

Innovation in Companies Survey. Year 2014

Methodology

1. Introduction

Currently, the innovation process is seen as the main driving force behind economic growth in first world economies, as well as an important factor which contributes to their social and cultural development. Innovation and technological change have recently become increasingly important issues in the economic analysis and political decision making of developed countries. These are aspects that involve serious information problems, particularly due to the absence of reliable systematic data.

1.1 Background

A large share of the work undertaken recently by the Organisation for Economic Cooperation and Development (OECD) has therefore consisted of drawing up and improving useful indicators in order to bring technological issues into the arena of economic policy analysis. At both national and international levels, numerous initiatives concerning technology have also been undertaken. To coordinate all of these activities, the OECD presented, during the *National Experts of Science and Technology Indicators* meeting, held in Paris on 10th December 1990, a preliminary version of a method for the collection and interpretation of technological innovation data (Innovation Manual), which was revised throughout 1991. In 1992, the *OECD guidelines for the collection and interpretation of technological innovation data*, more commonly known as the Oslo Manual, was released. The second edition was published in 1997. With the creation of the new Oslo Manual, revised in 2005, the definition of innovating company is enlarged. A company is considered to be innovating when it carries out product, process, marketing or organisational innovations.

Subsequently, the Statistical Office of the European Communities (EUROSTAT), in coordination with the OECD, embarked on a number of studies designed to collect innovation data in the member states, and for this purpose submitted a proposal for a

decision from the Council on R&D and innovation statistics, which was approved in January 1994. These studies culminated in 1993 in a Community Innovation Survey (CIS), whose main reference year was 1992, with the use of a harmonised questionnaire to collect innovation data from European Community companies. A questionnaire was sent to around 90,000 companies within the 12 Community countries. The methodology used was based on the OECD Oslo Manual. In 1997 and 2001 the collection of the second and third CIS questionnaires began, pertaining to the years 1996 and 2000 respectively.

Meanwhile, in Spain the Association of Businessmen carried out a survey directed at around 700 companies in 1985/86 to gather information on the characteristics of innovative companies, the nature and intensity of their efforts in this area, the results of such efforts and the companies' perception of the innovation process. Subsequently, in 1994 they carried out another study of similar characteristics.

For its part, the National Statistics Institute (INE) projected a Technological Innovation in Companies survey following the recommendations laid down in the OECD Oslo Manual, the collection of the information commencing in September 1992. This survey was sent to around 20,000 manufacturing companies with 20 or more employees. However, budget constraints meant that interviewers/pollsters who were to collect the information could not be hired. The INE was therefore forced to cancel the survey despite the fact that most of the questionnaires had already been sent out to the companies. The companies concerned were informed of this decision in October 1992, highlighting that the information received and any sent back voluntarily would be used in a pilot study. In this pilot study, which was not intended as such at the outset, information provided by some 2,400 companies was analysed. Furthermore, the data collected in this pilot study was included within the Community CIS project, despite the fact that a fully harmonised questionnaire had not been used. The information obtained

in 1992 cannot be considered representative of Spain as it was not gathered by sample techniques, nor was the sample chosen, but rather it was provided by those companies that voluntarily replied to the questionnaire.

Given that the methodology work and the harmonisation of definitions and classifications were at a highly advanced stage, it was thought that at an international level there was a stable framework to elaborate innovation data that could be compared internationally. This fact, together with the clear interest in obtaining basic information on the innovation of Spanish companies, led the National Statistics Institute to take up the Technological Innovation in Companies Survey once again in 1994. This study has allowed for the attainment of indicators which shall cast light on the structure and the effects of the innovation process. These indicators also provide a framework for future research. The continuity of the innovation survey is reflected in the subsequent consecutive studies with reference to the years 1996, 1998, 2000 and 2003. Since 2002 it has been carried out annually in coordination with Statistics on R&D Activities.

1.2 The analysis of the innovation process through surveys

To obtain a deeper knowledge of the innovation process, solve some of the problems not yet resolved with the available information and eliminate the information gaps necessary for an adequate scientific-technological policy, it would be necessary to obtain more information on the innovation process and the factors that accelerate it or slow it down.

Moreover, it would be convenient to be able to show the relationship existing between said innovation process and three other fields:

a) The strategy and plans of the company.

b) The factors that influence its innovative capacity and its performance (including actions of the Public Administration).

c) The results of innovation and the profitability of the company.

There are therefore five issues to be studied, which are described below.

Objectives of innovative companies

The technological strategy of a company may be defined as a combination of commercial objectives that said company intends to fulfil with the assistance of the diverse combinations of innovation activities described above. The company may decide whether it:

a) Attempts to completely develop new products that will open up new markets.

b) Attempts to imitate the leaders in the field of innovation.

c) Attempts to adapt to the needs of the company technology that is developed externally.

d) Makes an effort to progressively develop existing techniques.

e) Changes production methods with respect to existing products.

With the objective of:

– Replacing products that are suppressed.

– Broadening the product range.

– Maintaining market share.

– Opening new markets.

– Improving production flexibility.

– Reducing production costs.

– Improving working conditions.

– Reducing environmental damage.

These strategies may differ according to the branch of activity and, within each branch, according to the company. Given that these results are of a certain interest when it comes to considering possible

courses of action, it would be convenient to establish a question on the matter.

Structure of the innovation process

An analysis of innovation may commence with R&D, because despite the abundance of available data, R&D activity and organisation thereof within the company is not very well known.

Thus, it is necessary to ascertain whether R&D activities within companies are permanent or occasional, and if those companies without R&D anticipate elaborating a systematic R&D plan for the future, or if they only anticipate the realisation of occasional R&D activities during the next few years.

