

## ISIC REV. 3 TECHNOLOGY INTENSITY DEFINITION

### Classification of manufacturing industries into categories based on R&D intensities

#### High-technology industries

Aircraft and spacecraft  
Pharmaceuticals  
Office, accounting and computing machinery  
Radio, TV and communications equipment  
Medical, precision and optical instruments

#### Medium-high-technology industries

Electrical machinery and apparatus, n.e.c.  
Motor vehicles, trailers and semi-trailers  
Chemicals excluding pharmaceuticals  
Railroad equipment and transport equipment, n.e.c.  
Machinery and equipment, n.e.c.

#### Medium-low-technology industries

Building and repairing of ships and boats  
Rubber and plastics products  
Coke, refined petroleum products and nuclear fuel  
Other non-metallic mineral products  
Basic metals and fabricated metal products

#### Low-technology industries

Manufacturing, n.e.c.; Recycling  
Wood, pulp, paper, paper products, printing and publishing  
Food products, beverages and tobacco  
Textiles, textile products, leather and footwear

### Summary

#### *First definition in ISIC Rev. 2*

Classification based both on direct R&D intensity and R&D embodied in intermediate and investment goods proposed in [Hatzichronoglou \(1997\)](#). Four categories were introduced: high-, medium-high, medium-low and low technology.

#### *Definition updated to ISIC Rev.3*

Based on direct R&D intensity, first shown in the Annex of the 2001 edition of OECD's STI Scoreboard using 1991-1999 data. Updated calculations with identical results in the 2003 edition. The cut-off points between 'High', 'Medium-high', 'Medium-low' and 'low technology' were revealed by R&D relative to value-added and gross production statistics.

#### *Direct vs. indirect R&D*

While adding indirect R&D intensity changed the ranking of individual industries, it did not alter the composition of the technology groups compared to using direct R&D intensities only.

#### *ISIC Rev.2 vs. Rev.3*

"Medical, precision and optical instruments" (ISIC Rev.3 33) was moved to the 'High-technology' group. Previously it was considered 'Medium-high technology' as "Scientific instruments" (ISIC Rev.2 385).

#### *NACE versions*

Eurostat adopted the definition transforming it to [NACE Rev.1](#) and more recently to [NACE Rev.2](#)

#### *Remarks*

The technology-intensity classification is relative. Many manufacturing activities could be considered 'high-technology' but by looking at direct R&D intensities we are classifying according to relative recent R&D performance. Also, 'high-tech' industries can produce a variety of products ranging between 'low-tech' and 'high-tech'. The idea was to create a classification for OECD as a whole. Individual countries may have slightly different classifications using same method and compromise on level of industry detail i.e. subject to general data availability.

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#### *Service industries*

Direct R&D intensities are not much help for service activities. Instead, other indicators such as skill intensity (e.g. education levels in industry x occupation matrices) and indirect R&D measures such as technology embodied in investment or investment in ICT goods by industry must be explored.

## Tables and charts

1. Chart 1.1. Aggregate R&D intensity of selected OECD countries, 1997
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## References

Hatzichronoglou, T. (1997), "Revision of the High-Technology Sector and Product Classification", *OECD Science, Technology and Industry Working Papers*, No. 1997/02. doi: [10.1787/134337307632](https://doi.org/10.1787/134337307632)

OECD (2003), *OECD Science, Technology and Industry Scoreboard 2003*, OECD Publishing.  
doi: [10.1787/sti\\_scoreboard-2003-en](https://doi.org/10.1787/sti_scoreboard-2003-en)

## STI Scoreboard 2003, Annex 1

### Classification of manufacturing industries based on technology

Annex Table 1.1 presents manufacturing industries classified according to technology intensity using the ISIC Rev. 3 breakdown of activity.

Technological effort is a critical determinant of productivity growth and international competitiveness. However, since it is not spread evenly across the economy, analyses of industry performance and structural change attach much importance to technological criteria. Methodological work carried out at the OECD is used to determine these criteria.

In the past, a technology classification based on ISIC Rev. 2 industry classifications was widely used. The methodology uses three indicators of technology intensity reflecting, to different degrees, “technology-producer” and “technology-user” aspects: *i*) R&D expenditures divided by value added; *ii*) R&D expenditures divided by production; and *iii*) R&D expenditures plus technology embodied in intermediate and investment goods divided by production. These indicators were evaluated for 1990 and for the aggregate of the ten OECD countries for which a measure of embodied technology was available, using 1990 USD purchasing power parities (see T. Hatzichronoglou, “Revision of the High-Technology Sector and Product Classification”, STI Working Paper 1997/2).

