

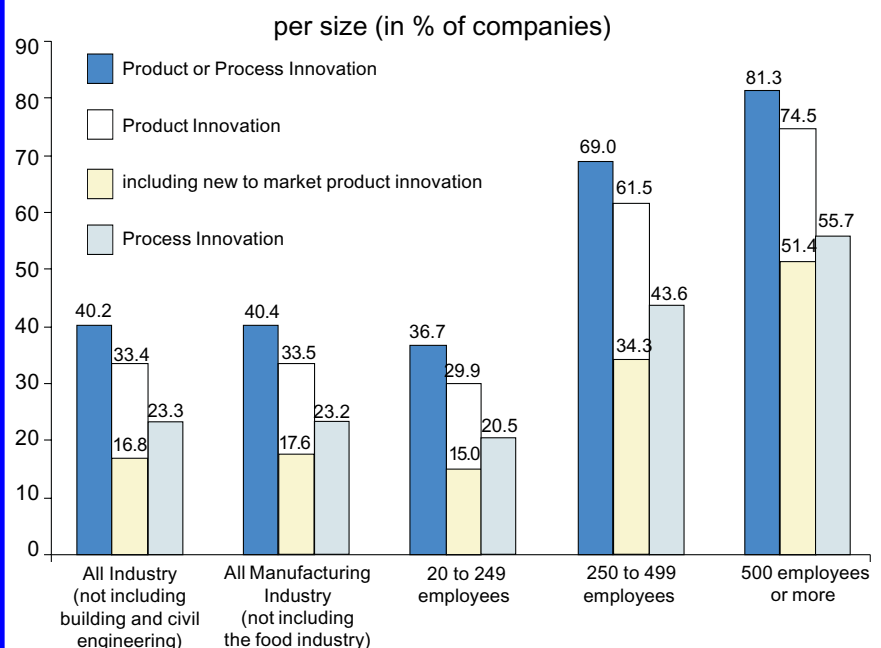
Technological Innovation in Industry

From 1998 to 2000, Four out of Ten Industrial Companies Innovated

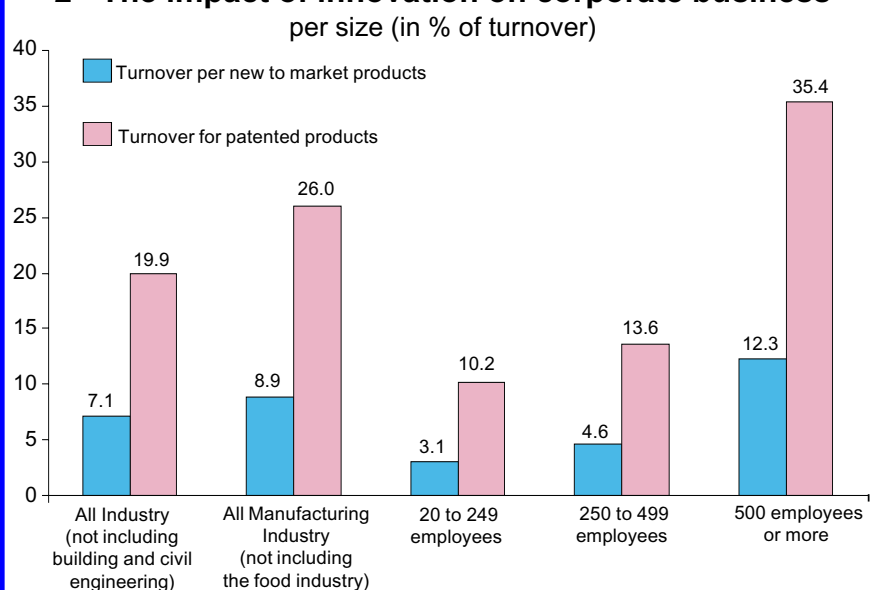
Industrial companies innovate primarily by introducing new products on the market. Electric and electronic equipment, pharmaceuticals, the chemical, home equipment and automobile manufacturing industries pioneered innovation. Innovating is a way of scoring points against the competition. The radically new products launched on the market from 1998 to 2000 generated nearly 9% of the manufacturing industry turnover. All the patented products accounted for slightly more than a quarter of the turnover. One-third of industrial companies deployed co-operations for their innovations, mainly with their customers, suppliers and the subsidiaries of their own group. Research and development activities produced many partnerships as well, often with public research organisations or universities. More than half the companies that innovated from 1998 to 2000 ran into hampering factors, mainly economic. One-third of the innovating companies received public funding, not including research tax credits.