Information should also be obtained on the existence of an official R&D organisation (department, laboratory, centre, ...) within the company, and on the percentage of total R&D expenditure. It would also be possible to ask about the allocation of R&D amongst the different research units of the company (R&D, design, production, marketing departments,...).

Moreover, it is clear that the innovation survey must include an R&D measure. However, the main thing is to complete this data with a description of the funds contributed to the innovation process for other innovative activities other than for R&D, so as to ascertain the relative weight given to these two types of activity by companies, as well as the allocation by branches of activity and in each branch. A better understanding of these allocations and their variation according to the branch of activity would be very useful to define policy in the field of innovation.

The action of the public authorities in industrial innovation

Due to the fact that R&D financed with public funds represents, in general, an important percentage of total R&D expenditure in OECD countries, it is necessary to have a more precise idea of its effects on companies. However, there exist other fields of government action

apart from R&D that encourage or slow down innovative activity, such as:

- Education and training of specialised personnel.
- Fiscal policy and accounting regulations.
- Industrial regulations (including in relation to the environment, norms on hygiene, quality control, standardisation,...)
- The legal system applicable to intellectual property rights (and, therefore, questions related to patent deposits and their exploitation, and copyrights).
- Capital market transactions.

These aspects of the actions taken by the public authorities may be studied through questions relative to the level of importance of certain obstacles to innovation.

It would also be interesting to study business inventions that have used the results of the basic research carried out in universities or public research bodies.

Origin of innovative ideas and obstacles to innovation

The ultimate objective of the research in this area would be to establish a connection between the technological strategies of the companies on the one hand, and the origin of their innovative ideas and the obstacles faced on the other.

The origin of an innovation project is usually found in an innovative idea, which may stem from different sources from within the company or from external sources. Once the project has been set in motion, diverse factors contribute to its success. These may also be internal or external.

The majority of companies have at their disposal potential sources of technical information and numerous innovative ideas, but the value of these sources vary according to the technological resources available and the strategy that has been adopted.

Obstacles to innovation are very important for the action of the public authorities, given that a great part of this action is designed to overcome them. They may be economic obstacles or obstacles relative to the innovation capacity of the company.

Products and effects of innovation

One of the main objectives of any innovation survey is to ascertain the results of innovation. The problem is to define what is considered as the results of innovation activities, or in short, innovations. Generally, and although they will be defined with greater precision later, the decision has been made to distinguish various classes of change:

- Total product innovation, which refers to a completely new product, with a new technological base or with new applications of existing technology.
- Progressive innovation of products, which consist in marginal improvements or in the improvements of the components or subsystems of a product.
- Process innovation, which consist in the adoption of new production methods, or methods that have been considerably improved.

Innovation implies a new feature, but this few feature may be within the company, on a national scale or on a worldwide level. This distinction has different impacts depending on whether they are perceived taking into account the performance of the company, national competition or the pace of technical progress throughout the world.

The most simple indicator, which describes the importance of innovation, is the number of companies that have introduced product innovations, process innovations or both, in relation with the total number of companies within the different branches of activity.

Although innovations are impossible to compare from one company to another, it is possible to use the definitions of innovation to ascertain the number and the type

of innovations within a company, or what is even more interesting, the number of new products launched onto the market and the part of sales and exports that are due to these new products.

On the other hand, it is difficult to interpret the number of innovations. This data varies considerably from one branch to another and within each branch of activity. If in one company an innovation may be the sole result of its R&D activities in two years, another company may launch many new products onto the market each year.

Therefore, the number of innovations will not be a significant indicator if it is not combined with the total number of products or processes commercialised or used, respectively, within the company under study.

From a political action viewpoint, the indicators of the consequences of the innovation process perhaps constitute the most interesting results of an innovation survey.

Other questions to be included within an innovation survey

- a) Sales pertaining to products that are in the market launch phase.
- b) Descriptive information on the results of innovation.
- c) Dissemination of innovations
- d) R&D cooperation
- e) Patents

Balance of technological payments

CONCLUSION

Inclusion in an innovation survey of all previously-shown questions would enable improved knowledge of the innovation process. It would also allow for the resolution of some of the problems raised, which up until now have not found a satisfactory solution, and it would cover the existing information gaps, necessary so that the

public authorities may make adequate decisions to this end.

Nevertheless, in practice it is very difficult to include all mentioned indicators in a survey, as well as others which, in the future, may be needed since the cost of the operation would be too great. Moreover, an excessively long questionnaire may reduce the response rate of companies.

The Innovation Survey, as projected, is defined as a framework survey which, together with a few basic indicators, like those from the proposed list that would allow us to obtain a time series that would permit a dynamic analysis of innovation, may include occasional more detailed studies on other related matters, or those which may be related in the future, to innovation (for example, patent research, use of state-of-the-art technology in manufacturing, technological payments and revenue,...).

Since 2002 the Innovation Survey has been distinguished for being coordinated with the R&D Statistics for the companies sector. The coordination has been articulated on two levels: the first level refers to the sample design, which takes into account both the companies which a priori develop R&D activities, analysed exhaustively, as well as those for which it is not known whether they carry out R&D activities, which are analysed in the sample; the second level relates to the use of a sole questionnaire, organised adequately, which allows for the inclusion of the questions relative to both studies.

1.3 Problems relative to the survey methodology

Choice of the survey method

The methods used by OECD countries for this type of study may be classified in two groups:

1. Those that begin by designing a list of innovations, successful or not, frequently

outlined in expert evaluations. Once the list has been established, diverse related factors are explored, subsequently surveying the companies that have introduced these innovations.

