



Innovation Activity of Finnish Industry 1988

1.3.1990

Pilot statistics on industrial innovation activities

The Central Statistical Office of Finland (CSO) has compiled a set of pilot statistics on industrial innovation activities. The data content is based on development work carried out in the CSO. The point of departure of the development work was provided by corresponding studies conducted in other countries, notably in the Federal Republic of Germany and Italy. During 1990, a comparative study will be conducted concerning the industrial innovation activities of the Nordic countries and a detailed research report will be prepared on Finland.

The statistics in this publication are of a preliminary nature. The structure of the publication is as follows:

- Description of the data set
- Innovational ideas, favourable factors, barriers
- Expenditure
- Results

1. The data set

The population of the statistics comprises industrial enterprises operating in Finland. For the purposes of sampling, the population was divided into the following four groups:

1. Large enterprises with own R & D (turnover in excess of FIM 200 million)
2. Small and medium-sized enterprises with own R & D (turnover FIM 10 – 200 million)
3. R & D-intensive small enterprises (minimum turnover FIM 0.1 million, R & D expenditure as a percentage of turnover in excess of 10 per cent)
4. Enterprises reporting no R & D activities (minimum turnover FIM 10 million)

A total of 377 questionnaires were sent out, addressed to an enterprise/concern or to a subdivision of an enterprise/concern. After exclusion of enterprises that had been closed or merged with some other enterprise, the proportion of acceptable responses was 58 per cent (205 in all). Table 1 shows the response rates of the four sample groups. The response rate was by far the lowest in

Group 4, about 40 per cent. In addition, about 78 per cent of respondents in this group reported internal R & D (the corresponding figure was about 93 per cent for all respondents). Thus, the weight of the statistics is heavily on enterprises with own R & D.

Table 1.
Respondents by sample groups

	Sample	Respondents	Response rate
Total	355	205	58
Large enterprises with own R & D	66	53	80
Small or medium-sized enterprises with own R & D	128	76	59
R & D-intensive small enterprises	38	27	71
Enterprises without R & D	123	49	40

2. Innovational ideas and barriers to innovation

Definitions:

Innovation activities refer to measures that introduce something essentially new to an enterprise's activities.

A **product innovation** refers to a product whose intended use, performance characteristics, technical properties, or materials and components use differ from the unit's previous products to the extent that it can be considered to be a new product or an essentially improved old product. A product innovation may include several incremental innovations relating to different components of the product.

Process innovation refers to the adoption of new production methods. The methods may be intended for producing new or essentially improved goods or for essentially increasing the production efficiency of existing goods. Acquisition and introduction of new types of machinery or equipment (but not the mere replacement or extension of existing processes) may also be regarded as instances of process innovation.

Both product and process innovations may derive from technologies based on R & D work or acquired by some other means.

To study the sources of innovation and the factors promoting or hampering innovation, the respondents were asked to rate the importance of a set of factors on a five-point scale, on which 1 denoted 'unimportant' and 5 'very important'. A factor is regarded as significant if rated 4 or 5.

Tables 2, 3 and 4 show, by size group of respondents, the proportions of respondents rating a factor as important. Size refers to personnel size as follows:

Small enterprises = less than 100 employees
 Medium-sized enterprises = 100 – 500 employees
 Large enterprises = more than 500 employees

Market factors – important incentives to innovation

The most important factors influencing the launching of innovation projects are requests from customers, the competitive situation, and marketing. About 67 per cent of respondents rate own R & D as essential for the generation of innovational ideas. About 35 per cent rate co-operation with other enterprises as an important source of innovational ideas. Co-operation with different research institutes and other bodies is rated less important.

Table 2.
Sources of innovational ideas: proportions of respondents rating a source as important

	Respon- dents 1)	Re- quests from cus- tomers %	Com- petitive situation %	Marketing %	Internal R & D %	Top man- age- ment %	Purchase of material tech- nology %	Production %	Co-oper. w/ other companies %	Trade fairs %
Total	205	87.1	78.9	72.1	67.3	59.3	43.2	35.5	35.4	34.5
Small enterprises	88	83.7	72.4	66.7	65.1	65.9	42.9	34.5	33.7	31.4
Medium-sized enterprises	63	88.7	82.5	74.6	66.1	56.5	49.2	40.3	35.5	36.5
Large enterprises	54	90.7	85.2	77.8	72.2	51.9	37.0	31.5	37.7	37.0
	Respon- dents 1)	Legis- lation %	Co-oper. w/ suppliers %	Co-oper. w/ Finnish univers- ities %	Purchase of imma- terial tech- nology %	System of encou- raging initiative %	Co-oper. w/ con- sultants %	Co-oper. w/ Tech- nical Research Centre of Finland %	Co-oper. w/ foreign univers- ities %	Govern- ment order %
Total	205	29.4	28.9	23.4	22.5	14.5	14.1	11.8	9.3	6.7
Small enterprises	88	25.3	31.4	21.7	20.0	17.7	15.3	13.6	9.5	12.7
Medium-sized enterprises	63	31.1	19.7	18.0	19.7	8.3	16.7	6.6	3.6	3.3
Large enterprises	54	34.0	35.2	32.1	29.6	16.7	9.4	15.1	15.1	1.9

1) A number of respondents, less than five per cent, failed to supply information on some individual items.