Following the adoption of ISIC Rev. 3 (NACE Rev. 1 in Europe) for collecting and presenting data on industrial activity both in national accounts (in the context of SNA93/ESA95) and industrial surveys, the 2001 Scoreboard used ISIC Rev. 3 R&D expenditure and output data to develop an updated technology classification based on an evaluation of R&D intensities for 13 OECD countries for the period 1991-97. In the absence of updated ISIC Rev. 3 input-output tables (required for estimating embodied technology), only the first two indicators could be calculated. This edition extends the analysis to cover the period 1991-99, although for only 12 OECD countries.

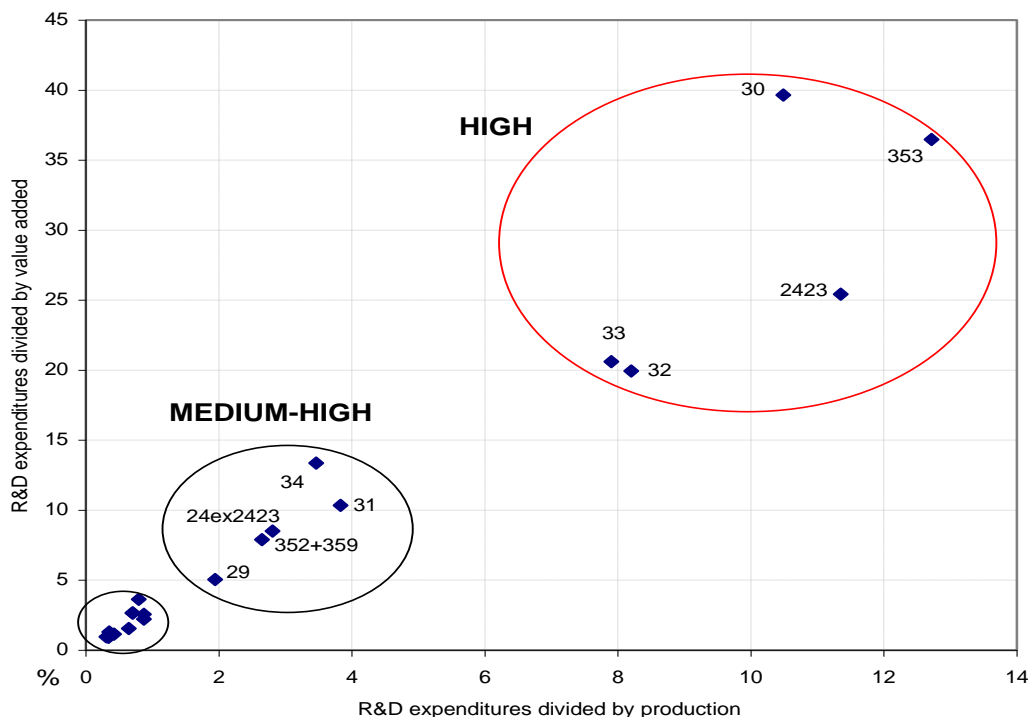
The division of manufacturing industries into high-technology, medium-high-technology, medium-low-technology and low-technology groups was made after ranking the industries according to their average over 1991-99 against aggregate OECD R&D intensities. Industries classified to higher categories have a higher average intensity for both indicators than industries in lower categories. Also considered were: *i*) temporal stability: for adjacent years, industries classified to higher categories have a higher average intensity than those in lower categories (see Annex Table 1.2); and *ii*) country median stability: industries classified to the higher categories have a higher median intensity than those in lower categories.