2. Those not concerned with a group of innovations but rather on innovative attitudes and activities of companies overall. The principle consists in exploring the factors that influence the behaviour of companies within this field (innovation strategies, incentives and obstacles), the field of the diverse innovative activities and, in particular, getting an idea of the results and the effects of innovation. Said surveys are representative of the manufacturing industry, hence it is possible to make comparisons between branches of activity.

This second method is more open to international standardisation, it has been chosen as the basis for the OECD innovation manual and it is the method that has therefore been chosen for this study.

Problems linked to data collection

To carry out this type of study it is possible to use the mail or interview survey method. The majority of innovation surveys compiled up until now within OECD countries have used the mail survey method. Taking into account the complexity of the notion of innovation, experience has shown that the interview method is preferable because it provides more reliable and more coherent results. The inconvenience is that it is more costly.

Therefore, a combination of both methods has been chosen as the most optimal solution for this study, although to reduce costs the use of the telephone has been reinforced instead of the personal interview.

Periodicity of the survey

Company innovation activities seem to be in continuous progression. Continuous chronological series are essential for obtaining a dynamic analysis of innovation.

The OECD and Eurostat recommend carrying out this statistical operation every two years, alternating with the R&D Statistics. But the convenience of having, on an annual basis, indicators of both statistical operations resulted in the joint collection of the data through a unified questionnaire. Therefore, from the 2002 reference period onwards, the Technological Innovation Survey will be carried out annually, offering complete data for the even reference years and basic data for the odd reference years. From 2005 onwards, and in order to improve on the chronological series, the questionnaire was amended in order to be able to provide, on an annual basis, all indicators from both studies.

As of the year 2008, the questionnaire has become known as the Innovation in Companies Survey, due to the incorporation within it of non-technological innovations: organisational innovations and marketing innovations.

1.4 The European Innovation Scoreboard

The European Innovation Scoreboard (EIS) entails benchmarking compiled by the European Commission General Directorate for Research, via which a synthesis is provided of the results obtained in the European Union regarding innovation via data on a series of indicators which have a bearing on the innovation process. It was developed as a consequence of the objectives established by the European Council in Lisbon in 2000 and has remained within the strategy developed by the European Comisión for promoting economic growth and the creation of jobs.

Each year, the Innovation Indicator Chart (EIS) provides comparative results referring to the phenomenon of innovation, on both a national level for the different member countries of the European Union, and an international level for other countries within a broader territorial scope. Said exercise in comparative analysis is based on a series of internationally com-

parative indicators, which cover the different aspects of the innovation process. A series of specific work are published annually regarding the basis of the EIS, which they serve to complement. They include, among others, The Regional Innovation Survey (RIS), the Global Survey on Innovation Indicators, Sectoral Analyses and Updated Methodologies.

The EIS is based on a new methodology implemented for the first time in 2008, and in which, greater weight is given to the services sector, to non-technological innovation and to the results obtained from innovation. It is comprised of 29 indicators that have been designed to assess the following:

- conditions that are favourable to carrying out innovation (human resources, financing and support)
- innovation activities in companies (investments, links and business initiatives, and results obtained, such as patents)
- productivity (innovations and economic effects).

The EIS includes data from 33 European countries, including the 27 Member States of the European Union. For each country, a Synthetic Innovation Index (SII) is compiled, obtained based on 29 indicators, and which enables establishing a ranking of the European countries.

2. Methodology

2.1 Objectives

This study attempts to offer, as its main objective, direct information on the innovation process in companies, elaborating indicators that allow us to obtain the different aspects of this process (economic impact, innovative activities, cost,...).

This large-scale study, apart from providing rich and varied information on innovation process, may serve as the base framework for diverse specific studies on other aspects related to science and technology.

Lastly, the use of a methodology that is widely accepted on an international level will allow us to fulfil the objective of international comparability of the results obtained, and contribute our national experience to the study of innovation.

- Transport and storage (49 a 53)
- Accommodation (55 to 56)
- Information and communications (58 to 63)
- Financial and insurance activities (64 to 66)
- Real estate activities (68)
- Professional, scientific and technical activities (69 a 75)
- Administrative and support service activities (77 to 82)
- Health activities and social services (86 to 88)
- Arts, recreation and entertainment activities (90 to 93)
- Other services (95 to 96)

Note: Since 2006 agriculture has been included.

Note: as the statistics on scientific research and technological development (r&d) and the technological innovation in companies survey are collected in a coordinated manner, companies that stated to have carried out r&d activities are selected with probability 1 and, when collecting the information for r&d, companies with less than 10 employees in **all branches of activity are included, except for the groups of the cnae 84 and 854.**

2.2 Scope

POPULATION

This statistical research extends to all industrial, construction and service companies with at least ten paid employees, whose main economic activity corresponds to the following activity groups of the CNAE-2009:

- Agriculture, livestock, forestry and fishing (01 to 03)
- Mining and quarrying industries (05 to 09)
- Manufacturing industry (10 to 33)
- Supply of electrical energy, gas, steam and air conditioning (35)
- Water supply, waste management and decontamination activities (36 to 39)
- Construction (41 to 43)
- Trade (45 to 47)

TERRITORIAL

This extends to all of Spain.

TEMPORAL

It is carried out annually.

In the companies included in the Innovation Survey there exist two time reference periods.

The main reference period of the survey is the year immediately prior to its execution. Nevertheless, the variables related to technological innovation implemented by com-

panies refer to the three years prior to the elaboration of the survey, with the objective of international comparability.

2.3 Statistical unit

The basic analysis unit is the company to which the population scope refers.