In large enterprises, internal R & D, purchases of immaterial technology, and co-operation with universities were rated higher than in small and medium-sized enterprises (see Table 2).

Co-operation between R & D, marketing and production – an important requirement for the success of an innovation project

Prominent among factors promoting innovation are internal co-operation between R & D, marketing and production, and the commitment and participation of the top management. Co-operation with other enterprises was more important than co-operation with universities or research institutes.

Co-operation with both foreign and Finnish universities and other research institutes was more important for large enterprises than for small and medium-sized enterprises (see Table 3).

As a source of innovational ideas or as a factor promoting innovation, co-operation with Finnish universities was

rated higher than co-operation with the Technical Research Centre of Finland, for instance.

Attendant risks and the shortage of qualified labour – the biggest barriers to innovation

On the whole, the element of uncertainty associated with innovation was rated as the biggest barrier to innovation. Unlike the other groups, small enterprises also rated the lack of qualified labour, venture capital and technical information as a major barrier to innovation. An additional problem for small enterprises was posed by the protection of innovations.

What set the medium-sized enterprises apart from the other groups was that they rated the qualitative shortcomings of their own R & D as a major barrier to innovation. Risks attending innovation and opposition to change were rated higher among large enterprises than among the other groups (see Table 4).

Table 3.
Factors promoting innovation: proportions of respondents rating a factor as important

	Respon- dents 1)	Co-oper. betw. R & D, marketing, production %	Commit- ment of top manage- ment %	Co-oper. w/ other enterprises %	Co-oper. w/ suppliers %	Use of techn. services %	Corporate information service %
Total	205	91.1	84.2	36.9	31.8	31.5	25.4
Small enterprises	88	88.4	83.7	34.1	31.4	35.3	20.5
Medium-sized enterprises	63	93.5	82.5	39.0	29.5	24.2	30.6
Large enterprises	54	92.6	87.0	38.9	35.2	34.0	26.9
	Respon- dents1)	Co-oper. w/ Finnish universities %	Co-oper. w/ other Finnish research institutes %	Use of other consulting services %	Co-oper. w/ Technical Research Centre of Finland %	Co-oper. w/ foreign universities %	Co-oper. w/ voc. and prof. ed. institutions %
Total	205	22.2	20.4	20.6	13.2	10.3	6.7
Small enterprises	88	17.5	15.6	23.8	15.9	6.9	6.3
Medium-sized enterprises	63	18.3	16.7	16.1	11.3	5.2	6.7
Large enterprises	54	33.3	31.5	20.8	11.3	20.4	7.4

1) A number of respondents, less than five per cent, failed to supply information on some individual items.

Table 4.
Barriers to innovation: proportions of respondents rating a factor as important

	Respon- dents 1)	Excessive risks %	Lack of qualified labour %	Qualitative short- comings of own R & D %	Lack of information on markets %	Lack of venture capital %		
Total	205	51.7	46.8	41.0	37.3	35.1		
Small enterprises	88	51.2	52.3	39.3	36.0	44.7		
Medium-sized enterprises	63	49.2	42.6	46.8	37.7	28.6		
Large enterprises	54	55.6	42.6	37.0	38.9	27.8		
	Respon- dents 1)	Innovation too easy to copy %	Lack of technical information %	Internal opposition to change %	Official regulations, Legislation %	Short- comings in the supply of external services %	Inadequate opportu- nities for co-opera- tion %	
Total	205	33.5	32.3	27.5	21.9	11.5	10.3	
Small enterprises	88	38.4	40.0	26.7	17.1	16.7	9.8	
Medium-sized enterprises	63	32.8	32.3	24.6	23.0	8.1	11.7	
Large enterprises	54	26.4	20.4	32.1	28.3	7.4	9.4	

1) A number of respondents, less than five per cent, failed to supply information on some individual items.

3. Expenditure

Innovation expenditure, expressed in Finnish marks, was divided into two main groups, R & D expenditure and other innovation expenditure.

Nearly 40 per cent of innovation expenditure accounted for by R & D

For the 176 respondents providing data on their innovation expenditure as divided into R & D expenditure and other innovation expenditure, R & D expenditure accounted for about 39 per cent of total innovation expenditure (see Figure 1). The figure was highest for the medium-sized enterprises, about 44 per cent, compared with about 39 per cent for the small and the large enterprises.

