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 ben 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 branchs 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 Technological 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 an-

nuall 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.

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.

The EIS consists of 17 indicators, in the majority stemming from official statistics, which are grouped into the following four classes: Human resources; Knowledge production; Transmission and application of new knowledge; and Financing of innovation, results and market. The complete list of indicators is shown below:

1. HUMAN RESOURCES

1.1. Advanced degrees in science and technology (20/29 years).

1.2. Population with higher education.

1.3. Participation in life-long learning activities.

1.4. Employment in the high and medium-high technology industry.

1.5. Employment in high technology services.

2. KNOWLEDGE PRODUCTION

2.1. Public expenditure on R&D as a percentage of GDP.

2.2. Private expenditure on R&D as a percentage of GDP.

2.3. A. EPO patents of high technology on the population.

2.3. B. USPTO high technology patents as a percentage of the population.

3. TRANSMISSION AND APPLICATION OF NEW KNOWLEDGE
EXTERNAL

3.1. SMSE's with internal innovation.

3.2. SMSE partnership in innovation.

3.3. Innovation expenditure on total sales.

4. FINANCING OF INNOVATION, RESULTS AND MARKETS-

4.1. Risk-capital in high technology as a percentage of GDP.

4.2. New capital obtained as a percentage of GDP.

4.3. New sales on the market.

4.4. Households connected to the Internet.

4.5. CIT expenditure as a percentage of GDP.

4.6. Added value of the high technology industry.

Finally, the EIS is complemented with six technical documents:

– Document 1. Member countries and associated countries: Detailed results of the data and current trends, innovation leaders, strengths and weaknesses by country, analysis of convergence / divergence.

– Document 2. Candidate countries: Analysis of the situation of these countries, in a similar manner to that set out in document 1.

– Document 3. EU Regions: Currently available results on EU regions.

– Document 4. Indicators and definitions: Complete definition and graphs on all the indicators.

– Document 5. Thematic chart on *life-long learning for innovation*. Prototype of a complementary chart on this theme.

– Document 6. Methodological report: General perspective of five different methods to construct compound indices, similarities and differences between the EIS and other European charts.

2. Methodology

2.1 Objectives

This study attempts to offer, as its main objective, direct information on the technological 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 the technological 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.

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 NCEA-93 Rev.1:

– Agriculture, livestock, game, forestry and fishing 05)

– Extractive Industries (10 to 14)

– Manufacturing Industries (15 to 37)

– Electricity, gas and water (40 and 41)

– Construction (45)

– Trade and Catering (50 to 55)

– Transport, storage and communications (60 to 64)

– Financial intermediation (65 to 67)

– Computer activities (72)

– Research and development (73)

– Other corporate services (70, 71 and 74)

– Motion picture and video activities (921)

– Radio and television activities (922)

– Other health, social, collective activities,...(85, 90, 92 except 921 and 922, and 93)

Note: Since 2006 agriculture has been included.

TERRITORIAL

This extends to all of Spain.

TEMPORAL

It is carried out annually.

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

The main reference period of the statistic is the year immediately prior to its execution. Nevertheless, the variables related to technological innovation implemented by companies refer to the three years prior to the elaboration of the statistic, 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 activities 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.

It coincides with the total amount resulting from the sum of sales (counted in net terms deducting refunds, as well as volume discounts on sales. Not deducted are cash discounts nor discounts for prompt payment goods manufactured by the company itself (or by third parties, via subcontracted production), whether they are finished, semi-finished products or by-product, waste or recyclable material, plus net sales of goods or merchandise acquired by the company for subsequent sale without transformation, plus the amount for rendering services to other companies (including subcontracting income).

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, professional 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 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 headphones 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 subsystems 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 TIS, technological innovation is studied with reference to the years t, t-1 and t-2.

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. 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.

As far as innovative activities are concerned, besides those covered, preparation for Marketing innovations and preparation for Organisational innovations are added.

Therefore the set of innovative activities taken from the new Manual is as follows:

- Internal R&D
- Acquisition of R&D (External R&D, includes the acquisition of R&D by companies in the same group).
- Acquisition of other external knowledge for innovation.
- Acquisition of machinery, equipment and software.
- Introduction of innovations in the market.
- Training.
- Other preparations for production and/or distribution.
- **Preparation for Marketing Innovations.**
- **Preparation for Organisational Innovations.**

Another new feature introduced is the difference in being considered an ***innovative company***. In the previous Manual a newly-created company in the reference period was considered to be an innovative company. Following the instructions in the new Manual, a newly-created company in the reference period will only be considered to be innovative if it introduces new features to the market.

As far as implementation of the new Manual is concerned, it will depend on the frequency of the Innovation Survey in the different countries. Many countries carry it out every four years, therefore in those countries the Manual will be applied in the survey for the reference year 2008, which will be carried out in 2009.