A company is understood to be any legal unit that constitutes an organised unit which produces goods and services and which has a certain amount of autonomy in making decisions, mainly when using the current resources that it has. From a practical point of view, and in its more general definition, the concept of company is defined as a legal or juridical unit, that is, all physical or legal persons (companies, cooperatives,...) whose activity is recognised by Law, and which is identified by its corresponding Fiscal Identification Number (NIF)

2.4 Variables and their definition

MAIN ECONOMIC ACTIVITY OF THE COMPANY

The economic activity carried out by a company is defined as the creation of added value through the production of goods and services.

Main economic activity is understood to be that which generates greatest added value. In view of the difficulty faced by some companies that carry out various activities when it comes to calculating the added value, the main activity is defined as that which generates greater business volume or, in its absence, that which employs the most employees.

DIMENSION OR SIZE OF COMPANY

The dimension of companies is one of the most important variables when it comes to determining the behaviour of companies. This dimension may be established by considering the magnitude of turnover, or

by considering the number of persons that constitute the company's workforce. Thus, the TIS questionnaire includes both questions, allowing for a quantification of both variables.

PERSONNEL EMPLOYED IN THE COMPANY

This is defined as the number of persons that work within the company, as well as the number of persons whom, working outside the company, belong and are paid by it (for example, sales representatives and delivery personnel, repair and maintenance personnel who work on behalf of the company). This includes paid as well as unpaid personnel.

A worker from a temping agency is an agency employee and not an employee of the unit (company) where they work.

Those workers linked to the company by an employment contract and who are paid fixed or periodic amounts in the form of a wage, salary, commission, efficiency wage or payments in kind are considered paid personnel.

This can be permanent personnel (with an indefinite contract or work relation) and temporary personnel (with a contract of specified duration).

Other remunerated personnel are: proprietors paid for their work; students with formal agreements whereby they contribute to the company's production process in return for remuneration and/or education services; employees contracted with a contract specifically destined to promoting the contracting of unemployed persons; home workers where there exists an explicit agreement that they are paid according to the work they carry out and they are included in the payroll.

Also considered paid personnel are part time workers, seasonal workers and persons on strike or who are on short term leave, but it excludes those who are enjoying long term leave.

Those persons who actively manage or participate in the company's work activi-

ties but do not receive fixed remuneration or a salary constitute *unpaid personnel*. Included are owners, autonomous partners who are active within the company and family assistance. Not included are partners that solely contribute capital, nor family members of the proprietor who do not actively participate in the company, nor persons that are included in the payroll of another company in which they carry out their main activity.

TURNOVER

This includes the amounts invoiced by the company during the reference year for services rendered and sale of goods that are the object of the company's trade. Deductible VAT invoiced by suppliers will not be included in the valuation of turnover. These are accounted for, including the taxes paid on the goods and services, with the exception of the VAT paid by the client. They are accounted for in net terms, deducting returns of sales, as well as volume discounts. Neither cash discounts nor discounts for prompt payment are deducted.

Business volume does not cover the sale of fixed assets nor production subsidies received. The amount of turnover is calculated as the sum of net sales of goods and the rendering of services.

GROSS INVESTMENT IN MATERIAL ASSETS

Investment during the reference period in new and existing material assets, both those purchased from third parties as well as those produced for self-consumption (that is, capitalised production of material capital assets) that have a useful life of more than one year, including non-produced material assets like the land.

All investments will be valued before (that is, gross) the value adjustments and before deducting revenue obtained from assignments. The goods purchased will be valued at purchase price, that is, transport and installation costs, profes-

sional fees, taxes and other costs pertaining to the assignment of the property are included. Self-produced goods are valued at production cost. Goods purchased through restructures (such as mergers, taking over of control, break-ups, divisions) are excluded. The purchases of small tools that are not capitalised are included as current expenditure.

All extensions, modifications, improvements and renovations that prolong or increase the useful life of material assets are also included.

TECHNOLOGICAL INNOVATION

Technological innovations include technologically new products (goods and services) and services as well as significant technological improvements to them. An technological innovation is considered as such when it has been launched onto the market (product innovations) or they have been used in the production process of goods or in the rendering of services (process innovation). All types of scientific, technological, organisational, financial and commercial activities intervene. Starting with this definition it is possible to distinguish two types of innovations: product innovation and process innovation.

Product innovation (goods or services) include technologically new products and technologically improved products.

A technologically new product refers to a product that is new to the market that presents significant differences with respect to previous products with regards to their purpose, features, technological characteristics, theoretical properties or raw materials and components used in their production. These types of innovations may be carried out with completely new technology or by means of new applications of existing technologies, or taking advantage of new knowledge.

Thus, the first microprocessors or the first videocassettes were technologically new products carried out with new technologies. The first cassette player with head-

phones that combined the existing techniques of cassette players and mini-headphones, would be a technologically new product carried out by means of new applications of existing technology. In both cases the product, considered as a whole, did not exist previously.

A *technologically improved product* refers to an existing product the results of which have been noticeably increased or improved. There are two forms: in the first, a simple product may be improved (due to an improvement in its features or a reduction of costs) thanks to the use of better components or materials; in the second, a complex product that includes various sub-systems may be improved by means of partial modifications to one of them.

The substitution of metal with plastic in kitchen equipment or furniture is an example of a technologically improved product, included within the former. The introduction of the ABS or other sub-systems in vehicles is an example of the latter.

Process innovation refers to the adoption of technologically new or noticeably improved production methods, including the methods for supplying the product. It may result from modifications to the equipment or in the organisation of production, or from these two modifications combined, and taking advantage of new knowledge. The methods introduced may be destined to the production and supply of technologically new or improved products that are impossible to obtain with classical installations or production methods, or to producing existing products more efficiently.