#### Points to note:

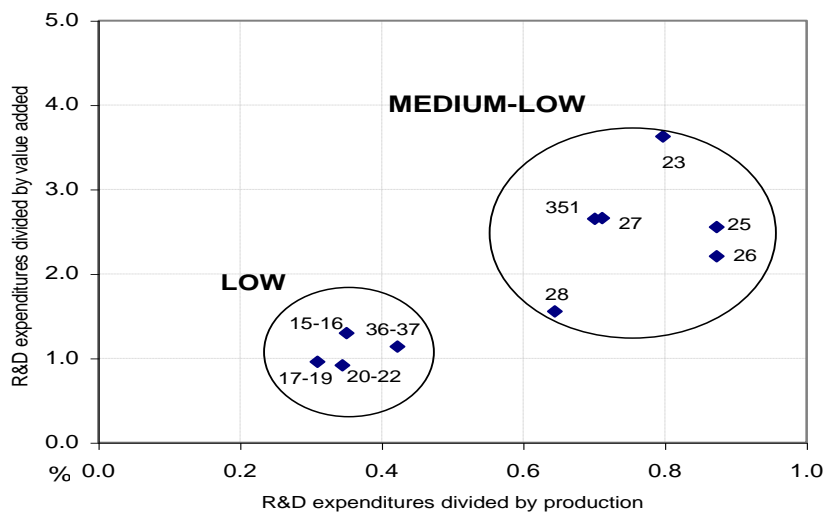
- This classification confirms that of the 2001 *Scoreboard* and also confirms the classification of “Medical, precision and optical instruments” (ISIC Rev. 3, Division 33) as a high-technology industry. This sector’s R&D intensity continues to rise, and its inclusion complements the definition of the ICT sector (see *Measuring the Information Economy*, OECD, 2002) which includes some of its sub-divisions (notably 3312 and 3313).
- The cut-off points are clear except possibly the distinction between the medium-low- and low-technology groups.
- The low-technology group consists of relatively aggregate sectors, owing to limited detailed R&D expenditure data across countries. The few cases in which R&D intensities are available for more detailed (2-digit) breakdowns confirm the allocation of these industries to low technology.

– Charts

**Annex 1.1. Aggregate R&D intensity of selected OECD countries, 1997**



**Annex 1.2. Aggregate R&D intensity of selected OECD countries, 1997: zoom on medium-low and low groups**



See Annex table 1.1. for description of ISIC Rev.3 codes shown in the plots above

Source: OECD STI Scoreboard (2001)

## Tables

Annex 1.1. Classification of manufacturing industries based on technology<sup>1</sup>

ISIC Rev. 3	1999				1991				
	R&D divided by production		R&D divided by value added		R&D divided by production		R&D divided by value added		
	Aggregate intensity <sup>2</sup>	Median intensity	Aggregate intensity <sup>2</sup>	Median intensity	Aggregate intensity <sup>2</sup>	Median intensity	Aggregate intensity <sup>2</sup>	Median intensity	
<b>High-technology industries</b>									
Aircraft and spacecraft	353	10.3	10.4	29.1	27.5	13.9	12.9	34.7	32.1
Pharmaceuticals	2423	10.5	10.1	22.3	25.8	9.4	8.7	20.6	19.7
Office, accounting and computing machinery	30	7.2	4.6	25.8	15.1	10.9	6.4	29.4	15.2
Radio, TV and communications equipment	32	7.4	7.6	17.9	22.4	7.9	8.2	17.0	21.5
Medical, precision and optical instruments	33	9.7	5.6	24.6	11.9	6.6	6.1	15.6	12.5
<b>Medium-high-technology industries</b>									
Electrical machinery and apparatus, n.e.c.	31	3.6	2.3	9.1	6.7	4.2	2.6	9.3	5.9
Motor vehicles, trailers and semi-trailers	34	3.5	2.8	13.3	11.7	3.7	3.0	14.3	11.9
Chemicals excluding pharmaceuticals	24 excl. 2423	2.9	2.2	8.3	7.1	3.4	2.8	9.8	8.0
Railroad equipment and transport equipment, n.e.c.	352 + 359	3.1	2.8	8.7	7.9	2.9	2.1	7.6	5.4
Machinery and equipment, n.e.c.	29	2.2	2.1	5.8	5.3	1.9	2.0	4.6	4.7
<b>Medium-low-technology industries</b>									
Building and repairing of ships and boats	351	1.0	1.0	3.1	2.9	0.9	0.9	2.8	2.6
Rubber and plastics products	25	1.0	1.1	2.7	3.0	1.0	0.6	2.6	1.5
Coke, refined petroleum products and nuclear fuel	23	0.4	0.3	1.9	2.7	1.2	0.7	5.4	3.8
Other non-metallic mineral products	26	0.8	0.6	1.9	1.3	1.0	0.6	2.4	1.5
Basic metals and fabricated metal products	27-28	0.6	0.5	1.6	1.4	0.7	0.6	2.0	1.6
<b>Low-technology industries</b>									
Manufacturing, n.e.c.; Recycling	36-37	0.5	0.5	1.3	1.2	0.5	0.4	1.2	0.9
Wood, pulp, paper, paper products, printing and publishing	20-22	0.4	0.1	1.0	0.3	0.3	0.1	0.8	0.3
Food products, beverages and tobacco	15-16	0.3	0.3	1.1	1.0	0.3	0.3	1.1	1.1
Textiles, textile products, leather and footwear	17-19	0.3	0.4	0.8	1.0	0.2	0.3	0.7	0.7
<b>Total manufacturing</b>	15-37	2.6	2.2	7.2	6.5	2.5	2.0	7.0	5.7

1. Based on data for 12 OECD countries: United States, Canada, Japan, Denmark, Finland, France, Germany, Ireland, Italy, Spain, Sweden, United Kingdom.