From 1998 to 2000, more than 40% of the companies with 20 employees or more innovated in the manufacturing industry, not including the food industry. They earned 80% of the turnover of the entire industry. Practically all the big companies were innovative (see chart 1). These are the first conclusions of the third Community survey on innovation, based on the international definition found in the OECD Oslo Manual (see box 1).

1 - Innovation according to the international definition of the Oslo Manual



2 - The impact of innovation on corporate business



Scope: industrial companies with 20 employees or more (including the food industry and energy, not including building and civil engineering)
Source: SCEES-CIS3 survey, Sessi-CIS3

Mostly Product Innovation

Industrial companies mostly generated product innovation, nearly 34% of the companies and almost all the innovating companies. Electric and electronic equipment companies boasted intense innovating activities: 58% of the companies produced product innovation, with a focus on information technologies. This industry networked the entire economy with new products integrating advanced technologies that, in turn, have become the cornerstone for further innovations.

The drive in pharmaceuticals, fragrances and cleaning products, and chemical industries was very strong. Half of the companies in these industries innovated. The home equipment industry focused on offering its customers new products. Home appliances and sound and image equipment were particularly innovative sectors. The automobile manufacturing industry was not far behind with 41% of companies generating product innovation from 1998 to 2000 (see chart). Big companies launched several projects simultaneously to feed innovation, an average of fifteen in companies with more than 500 employees compared to an average of five projects for SMEs.

Deploying new processes was another facet of innovation for 23% of the industrial companies. The majority of the production processes are rolled out for the launch of innovating products. Accordingly, industries with a high output of innovating products also engineer process innovation. For instance in the chemical industry, more than one-third of the companies rolled out process innovation.

Radical Innovations, New to Market Products

18% of the industrial companies launched new to market products. Again, the electric and electronic equipment and pharmaceutical industries were at the forefront of this kind of innovation. More than one-third of the companies in both these industries introduced new to market products. More than half the big companies with more than 500 employees offered products that had no market equivalent.

On the other hand SMEs drew on existing products for their innovations. They were involved in the dissemination of technological advances throughout the economic fabric. Only 15% of the companies with fewer than 250 employees marketed new to market products.

1 – Measuring Innovation

Third Community Innovation Survey (CIS3)

The third Community Innovation Survey (CIS3) was launched jointly in every European country. It covers a large share of the French economy over the 1998-2000 period.

In the industrial sector alone, the survey covered companies with 20 employees or more including the food industry and energy but not the building trade. *De facto*, start-ups and companies in the works were not widely represented because they employ but few people. Roughly 5,500 companies were surveyed in the manufacturing industry (not including the food industry). 86% of the enterprises answered; they earn 89% of the turnover in the manufacturing industry.

Product Innovation, Process Innovation

The innovation concept is defined in the OECD Oslo Manual. The concept makes international comparisons possible. The OECD definition is more restrictive than the definition qualifying for public funding. The vast majority of the accepted innovations are technological in the strict sense of the word (*see table below*). The innovations may also be the result of improvements or of the supply of new services for the products ('service' innovations).

Product innovation is the market introduction of a product (goods or services) that is new or significantly changed in terms of core characteristics, technical specifications, built-in software or any other immaterial component or the intended use or ease of use.

Process innovation comprises the introduction of a new or significantly changed production process, service supply method or product delivery method into the company. The result must have a significant impact on the level of production, the product quality or the production and distribution costs.

The international definition does not include purely aesthetic changes such as the design or fashion trends, organisational changes or packaging alterations. These changes are taken into consideration for overall innovation.

Innovation may result from a product or process that is new to the company but not to the market. This applies when a company adopts a technology that is already used by a rival. On the other hand, a new to market product has no earlier equivalent.

Innovation according to different concepts

(in % of industrial companies)	Manufacturing Industry (not including the food industry)	Manufacturing Industry (including the food industry)	Industry (not including building and civil engineering)
Technological Innovation (restrictive definition)	36.4	36.0	36.0
Innovation - international definition (1)	40.4	40.3	40.2
Broad Innovation (2)	42.8	43.4	43.3
Attainable Innovation (3)	45.5	45.6	45.4
Overall Innovation (4)	54.7	55.4	55.2

Source: SCESS-CIS3 survey, Sessi-CIS3.