With regards to the IS, technological innovation is studied with reference to the years t , $t-1$ and $t-2$.

NON-TECHNOLOGICAL INNOVATION

With the creation of the new Oslo Manual, revised in 2005, the definition of innovating company is enlarged. A company is considered to be innovating when it car-

ries out product, process, marketing or organisational innovations. This includes marketing and organisational innovations.

Marketing innovation: this is the implementation of new market methods which entail changes in what the Oslo Manual terms "the 4Ps":

- Product (design or packing)
 - Price (price strategies)
 - Promotion
 - Placement
- Innovation in design or packing (product) refers to all those innovations whose purpose is to enlarge the market but not variations in product use.
Example: change in flavour of yoghurts or change in milk packaging.
 - Innovation in price strategies (price) refers to variations carried out by a company in its product prices in order to enlarge the market.
Example: supermarket own brands
 - Innovation in promotion is the implementation of new methods in the way products are advertised.
Example: the introduction of advertising in television series.
 - Innovation in points of sale (placement) is the implementation of new methods in product distribution channels.

Innovation in organisation: this is the implementation of a new organisational method in company business practices, workplace organisation or external relations.

Example: redistribution of employee duties, any training practice for the worker, agreements with other companies, etc.

This may affect data comparison since there are expected to be transfers from some types of innovation to others when companies find that their activities fit better with new types of innovation. One example of this aspect may be the introduction of a change in flavour, which was previously considered a product innovation, with the new Manual where this change in flavour does not change the use and it merely aims

to increase the number of consumers, it will be considered to be a marketing innovation.

DEFINITION PROBLEMS IN THE DETERMINATION OF INNOVATIONS

Determining what is new and important

The main criteria that allow us to distinguish an innovation from minor modifications to products and processes are new features and importance. The difference between new and old, between important and non-important, is without a doubt very difficult to establish, and must be determined by those who respond to the survey.

One of the criteria of innovation is that the product must have been launched onto the market as a new product or as a significant improvement of an old product. Aesthetic or style innovations (such as a change in colour or change in decoration) constitute a marketing innovation. Product differentiation (such as minor changes in their design or presentation that do not imply a change in their construction or in their features) also constitutes a marketing innovation.

Product differentiation

Some minor technical or aesthetic modifications do not constitute product innovation. The differentiation of a product may constitute or not an innovation according to whether the changes notably modify the features, properties, the cost or the use of the product's materials and components.

For example, within the textile sector, the modification of a mixture of synthetic or natural fibres may be considered an innovation, in contrast with a new colour or a new design. Food products prepared with new ingredients, or with a different composition, or thanks to new food conservation methods, may be considered product innovations. The introduction of a new flavour to an existing range -for example, a new fruit essence for a yoghurt product range- constitutes marketing innovation, but is not considered a product innova-

tion. This is a field where there evidently exist numerous definition problems that can solely be resolved by those responding to the survey.

The case of personalised production

Companies that have a personalised production sector or which manufacture unique products (frequently complex) at the request of clients, must analyse each product to determine if they respond to the pre-requisite conditions in the above definitions.

It will be possible to maintain, as innovation criterion, the fact that the planning phase of the product implies the construction and the testing of a prototype or of other R&D activities destined to changing at least one attribute of the aforementioned product. If the attributes of this unique product do not differ from the products previously manufactured by the company, this does not constitute product innovation.

Change of organisation

The computerising of sales in the finance department of a company must not appear among organisational innovations. In the same way, complete reorganisation of the company or reorganisation of the workshops constituting an organisational innovation. On the other hand, the introduction of *just in time* systems must be considered an innovation (reorganisation of the production process by which in each phase, from production up until delivery to the client, the process adapts to the clients' demand, avoiding storage costs).

Machinery and equipment

Innovation, in particular innovation processes, frequently imply the installation of new machinery and new equipment. Three cases may arise:

The installation of *machinery and equipment that improves the production methods* of the company constitutes process innovation. The cost of the equipment is recorded as an established cost of the innovation.

The installation of the *machinery and equipment necessary for the manufacture of a new product* but which does not improve the production methods (for example a new moulding or packaging machine) does not constitute process innovation. The cost of the equipment, however, is recorded as an established cost of the innovation.

Other machinery and equipment purchases must not be considered process innovation nor recorded as innovation costs. For example, increasing production capacity adding machinery of a model already in use, or replacing antiquated machines with a newer model, does not constitute innovation.

ACTIVITIES PERFORMED FOR TECHNOLOGICAL INNOVATION

We are dealing with a combination of activities that lead to the development or introduction of technological innovations. The following seven activities are considered: Internal scientific research and technological development (R&D); R&D acquisitions (external R&D); acquisition of machinery, equipment, hardware and software; acquisition of other external knowledge; training; launching innovations onto the market; design, other preparations for production and / or distribution.

Internal scientific research and technological development (R&D) includes current and capital expenditure effected within the company, irrespective of the origin of the funds. Expenditure occurring outside the company that does not constitute R&D, but in support of internal R&D tasks, will also be included. This definition coincides with that included within the Statistic on Scientific research and technological development (R&D).

External R&D expenditure consists of those costs occasioned by the acquisition of R&D from outside the company by means of a contract or agreement.

The acquisition of machinery, equipment, advanced software and buildings comprises advanced machinery, equipment and hardware or advance software and buildings purchased specifically for creating new or slightly-improved products (goods / services).

The acquisition of other external knowledge includes the purchase of the rights to use patents and non-patented inventions, licences, know-how (non-patented knowledge), trademarks, software (computer programs) and other types of knowledge from other organisations that is used for innovation within companies.

