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ABSTRACT

Reported in this newsletter in narrative, graphical, and tabular form are data related to industrial research and development expenditures in 1974, showing a seven percent increase over 1973. It is noted that more than 80 percent of a total of $22.3 billion was spent by five industries; these included electrical equipment and communication, aircraft and missiles, machinery, motor vehicles and equipment for same, and chemicals and allied products. Total industrial research and development expenditures for energy and pollution abatement, by industry, 1973-1975, are summarized. A brief summary is presented relating research and development funds with net sales, as well as with basic research, applied research, and development. (EB)

nsf SCIENCE RESOURCES STUDIES **HIGHLIGHTS**

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Industrial R&D Expenditures Rise to $22 Billion in 1974

- Total industrial R&D spending increased from $20.9 billion in 1973 to $22.3 billion in 1974, a 7-percent increase in current dollars. In constant dollars, however, this translates into a 3-percent decrease (chart 1). Based on companies' expectations in the spring of 1975, total industrial R&D spending in 1975 should exceed $24.0 billion.

- Federal R&D funds to industry rose to $8.3 billion in 1974, 1 percent above the 1973 level.

- R&D spending from companies' own funds totaled $14.0 billion in 1974, an increase of nearly 11 percent over 1973. The company-financed portion of total industrial research and development continued to rise from a low of 41 percent in 1959 to 63 percent in 1974.

- The employment of full-time-equivalent (FTE) scientists and engineers in industry remained nearly level at 357,000 between January 1974 and January 1975 (chart 1).

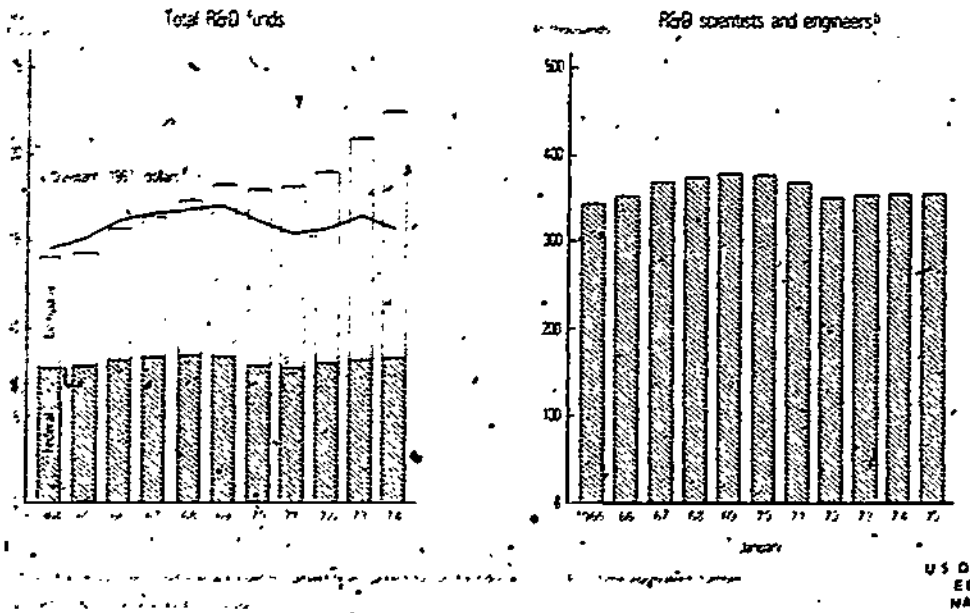
- The ratio of total industrial R&D funds to net sales for all R&D-performing manufacturing companies continued its general decline of the last 10 years, dropping from 3.2 percent in 1973 to 2.9 percent in 1974.

- Funds for basic research in industry rose by 10 percent between 1973 and 1974 to $684 million, the largest percentage increase in this category since 1962. This rise was largely influenced by increased emphasis on energy and environmental research by companies in the industrial chemicals industry. Applied research spending amounted to $4.1 billion in 1974, an 11-percent increase from a year earlier, while development performance rose by 6 percent to $17.5 billion (table 1).

- Energy R&D spending by industry increased by 19 percent to $1.2 billion in 1974. Federal support of energy-related research and development rose by 24 percent to $479 million.

- Industrial R&D expenditures for pollution abatement reached $646 million in 1974, up 7 percent from the 1973 level. Companies' own funds financed 92 percent of industry's pollution abatement R&D effort.

Chart 1 R&D resources in industry



(Prepared in the Industry Studies Group, Division of Science Resources Studies.)