In enterprises providing data on the distribution of other innovation expenditure, the biggest item of other innovation expenditure was acquisition of new production capacity, accounting for about 76 per cent of the total. Expenditure on the acquisition of production capacity was especially high, in relative terms, in large enterprises (see Table 5). Relatively speaking, small companies spent considerably more on the acquisition of technology than the other groups.

Figure 1.
Distribution of total innovation expenditure

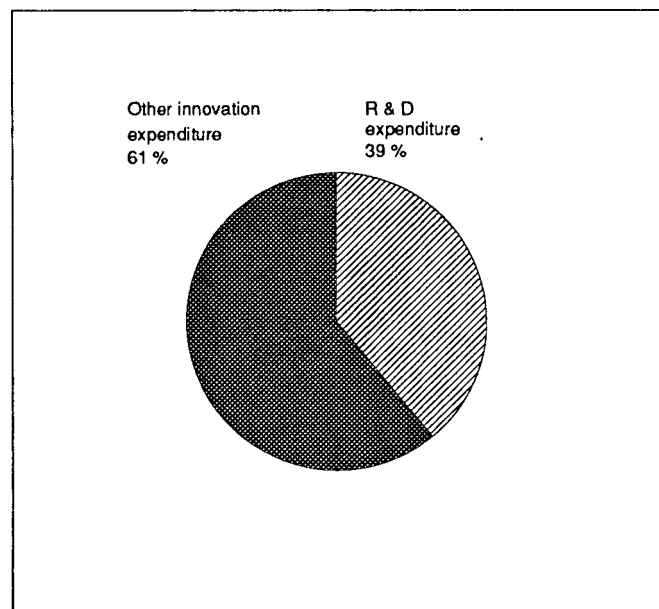


Table 5.
Distribution of other innovation expenditure

	Respondents	Acquisition of technology %	Application of innovations %	Marketing of innovations %	Acquisition of new production capacity %
Total	101	6.6	10.3	7.4	75.7
Small enterprises	41	29.3	15.4	12.0	43.2
Medium-sized enterprises	35	15.2	11.5	11.8	61.5
Large enterprises	25	4.7	10.0	6.7	78.6

Other innovation expenditure was divided into the following four categories:

- **Acquisition of technology**, i.e. patenting and licencing expenditure, covering the administrative and legal costs for patents and licences, and other expenditure on the acquisition of external know-how.
- **Application of innovations**, i.e. the expenditure on launching the production of a new product, or an essentially improved existing product, and the expenditure on implementing a new production process, covering such cost items as post- R & D product design, trial production as part of the production startup, tooling, training and education, and organisational development.
- **Marketing of innovations**, i.e. the expenditure on market research, advertising campaigns, trial marketing, etc.
- **Acquisition of new production capacity**, i.e. the expenditure on acquiring machinery and equipment incorporating new technology and the expenditure on acquiring plant and equipment related to the application of an innovation.

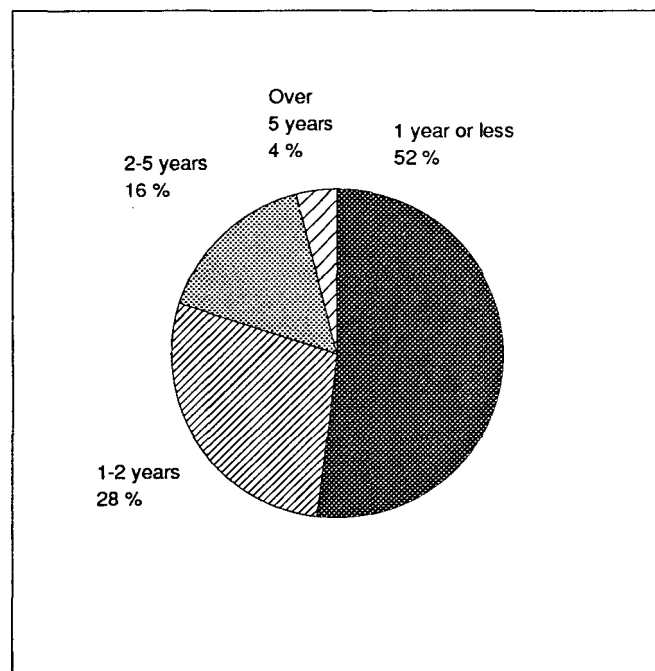
Half the R & D projects of a duration of one year at the most

Part of an enterprise's R & D expenditure may be allocated to internal R & D projects in progress, investing in them contributing to the generation of innovations.

Figure 2 shows the distribution of R & D projects at the end of 1988 according to the estimated length of the projects in enterprises reporting as engaging in R & D.