Training consists of the internal or external training given to the personnel directly involved in the development and / or introduction of innovations.

Launching innovations onto the market is defined as the internal or external commercialisation activities (marketing) that are directly related to the launch onto the market of new or noticeably improved products (goods / services).

Design and other preparations for the production and / or distribution includes other technical procedures and preparations for the effective carrying out of product innovations (goods / services) and processes not included in other sections.

INTERNAL SCIENTIFIC RESEARCH AND TECHNOLOGICAL DEVELOPMENT (R&D) ACTIVITIES

This is defined as the set of creative work that is undertaken systematically with the objective of increasing the volume of knowledge, including the knowledge of man, culture and society, as well as the use of this sum of knowledge to conceive new applications. The term R&D comprises three activities: basic research, applied research and experimental development.

Basic research consists of original, experimental or theoretical work that is mainly undertaken to obtain new knowledge on the essentials of phenomena and observ-

able facts, without being directed at a specific application or use.

Applied research also consists, in turn, of the realisation of original work to acquire new knowledge. However, it is mainly directed towards a specific practical objective.

Experimental development consists in systematic work based on existing knowledge derived from research and / or practical experience, directed at the manufacture of new materials, products or devices, to the setting up of new processes, systems and services, or to the substantial improvement of those already in existence.

All personnel directly employed in R&D must be accounted for, as well as those persons that provide services directly related to R&D activities, for example, directors, administrators and office personnel. The *Proposal for practical standards for experimental research and development questionnaires*, better known as the Frascati Manual, classifies staff in R&D by occupation into: researchers, technicians and / or similar personnel and other (assistant) personnel.

Researchers are professionals who work on the conception or creation of new knowledge, products, processes, methods and systems, and on the management of their respective projects (including post-graduate students who carry out R&D activities).

Technicians and / or similar personnel are persons whose main tasks require technical knowledge and experience in one or various fields, engineering, physical and life sciences, or social sciences and humanities. They participate in R&D, carrying out scientific and technical tasks that require the application of operational methods and principles, generally under the supervision of researchers.

Auxiliary personnel (remaining personnel) includes workers, both qualified and unqualified, and secretaries and office personnel, who participate in the execution of

the R&D projects, or whom are directly related to the execution of said projects.

A partir del año de referencia 2008, han de incluirse como personal de I+D, de forma desglosada, los consultores "in situ", entendiéndose como tales las personas que, sin pertenecer al personal propio de la empresa, se encuentran realizando tareas de I+D dentro de la misma.

Internal R&D expenditure includes all current costs (personnel costs and other current costs) and the capital costs of companies in R&D programs (instruments and equipment together with land and buildings, and the acquisition of specific software for R&D).

REGIONALISATION OF THE RESOURCES

To ascertain the special distribution of the resources destined to R+D, a regionalisation by Autonomous Community of expenditure and R+D personnel is carried out. Therefore, it is requested that companies which have carried out the aforementioned R&D and innovation activities (el gasto sólo se mide en términos de innovación tecnológica) in a number of establishments located in different Communities, distribute the expenses and personnel among those Communities in which the aforementioned activities have been carried out. To this end, expenditure that may be considered common to different company units, are distributed geographically according to the percentage that the company considers corresponds to each unit.

COOPERATION IN TECHNOLOGICAL INNOVATION

Cooperation in technological innovation is defined as the active participation in joint innovation projects (including R&D) with other organisations. These organisations may be both companies as well as non-commercial institutions. It does not necessarily imply that both parties will obtain immediate commercial profits from said cooperation. The simple contracting of work outside the company, without the

active collaboration of same, is not considered cooperation.

It is of interest to find data referring to cooperation in research with other institutions, both in Spain and abroad, with different countries or groups of companies, for which the Innovation Survey defines the cooperation by the type of interlocutor and the country where he or she is located.

Type of party:

- Other companies of the same group
- Suppliers of equipment, material, components and software
- Private sector clients
- Public sector clients
- Competitors or other companies in the same branch of activity
- Consultants or commercial laboratories or private institutes
- Universities or other higher education institutions.
- Public research bodies
- Public or private Research Centres

PATENTS

a patent is a title that recognises the right to exclusively exploit a patented invention, preventing others from the manufacturing, sale or use of said invention without the consent of the holder.

The patent may refer to a new procedure, new apparatus, a new product or the perfection or improvement of same. The duration of a patent is twenty years as from the date upon which the application was filed. Once granted, to maintain the patent in force it is necessary to pay annual fees.

Patents filed or patents obtained are not indicative of the results of innovation, but rather indicators of product innovation. However, studying this is essential for

obtaining greater knowledge on the innovation process.

2.5 Sample design

The population framework of the IS is the Central Companies Directory (CCD). This is an organised information register with identification, localisation and territorial distribution data, and classification by size and economic activity of company type units, obtained from administrative sources and complemented by other information that stems from current INE statistical operations.

Similarly, due to the coordination of the R&D Statistics and the IS, the survey has included within the population scope the directory of companies that potentially might carry out research. We are dealing with a registry of companies that potentially carry out R&D activities, be it because it is on record as such in previous years' statistics, or because they have applied for public financing to carry out R&D during the reference year of the survey. With the object of updating this directory, information is requested annually from the State Administration bodies and from all the Autonomous Communities on the entities that receive public R&D funds. This information is cross-referenced with the previous year's directories, incorporating new registrations and modifications, and delistings.