Table 1.—Selected industrial R&D data
(Dollars in millions)

Industry	Total R&D funds			1974 R&D funds				R&D scientists and engineers	
	1973	1974	$ change	Company	Basic research	Applied research	Development	Jan. 1974	Jan. 1973
Total	$20,894	$22,348	$1,454	$14,878	$664	$4,138	$17,547	357,900	357,400
Food and kindred products	358	394	36	293	22	119	152	7,000	6,600
Textiles and apparel	64	68	4	60	2	23	44	1,800	1,850
Lumber, wood products, and furniture	55	65	10	[illegible]	[illegible]	[illegible]	48	2,000	1,700
Paper and allied products	190	279	89	218	5	68	145	5,200	4,900
Chemicals and allied products	2,064	2,364	300	2,148	267	949	1,157	43,400	41,500
Industrial chemicals	1,135	1,322	187	1,121	199	561	602	20,800	19,800
Drugs and medicines	636	709	73	[illegible]	87	358	348	13,000	12,000
Other chemicals	314	333	19	[illegible]	21	111	206	9,600	9,500
Petroleum refining and extraction	498	598	100	518	32	258	308	8,400	8,200
Rubber products	280	297	17	267	3	62	225	5,900	5,700
Stone, clay, and glass products	175	189	14	181	12	61	116	4,300	4,100
Primary metals	276	316	40	308	9	132	175	5,900	5,700
Fabricated metal products	147	163	16	159	[illegible]	[illegible]	106	3,300	3,200
Nonelectrical machinery (not including office machines)	130	153	23	149	[illegible]	[illegible]	69	2,600	2,500
Office, computing, and accounting machines	271	282	11	274	5	56	224	7,100	6,800
Machinery	2,176	2,493	317	2,134	26	323	2,144	44,900	43,300
Other nonelectrical machinery and ordnance	1,519	1,539	20	1,455	30	162	1,346	26,600	25,700
Electrical equipment and communication	5,273	5,469	196	2,892	180	857	4,433	92,000	92,900
Radio and TV receiving equipment	50	51	1	[illegible]	[illegible]	[illegible]	37	1,200	1,300
Electronic components	578	576	(2)	428	20	53	302	9,200	9,200
Communication equipment and electronic systems	3,651	3,928	277	1,565	141	471	2,413	50,500	52,200
Other electrical equipment	1,814	2,019	205	[illegible]	[illegible]	[illegible]	1,681	31,100	30,100
Motor vehicles and motor vehicle equipment	2,419	2,392	(27)	2,086	9	153	2,230	26,100	27,600
Other transportation equipment	27	31	4	26	4	4	26	900	800
Aircraft and missiles	5,083	5,317	234	4,139	53	615	4,644	66,600	70,800
Professional and scientific instruments	910	1,007	97	824	22	110	875	16,900	16,600
Scientific and mechanical measuring instruments	135	120	(15)	101	11	13	96	4,000	4,200
Optical, surgical, photographic, and other instruments	794	887	93	723	11	97	779	12,900	12,400
Other manufacturing industries	158	174	16	[illegible]	[illegible]	[illegible]	125	4,100	4,000
Nonmanufacturing industries	714	779	65	315	35	286	457	15,200	14,400

(1) Not separately available but included in total.

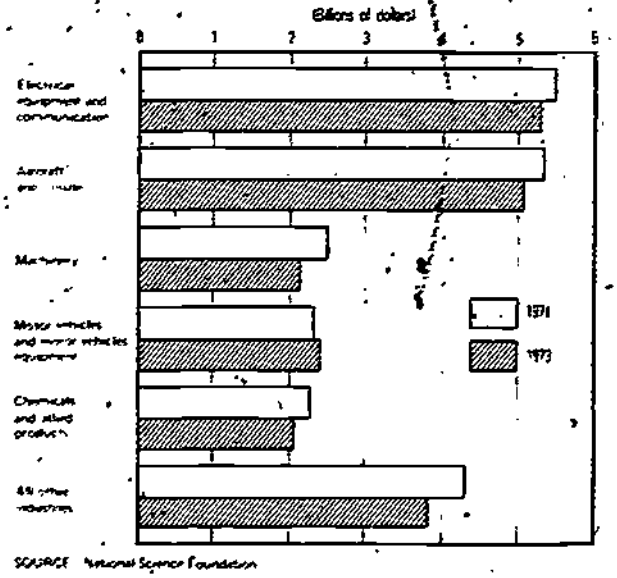
Source: National Science Foundation.

Total R&D Funds, 1974

Industrial firms spend $22.3 billion on research and development in 1974, 7 percent above the 1973 level. The industrial sector accounts for about 70 percent of total U.S. R&D spending, an amount which has remained relatively level over the past decade.

In 1974 five industries accounted for more than 80 percent of the $22.3 billion total spent by companies on R&D activities. They were electrical equipment and communication, $5.5 billion; aircraft and missiles, $5.3 billion; machinery, $2.5 billion; motor vehicles and motor vehicles equipment, $2.4 billion; and chemicals and allied products, $2.4 billion. The largest percentage increases in total R&D spending were recorded by the chemicals and machinery industries, both up 14 percent over 1973. After a 23-percent increase between 1972 and 1973, total R&D expenditures by the motor vehicles industry remained virtually constant in 1974. The aircraft and missiles industry experienced its largest increase in total R&D spending—4 percent—since the late sixties. The electrical equipment industry also showed a 4-percent gain (chart 2).