Scope: industrial companies with 20 employees or more (including the food industry and energy, not including building and civil engineering)

(1) according to the OECD Oslo Manual. This definition includes technological innovation (restrictive definition) and 'service' innovation or innovation through improvement

(2) International definition and design innovation

(3) International innovation and ongoing projects

(4) Broad innovation and organisational changes (including new management and administrative methods, not including organisational chart alterations) and ongoing projects

Getting an Edge on the Competition

Innovation for four-fifths of the innovating firms was an essential means of conquering new markets or of increasing their hold on markets where they already did business. Innovation for three-fourths of these companies renewed product ranges and improved the quality of goods and services.

Innovation did not have as great an impact on production processes although its effect was still considerable. Innovation for half the innovating companies increased production capacity, made manufacturing chains more flexible, and lowered products costs. For one out of two innovating companies, it also helped them adjust to regulations and standards.

Innovation per Industry according to the International Definition of the Oslo Manual

(in % of industrial companies)	Product Innovation	Process Innovation	Product or Process Innovation	New to Market Product Innovation	Turnover in New to Market Products
Consumer Goods Industry	26.8	18.4	32.9	12.4	5.3
Clothing and leather Products	13.9	9.2	18.3	6.7	2.7
Publishing, Printing & Reproduction	16.6	18.3	25.9	5.7	0.3
Pharmaceuticals, Fragrances, and Cleaning Products	57.6	29.9	60.8	33.3	7.9
Home equipment	42.4	24.4	47.7	19.3	6.4
Automobile Manufacturing Industry	41.2	27.5	48.1	23.6	14.7
Capital Goods Industry	40.7	20.8	44.6	25.1	15.1
Shipbuilding, Aircraft and Railroad Construction	38.7	24.5	45.4	18.7	5.0
Mechanical Engineering Products	35.0	17.3	38.8	20.9	8.2
Electric and Electronic Equipment	58.3	30.7	61.9	39.1	26.4
Intermediate Goods Industry	33.5	17.7	38.6	15.4	2.8
Mineral Products	33.5	17.7	38.6	15.4	2.8
Textiles	34.4	18.2	37.0	13.4	3.1
Wood and Paper Industry	25.7	23.1	36.7	10.4	2.3
Chemicals, Rubber & Plastics	50.2	37.1	56.9	25.7	3.6
Metal Processing & Metalworking	21.8	25.5	33.8	11.4	2.9
Electric and Electronic Components	46.6	34.2	55.1	28.0	11.6
All Manufacturing Industry (not including the food industry)	33.5	23.2	40.4	17.6	8.9
Food industry	34.0	24.2	40.2	11.3	1.7
All Manufacturing Industry	33.6	23.3	40.3	16.8	7.8
Energy	18.3	21.5	29.7	12.6	2.8
All Industry (not including building and civil engineering)	33.4	23.3	40.2	16.8	7.1

Scope: industrial companies with 20 employees or more (including the food industry and energy, not including building and civil engineering)

Source: SCESS-CIS3 Survey, Sessi-CIS3.

■ Boosting Turnover

The radically new products introduced on the market from 1998 to 2000 generated nearly 9% of the turnover of the manufacturing industry in 2000 (see chart 2). These radical innovations had the most impact on business, accounting for more than half the turnover stemming from the introduction of innovations from 1998 to 2000.

Patents provide the economic protection of the radical, recent or older innovations. However, not all companies applied for patents. Patents accounted for 26% of the manufacturing industry turnover. Patents protected 42% of the turnover of the companies marketing radically new products.

Building on the fast-moving renewal of its car models, the automobile manufacturing industry earned nearly 15% of its turnover from new to market innovations that were marketed from 1998 to 2000, closely followed by the electric and electronic component industry. Pharmaceuticals were clearly lagging despite the huge breeding ground of innovating companies, probably due to the huge amount of earlier molecules launched before 1998. Actually, patented molecules account for 56% of the industry's turnover but it takes a long time before a new pharmaceutical product reaches market maturity, 27 months on average. Product maturity takes 16 months for the entire French industry and 23 months for the big companies.

Innovations have to break some consumer habits but they do remain on the market for a long time.

■ Forging Partnerships

One-third of industrial companies deploy outside co-operation for innovating. Their first choice is to join up with the company's usual partners: the subsidiaries of their own group and suppliers that are encompassed in the production network. One-fourth of the innovating companies forge this kind of partnership. Many pharmaceutical firms innovate within their group while the automobile manufacturing industry actively works with its equipment suppliers. Joint undertakings with customers are not as frequent.