Considering the previously defined population scope, the population of companies under study in this survey has been structured by crossing the following variables:

- a) Belonging to the directory of companies that potentially might carry out research, which is analysed exhaustively.
- b) Size of the company: The following intervals are considered, depending on the number of employees:
 - Between 10 and 49
 - Between 50 and 199
 - 200 and over

The strata constituted by companies with 200 or more employees has been analysed exhaustively.

c) Branch of main activity according to CNAE-2009: The 59 divisions or activity groups that appear in table 1 are considered. Its enumeration is detailed in this table.

d) Autonomous Community where the corporate headquarters of the company is located.

The final sample obtained was 38,491 companies. In each stratum an automatic selection was made with negative coordination in time, as well as with the rest of the structural surveys from the same year.

Table 1. Divisions of activity groups for the stratification and correspondence with the National Classification of Economic Activities (CNAE-2009)

Divisions and activity groups	NCEA-2009
1. Agriculture, Crop and animal production, Forestry and Fishing	01, 02, 03
2. Extraction of anthracite, coal and lignite	05
3. Extraction of crude petroleum, natural gas	06
4. Extraction of metallic mineral products	07
5. Other extractive industries	08
6. Actividades de apoyo a las industrias extractivas	09
7. Food industry	10
8. Fabricación de bebidas	11
9. Tobacco	12
10. Textil	13
11. Textil industry	14
12. Leather and footwear	15
13. Wood and Cork (except furniture; basketwork and wickerwork)	16
14. Paper industry	17
15. Graphic arts and reproduction	18
16. Coke and petroleum refinement	19
17. Chemical industry	20
18. Manufacture of pharmacy products	21
19. Manufacture of rubber and plastic products	22
20. Manufacture of other non-metallic mineral products	23
21. Metallurgy; manufacture of iron, steel and ferro-alloys	24
22. Manufacture of metallic products (except for machinery and equipment)	25
23. Manufacture of computer, electronic and optical products	26
24. Manufacture of electrical material and equipment	27
25. Manufacture of electrical material and machinery	28
26. Manufacture of motor vehicles, trailer and semi-trailer	29
27. Manufacture of other transport material	30
28. Manufacture of furniture	31
29. Other manufacturing activities	32
30. Repair and installation of machinery and equipment	33
31. Electrical power, gas, steam and air-conditioning supply	35
32. Water supply, waste management and decontamination activities	36
33. Collection and treatment of waste water	37
34. Collection, treatment and disposal of waste; valuation	38
35. Decontamination activities and other waste management services	39
36. Construction, civil engineering, specialised construction activities	41, 42, 43
37. Sale and repair of motor vehicles and motorbikes	45
38. Wholesale trade and trade intermediaries (except motor vehicles and motorbikes)	46
39. Retail commerce (except motor vehicles and motorbikes)	47
40. Land transport and transport via pipelines	49
41. Sea and river transport	50
42. Air transport	51
43. Storage and transport support activities	52

44. Post and courier activities	53
45. Accommodation services and food and beverage services	55, 56
46. Edition	58
47. Motion picture, video and TV production, sound recording and music publishing. TV and radio programming and broadcasting activities	59, 60
48. Telecommunications	61
49. Programmation, consultancy and other computer activities	62
50. Information services	63
51. Financial and insurance activities	64, 65, 66
52. Real estate activities	68
53. Professional, scientific and technical activities; administrative activities and support services	69, 70, 73, 74, 75, 77, 78, 79, 80, 81, 82
54. Architecture and engineering technical services; Technical trials and analysis	71
55. R+D	72
56. Health activities, social services; Arts, recreation and entertainment activities, computer repair, personal effects and domestic use; other personal services	86, 87, 88, 90, 91, 92, 93, 95, 96

It should be taken into account that the publication of the results of the Survey is carried out according to a structure of agroupation activity different from the specified by Table 1.

The abovementioned structure is detailed in the Table 2 below:

Table 2. Group of activities included in the IS and its correspondence with the National Classification of the Economic Activities (NCEA-2009)

Activity branch	NCEA-2009
AGRICULTURE	01 a 03
1. Agriculture, Crop and animal production, Forestry and Fishing	01, 02, 03
INDUSTRY	05 a 39
2. Extractive and petroleum industries	05, 06, 07, 08, 09, 19
2.1. Extractive industries	05, 06, 07, 08, 09
2.2. Petroleum industries	19
3. Food products, beverages and tobacco	10, 11, 12
4. Textil, clothing, leather and footwear	13, 14, 15
4.1. Textil	13
4.2. Clothing	14
4.3. Leather and footwear	15
5. Wood, paper and graphic arts	16, 17, 18
5.1. Wood and cork	16
5.2. Cardboard and Paper	17
5.3. Graphic arts and reproduction	18
6. Chemistry	20
7. Pharmacy	21
8. Rubber and plastic products	22
9. Non-metallic mineral products	23
10. Metallurgy	24
11. Metallic products	25
12. Computer, electronic and optical products	26
13. Electrical machinery and material	27
14. Other machinery and material	28
15. Motor Vehicles	29
16. Other transport material	30
16.1. Naval construction	301
16.2. Aircraft and spacecraft construction	303
16.3. Other transport equipment	30 (exc. 301, 303)
17. Furnitures	31
18. Other manufacturing activities	32
19. Repair and installation of machinery and equipment	33
20. Energy and water	35, 36
21. Water supply, waste management and decontamination activities	37, 38, 39
CONSTRUCTION	41 a 43
22. Construction	41, 42, 43
SERVICES	45 a 96
23. Trade	45, 46, 47
24. Transport and storage	49, 50, 51, 52, 53
25. Accommodation	55, 56
26. Information and communication	58, 59, 60, 61, 62, 63
26.1. Telecommunication	61
26.2. Programmation, consultancy and other computer activities	62
26.3. Other information and communication activities	58, 59, 60, 63
27. Financial and insurance activities	64, 65, 66
28. Real estate activities	68
29. Professional, scientific and technical activities	69, 70, 71, 72, 73, 74, 75
29.1. R+D services	72
29.2. Other activities	69, 70, 71, 73, 74, 75
30. Administrative and support service activities	77, 78, 79, 80, 81, 82
31. Health activities and social services	86, 87, 88
32. Arts, recreation and entertainment activities	90, 91, 92, 93
33. Other services	95, 96