The projects were rather short in all size groups. However, it would seem as if large enterprises were better equipped to undertake long-range R & D projects, especially projects lasting more than five years. Large enterprises were operating one such project per enterprise on average.

Figure 2.
R & D projects in progress according to estimated length of projects



4. Results

The success of innovation activities has been measured with the following three indicators:

- Proportion of turnover accounted for by products in the introductory phase
- Proportion of turnover accounted for by product innovations
- Proportion of the product base accounted for by product innovations

These indicators relate to product innovations. Process innovations were reported by about 63 per cent of all respondents. The figure for small enterprises and for medium-sized enterprises was the same, about 54 per cent, and for large enterprises about 91 per cent.

About six per cent of the turnover accounted for by products in the introductory phase

The respondents were questioned about the distribution of the turnover of their three most important product groups across the different phases of the products' life cycles. These phases were as follows:

- 1) Introduction
- 2) Growth
- 3) Saturation
- 4) Decline

Of the turnover of a unit's three most important product groups, almost six per cent was accounted for by products in the introductory phase. In small enterprises, the proportion of turnover accounted for by the introductory phase was considerably larger than in the other enterprises, nearly nine per cent (see Table 6).

Some indication of how enterprises adapt to changes in the market situation can be obtained by combining the data on market growth expectations with the data on the proportion of turnover accounted for by products in the introductory phase in the enterprises' three most important product groups (see Table 7). As can be seen, small and medium-sized enterprises appear to be more flexible than large enterprises when it comes to adapting to changes in demand expectations by focusing the market introductions of new products on growing markets.

Table 6.
Distribution of turnover across phases of life cycle of a unit's three most important product groups

	Respondents	Introduction %	Growth %	Saturation %	Decline %
Total	195	5.8	37.0	48.0	9.3
Small enterprises	83	8.9	42.5	43.2	5.4
Medium-sized enterprises	59	5.6	32.3	48.9	13.1
Large enterprises	53	5.7	37.5	48.0	8.8

Table 7.
Proportion of turnover accounted for by products in the introductory phase in a unit's three most important product groups according to expected growth in respective demand

	Respondents	Demand expected to grow	Demand expected to remain unchanged or to decline
		Proportion of turnover accounted for by the introductory phase %	Proportion of turnover accounted for by the introductory phase %
Total	195	6.0	5.5
Small enterprises	83	11.3	5.3
Medium-sized enterprises	59	7.6	2.4
Large enterprises	53	5.5	6.0

One-fifth of the turnover of enterprises engaging in innovation activities accounted for by new products

Table 8a shows the proportion of turnover accounted for by product innovations in 1988 for enterprises reporting market introductions of new products during 1984 – 1988 (exclusive of enterprises established in 1984 or later). The proportion diminishes according to the size group of the enterprise.

Table 8a.
Proportion of turnover accounted for by product innovations according to size group of units reporting product innovations

	Respon- dents	Proportion of turnover accounted for by product innovations %
Total	158	21.0
Small enterprises	63	42.1
Medium-sized enterprises	46	32.7
Large enterprises	49	19.2

Proportion of turnover accounted for by product innovations biggest in the manufacture of vehicles

Table 8b shows the proportion of turnover accounted for by product innovations according to the industry of the unit. The biggest proportions are shown by the product innovations of vehicles manufacture, of textiles, clothing and furniture manufacture, and of electrical products and instruments manufacture.

Table 8b.
Proportion of turnover accounted for by product innovations according to the industry of units reporting product innovations

Industry	Respon- dents	Proportion of turnover accounted for by product innovations %
Total	158	21.0
Food	14	11.2
Textiles, clothing, furniture	16	38.6
Wood processing	20	22.6
Chemicals, plastics products	12	13.6
Metals, metal products	16	14.4
Machinery and equipment	37	33.6
Electrical products, instruments	21	36.6
Vehicles	13	43.2
Other manufacturing industries	9	15.6

The industrial classification has been adapted from the 1988 Standard Industrial Classification of the Central Statistical Office of Finland.

Almost half the product base accounted for by product innovations

Table 9 shows the proportion of product innovations in the product base of the three most important product groups of enterprises reporting new products at the end of 1988. By this indicator, the proportion of product innovations was about 43 per cent in all enterprises. Small enterprises showed the highest figure, about one half.

Table 9.
Proportion of product innovations in the product base of the three most important product groups of units reporting product innovations

	Respon- dents	Proportion of product innovations in product base %
Total	152	43.2
Small enterprises	59	49.4
Medium-sized enterprises	46	40.7
Large enterprises	47	37.8

In large enterprises, the proportion of product innovations in the product base appears to be considerably larger than the proportion of turnover accounted for by product innovations.



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