production and importation of goods and services, the employment of labor, the ownership or use or assets used in production. Include taxes on products and other taxes on production. Do not include any income and wealth tax of companies. Such taxes are payable irrespective of profits made.*
Taxes on products	*They are taxes that are payable per unit of a given product produced or transacted. The tax may be a specific amount of money per unit of quantity of a good or service, or it may be calculated ad valorem, as a specified percentage of the price per unit or value. (Example: special excise duties taxes, etc.).*
Trade margins	*Difference between the actual or imputed sale price realized on a good purchased for resale, and the price that would have to be paid by the distributor to replace the good at the time it is sold.*
Unit of homogeneous production	*It is characterized by carrying out a unique activity which is identified by its inputs, process of production, and its outputs.*

Madrid, August 2013