Provided that the potentially researcher units are researched comprehensively, the following branches are also included within the population scope of the survey:

CNAE-2009	Literal
85 (except 854)	Education (except Postsecondary Education)
94	Associative activities

Note: As it is collected in a coordinated manner with the Statistics on Scientific Research and Technological Development (R&D), companies that stated to have carried out R&D activities are selected with probability 1 and, when collecting the information for R&D, companies with less than 10 employees in all branches of activity are included, except for the groups of the CNAE 84 and 854.

ESTIMATORS

The estimator of the total of a characteristic X in domain m is given by:

$$\hat{X}_m = \sum_{j \in m} X_j \cdot F_j,$$

where X_j is the value of the characteristic X from questionnaire j belonging to domain m.

F_j is the elevation factor from questionnaire j that is calculated as follows:

a) If the company j was selected in stratum h and according to the questionnaire it is included within the different stratum k,

$$\text{then: } F_j = \frac{N_h}{n_h} \quad (1)$$

b) If the company j continues to belong to the same stratum h, where it was selected,

$$\text{then: } F_j = \frac{\hat{N}_h^*}{n_h} \quad (2)$$

c) In specific cases that are appropriately specified $F_j=1$ (3)

Variables used

N_h , number of companies in stratum h.

n_h , number of companies selected in stratum h.

$n_{h,r}^*$, number of companies that have replied, selected in stratum h and that have not changed stratum.

$$\hat{N}_h^* = N_h \left(1 - \frac{n_h}{N_h} \right) - \sum_{k \neq h} \sum_{j=1}^{n_h^k} F_j$$

being n_h^* the number of companies selected in stratum h and which have the following incidents: temporal closure or they are duplicated.

$n_{h,r}^k$, number of companies selected in stratum h, and which according to the questionnaire are in the different stratum k.

Sample errors are also calculated by expressing the variation of the estimator of the total stratified sample.

2.6 Collection of the information

The collection of the IS-12 questionnaires is distinguished for being coordinated with the collection of the Industrial Companies Survey, the Annual Services Survey, the Industrial Products Survey and the Survey on the use of Communications and Information Technology, and E-Commerce in companies has been carried out by Centralised Collection Unit (CCU).

The follow-up of the calendar of the field work and the quality control of the information has been carried out from the Central Services of the INE. The percentage of non responses has been 7.75 per cent.

The personnel involved in the survey work are compelled by law to preserve statistical secrecy.

The survey inspectors are responsible for the theoretical and practical training of the personnel involved in same, and for the control of the work relating to the collection of the information. To this end, the corresponding manuals and training and enquiry documents are prepared.

A presentation letter of the survey is sent to the informing units, without a hard copy questionnaire, which includes a user name and a password in order to complete the questionnaire online. Since 2013, the access to the online completion is made through the protocol secure website <https://iria.ine.es>

When the letter is received, companies have a period of 15 days to complete and send the questionnaire.

From URCE a first telephone contact is established with the company to verify that the questionnaire has been received. If the established period has passed, and the completed questionnaire has not been

received, the necessary telephone and written claims are carried out.

The Innovation Survey on companies is contemplated within the National Statistical Plan as a statistic of obligatory compliance.

From URCE an integrated information collection procedure is carried out, which consists in the filtering and recording of the data as soon as the information is received. If required, the necessary clarifications are requested from the company with respect to the data provided.

2.7 Processing of results

The information processing phase is the following:

- Control and manual filtering of the questionnaires by the units involved in the collection of the information, with the objective of recovering the possible lack of data or correcting errors in the questionnaires before they are recorded.
- Interactive recording with filtering and correction of the errors in the information obtained by the units involved in the collection of the information.
- Control of the information received by the department promoting the survey.
- Control of the scope and processing of identification errors.
- Validation of the quality of the information.
- Imputation of partial non responses.
- Filtering and interactive collection of inconsistencies in the validated information.
- Compilation of a first phase of results analysis tables.
- Macro publishing of the main aggregates to correct the errors not detected in the previous micro filtering phase.

- Analysis of the data.
- Creation of a final data file.
- Obtaining of final results tables in the department promoting the survey compiled from the final data file.

2.8 Tabulation of results

The use of the results tables in this publication has been structured in the following manner:

- General results
- Detailed results for industry
- Detailed results for services

The tabulation is presented bearing in mind three classification variables:

- Main activity group, according to NCEA-93 rev. 1 codes.¹
- Dimension of the company according to occupied personnel.
- Autonomous Community (since 2005)

This structure is similar to that followed in the publications of the Industrial Companies Survey and the Annual Services Survey, with the purpose of allowing, where possible, and safeguarding statistical secrecy, the integration of the results of both studies.

The main results are presented in this publication, which allows for an overall view of innovative activity and which may be useful to the different users of this information. Moreover, current computer tools means that it is possible to meet the information needs of international organisms (OECD, EUROSTAT, UNESCO), of national organisms and individual users, through personalised requests of aggregated data, which may be provided in the medium or format chosen by the user, provided that statistical secrecy is maintained.

This publication is available on paper, electronic medium and on the web page of

the National Statistics Institute
(www.ine.es/en/welcome_en.htm).