2. Aggregate R&D intensities calculated after converting countries' R&D expenditures, value added and production using GDP PPPs.

Source: OECD: ANBERD and STAN databases, May 2003.

Tables, continued

Annex 1.2. R&D intensity<sup>1</sup> for aggregate of 12 OECD countries, 1991-1999

	ISIC Rev.3	1991	1992	1993	1994	1995	1996	1997	1998	1999	mean intensity 1991-1999
Aircraft and spacecraft	353	13.9	13.9	13.5	13.9	16.2	14.8	12.8	10.7	10.3	13.3
Pharmaceuticals	2423	9.4	10.1	10.8	10.9	10.6	10.3	11.0	11.1	10.5	10.5
Office, accounting and computing machinery	30	10.9	10.4	9.3	8.8	7.5	9.1	10.4	8.9	7.2	9.2
Radio, TV and communications equipment	32	7.9	8.3	7.9	7.8	7.7	8.2	8.0	8.6	7.4	8.0
Medical, precision and optical instruments	33	6.6	6.8	7.1	7.7	7.7	7.4	8.0	8.0	9.7	7.7
Electrical machinery and apparatus, n.e.c.	31	4.2	4.0	4.0	3.8	4.0	3.9	3.9	4.0	3.6	3.9
Motor vehicles, trailers and semi-trailers	34	3.7	3.4	3.5	3.4	3.5	3.7	3.5	3.3	3.5	3.5
Chemicals excluding pharmaceuticals	24 excl. 24	3.4	3.3	3.4	3.1	2.8	3.1	2.7	3.1	2.9	3.1
Railroad equipment and transport equipment, n.e.c.	352 + 359	2.9	2.4	2.4	2.7	2.6	3.2	3.5	3.0	3.1	2.9
Machinery and equipment, n.e.c.	29	1.9	2.0	2.0	2.1	2.0	2.1	2.1	2.1	2.2	2.1
Building and repairing of ships and boats	351	0.9	1.0	1.0	0.9	0.9	1.0	0.8	1.0	1.0	1.0
Rubber and plastics products	25	1.0	1.0	0.9	1.0	0.8	0.9	0.9	0.9	1.0	0.9
Coke, refined petroleum products and nuclear fuel	23	1.2	1.2	1.1	1.0	0.9	0.8	0.7	0.9	0.4	0.9
Other non-metallic mineral products	26	1.0	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.8	0.9
Basic metals and fabricated metal products	27-28	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.6
Manufacturing, n.e.c.; Recycling	36-37	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.6	0.5	0.5
Wood, pulp, paper, paper products, printing and publishing	20-22	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.3
Food products, beverages and tobacco	15-16	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3
Textiles, textile products, leather and footwear	17-19	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
<b>Total manufacturing</b>	<b>15-37</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.4</b>	<b>2.4</b>	<b>2.6</b>	<b>2.6</b>	<b>2.6</b>	<b>2.6</b>	<b>2.5</b>
<b>High-technology industries</b>		<b>9.4</b>	<b>9.5</b>	<b>9.3</b>	<b>9.3</b>	<b>9.2</b>	<b>9.3</b>	<b>9.5</b>	<b>9.3</b>	<b>8.7</b>	<b>9.3</b>
<b>Medium-high-technology industries</b>		<b>3.1</b>	<b>3.0</b>	<b>3.1</b>	<b>3.0</b>	<b>2.9</b>	<b>3.1</b>	<b>2.9</b>	<b>3.0</b>	<b>3.0</b>	<b>3.0</b>
<b>Medium-low-technology industries</b>		<b>0.9</b>	<b>0.9</b>	<b>0.9</b>	<b>0.8</b>	<b>0.8</b>	<b>0.8</b>	<b>0.8</b>	<b>0.8</b>	<b>0.7</b>	<b>0.8</b>
<b>Low-technology industries</b>		<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>0.4</b>	<b>0.4</b>	<b>0.4</b>	<b>0.4</b>	<b>0.3</b>

1. R&D intensity defined as direct R&D expenditures as a percentage of production (gross output), calculated after converting countries' R&D expenditures and production using GDP PPPs.

Source: OECD: ANBERD and STAN databases, May 2003.