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 innovation. 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 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 and software comprises advanced machinery, equipment and hardware or software 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 observable 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 postgraduate 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.

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 in a number of establishments located in different Communities, distribute the ex-

penses 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 Technological 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

– Clients

– Suppliers of equipment, material, components and software

– Competitors or other companies in the same sector

– Consultants, commercial laboratories or private institutes

– Universities or other higher education institutions.

– Public research bodies

– Technological 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.

Essentially there are three forms in which international patent applications may be filed:

National: By means of the filing of a patent application in each one of the states in which protection is sought. For example at the Spanish Patent and Trademark Office (SPTO)

European: The European Patent system allows for protection to be obtained by means of a direct European patent application with the designation of those European States in which protection is sought, and which are a part of the European Patent Convention (24 countries). The European patent application is processed by the European Patent Office (EPO) and the granting of the patent has the same effect as a national patent in all those states in which it is granted.

International PCT (Patent Co-operation Treaty): The PCT system allows for protection to be claimed for the invention in each one of the States which are party to the international treaty (115 countries as of 1st January 2002), by means of one sole application known as international application.

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.

With regard to this issue, it is also possible to ask the company on their general policy in the area of patents, so as to ascertain whether:

– They rarely deposit patents.

– They solely patent the most important discoveries or a small proportion of discoveries, and only in their field of activity.

– For numerous activities they trust the protection obtained via patents, but in other cases they opt for factory secrecy.

– They patent almost all their discoveries that, in their opinion, are likely to have commercial potential.

– They patent many discoveries for which the commercial potential cannot be observed in the short term.

– They patent many discoveries with respect to which it is desirable to prevent their competitors from obtaining exploitation rights.

The responses to these questions allow for an evaluation of business policy in the field of patents. From here it will be possible to evaluate the trends in the number of patents filed and the number of patents granted.

2.5 Sample design

The population framework of the TIS 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.

This directory, updated annually with the information provided by the State Tax Office and Social Security Office, as well from their own surveys, complies with sufficient requirements so as to be used as the basis for the TIS.

Similarly, due to the coordination of the R&D Statistics and the TIS, 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 NCEA-93 Rev.1: The 45 divisions or activity groups that appear in table 1 are considered.

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

The final sample obtained was 42,480 companies. In each stratum an automatic selection was made with random start, ordering companies by size, NCEA and Autonomous Community.

Chart 1. Groups of activities included in the TIS

Sports	NCEA
Agriculture, livestock, game, forestry and fishing	01 + 02 + 05
Extractives	10 + 11 + 12 + 13 + 14
Food products and beverages	15
Tobacco	16
Textile	17
Clothing and furs	18
Leather and footwear	19
Wood and cork (except furniture)	20
Paper	21
Publishing, graphic arts and reproduction	22
Manufacture of coke oven products, petroleum refinement	23
Chemistry	24
Rubber and plastic products	25
Non-metallic mineral products	26
Metallurgy	27
Metallic products (except machinery and equipment)	28
Mechanical machinery and equipment	29
Office machines and computers	30
Electrical machinery and material	31
Electronic Material; Radio, TV and communications Equipment and apparatus	32
Medical, precision and optical instruments	33
Motor vehicles	34
Other transport material	35
Furniture and other manufacturing industries	36
Recycling	37
Production and distribution of electricity, gas and water	40+41
Construction	45
Sale and repair of motor vehicles	50
Wholesale trade	51
Retail commerce	52
Accommodation	55
Land transport; transport via pipelines	60
Sea, air and space transport	61+62
Activities incidental to transport, travel agencies	63
Post and courier activities	641
Communications services	642
Financial intermediation	65+66+67
Real estate activities	70
Renting of machinery and equipment	71
Computer activities	72
Research and development	73
Other business activities	74 (exc.742 and 743)
Architecture and engineering technical services	742
Technical trials and analysis	743
Motion picture and video activities, radio and television	921+922
Other health, social, group activities, ..	85+90+(92-921-922)+93

ESTIMATORS

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

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

b) If the company j continues to belong to the same stratum h, where it was selected, then: $F_j = \frac{\hat{N}_h^*}{n_h^*}$ (2)

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

Variables used

N_h, number of companies in stratum h.

$_nh$, number of companies selected in stratum h.

n^*_h, 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: they correspond to closures, are not industrial, they are duplicated or correspond to self-employed persons.

n^k_h, 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 TIS-05 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). However, due to the lack of resources, part of the collection has been carried out via an external company.

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 9.4 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.

The questionnaire is forwarded by mail to the informing units, together with a presentation letter and the norms for the completion of same. Companies have a period of 15 days to return same duly completed.

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 Technological 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 stuctured 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).