Partnerships serve to carry out projects and to roll out efficient co-ordination with the upstream production chain. The information sources used for selecting innovating projects are very different from partnerships. The end-purpose of the information sources is to gain market positions; the sources are mainly in-house or come from customers. Competitors were the third information source for innovation. On the other hand, co-operative ventures are rarely forged with the competition and seldom range beyond the scope of the usual partners so as not to disclose any strategic information.

Partnerships are also active at the core of innovating projects during the research and development stage. Actually, companies innovate either by marshalling

existing knowledge or by generating new knowledge. Eighteen percent of innovating companies resorted to active partnerships to invent new knowledge. The partnerships are mainly forged with public research organisations and universities (16%). There are many more partnerships in pharmaceuticals with private research and development firms than average and are also extensively rolled out with universities or public research organisations (30% of the innovating companies).

Among the industries that spent the most on research and development, pharmaceuticals, electric and electronic equipment deployed more outside partnerships. Pharmaceuticals subcontracted two-thirds of their research and development, electric and electronic equipment subcontracted half whereas the manufacturing industry subcontracted less than a third of its R & D. On the other hand, shipbuilding, aircraft and railroad construction conducted all its research in-house. Between these two extremes and although the automotive and electric component industries mainly developed in-house research, they did, however, subcontract research to outside companies.

Two-thirds of the innovating industrial companies resorted most often to ongoing research and development and seldom to piecemeal operations. In-house research and development spending accounted for 13% of the added value of innovating companies.

Innovation without Research and Development

Industrial companies in low technology industries innovate without much research and development. In publishing and printing, a mere one-fourth of the innovating companies invested in research, while in clothing and leather, only one out of two. Hence, resorting to the market is critical. Printing and publishing companies mostly use the information supplied by equipment suppliers. The clothing firms conduct a strategic watch of their competitors. They also marshal information from professional intermediaries.

Public Funding Backing Innovation

The public authorities backed innovation locally, nationally or at the European level. From 1998 to 2000, 30% of the innovating industrial companies received public funding, not including research tax credits. The companies receiving funding earned slightly more than half the turnover of the manufacturing industry.

Very often, they received national funding. Also, 11% of the companies got regional funding from the local authorities while 6% received European Union funds intended to foster cross-border partnerships. The European funds benefited big companies to a slightly greater degree; 21% of the beneficiaries had more than 500 employees compared to an average 9% of the companies receiving public aid. From 1998 to 2000, the big companies accounted for more than a third of the beneficiaries of the 5th European Framework Programme for Research and Development.

■ Yann LHOMME

2 – Mainly Economic Barriers to Innovation

More than half the companies that innovated from 1998 to 2000 encountered hampering factors. 37% of the innovating companies in the manufacturing industry discarded their projects. 35% were plagued by major delays. 24% did not start their innovating projects. 22% were faced with other major difficulties but did not delay project rollout. At the same time, 6% of the companies in the manufacturing industry made absolutely no innovations from 1998 to 2000 because they ran up against huge barriers.

By definition innovation is a chancy investment where profitability is not always guaranteed. The companies discarding or not launching innovating projects did so mainly because of economic barriers. According to the 1999 survey on innovation funding, more than four-fifths of the companies ran into economic hampering factors.

On the other hand, companies that postponed their projects did so because of the lack of skilled personnel which was the most penalising barrier, even greater than economic stumbling blocks for over half the companies. Finding financial resources was also a barrier for 40% of the companies.

3 - Innovation, a Concern for Half the Non-Innovating Companies

Many industrial companies did not innovate from 1998 to 2000, nearly 60% according to the international definition. The companies were hardly inactive however. Some of them have projects in the works that are about to hit the market (8% of the non-innovating companies). Innovation takes times. Building an innovating project lasts an average of 13 months and even up to 22 months in big companies.

Furthermore, many industrial companies have already innovated but do not think it necessary to initiate the technological renewal of their products or processes. This was the case for one-fourth of the non-innovating companies. Two-thirds of the non-innovating companies felt their competitive advantage was sufficient and were satisfied with their market conditions.

The non-innovating companies were mostly SMEs with fewer than 250 employees. The small companies were mostly in low-tech industries: metalworking and metal processing, printing and publishing, clothing and leather where product renewal due to design is a major factor.

Suggested Reading

- LHOMME Y.: *Le financement de l'innovation technologique dans l'industrie* (Financing technological innovation in industry, in French), Chiffres clés Référence, Sessi, 2002
- The Oslo Manual, OECD-Eurostat, 1997
- French Innovation Scoreboard, www.minefi.gouv.fr/minefi/chiffres/innovation
- European Innovation Scoreboard, European Commission, www.cordis.lu/



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