Chart 2. R&D spending by selected industry: 1973 and 1974



SOURCE: National Science Foundation.

Between 1973 and 1974 company R&D funds continued to rise at a faster rate than Federal R&D support to industry. Company funds in 1974 rose by 11 percent to $14.0 billion, while Federal funds to industry were up by 1 percent to $8.3 billion. The company-financed portion of total research and development in industry reached an all-time high of 63 percent in 1974, as every industry group recorded an increase in company R&D funds.

ENERGY AND POLLUTION ABATEMENT R&D

Total energy R&D spending by industry amounted to $1.2 billion in 1974, up 19 percent from the 1973 level (table 2). Two industries, electrical equipment and petroleum, accounted for 62 percent of the total. Industry expects a 6-percent increase in total energy R&D spending in 1975.

Most of the industrial energy R&D effort in 1974 was devoted to nuclear sources, primarily fission, and fossil fuels, primarily oil. Solar energy R&D spending showed a large relative rise (table 3).

Industrial R&D expenditures for pollution abatement increased by 7 percent between 1973 and 1974, reaching $646 million. Over 90 percent of these expenditures were financed by companies' own funds. The motor vehicles industry accounted for 57 percent of the 1974 total pollution abatement R&D spending in industry. By type, air pollution abatement research and development received three-quarters of the total funds. Industry expects a 4-percent decline in 1975 for pollution abatement research and development.

Table 2.—Total industrial R&D expenditures for energy and pollution abatement, by industry: 1973-75
[Dollars in millions]

Industry	Energy			Pollution abatement		
	1973	1974	1975 (est.)	1973	1974	1975 (est.)
Total	$1,004	$1,197	$1,266	$603	$646	$621
(Federal funds)	(385)	(479)	( )	(35)	(52)	( )
(Company funds)	(619)	(718)	( )	(568)	(594)	( )
Electrical equipment and communication	318	374	420	13	15	13
Petroleum refining and extraction	313	372	436	51	61	67
Aircraft and missiles	121	129	105	25	34	30
Chemicals and allied products	58	84	92	55	66	69
Motor vehicles and motor vehicles equipment				380	371	330
Other manufacturing industries	176	188	196	44	71	74
Nonmanufacturing industries	38	50	57	35	28	38

Not separately available but included in other manufacturing industries.
Source: National Science Foundation.

Table 3.—Industrial R&D expenditures for energy and pollution abatement, by type: 1973-75
[Dollars in millions]

Primary energy source*	1973			1974			1975 (est.)
	Total	Federal	Company	Total	Federal	Company	Total
Total	$1,004	$385	$619	$1,197	$479	$718	$1,266
Fossil fuel	433	10	423	506	13	493	524
Oil	297	2	295	336	3	333	326
Gas	51	(1)	(1)	61	(1)	(1)	62
Shale*	7	0	7	10	(1)	(1)	14
Coal	49	7	42	66	9	57	86
Other	29	(1)	(1)	33	(1)	(1)	36
Nuclear	501	366	135	600	444	156	631
Fission	476	349	127	566	421	145	603
Fusion	25	18*	7	34	23	11	28
Geothermal	1	(1)	(1)	2	(1)	(1)	5
Solar	2	(1)	(1)	7	(1)	(1)	11
All other	67	8	59	82	19	63	95
Type of pollution abatement							
Total	603	35	568	646	52	594	621
Air	461	10	451	488	18	470	468
Water	76	(1)	(1)	74	(1)	(1)	79
Solid waste	10	(1)	(1)	18	(1)	(1)	19
Other	56	21	35	66	29	37	54

*Not separately available but included in total. Source: National Science Foundation.

R&D FUNDS/NET SALES

Total R&D spending in manufacturing companies averaged 2.9 percent of net sales in 1974. The ratio fell from the 1973 level of 3.2 percent, continuing the general decline from the 1964 peak of 4.6 percent. Total R&D funds in industry have increased every year but one since 1964; however, net sales have increased at a faster pace, causing the ratio to decline. Following this pattern, notable decreases in 1974 occurred in the following industries: Chemicals, 3.5 to 3.2; petroleum, 0.7 to 0.5; electrical equipment, 7.2 to 6.9; and aircraft and missiles, 12.9 to 12.5. Motor vehicles was the only industry to show an increase in its R&D net sales ratio, from 3.5 percent in 1973 to 3.7 percent in 1974, as R&D spending in this industry remained nearly constant in the face of decreasing sales.

BASIC RESEARCH, APPLIED RESEARCH, AND DEVELOPMENT

As in recent years, the distribution of industrial R&D funds in 1974 remained steady with basic research at 3 percent, applied research at 18 percent, and development at 79 percent.

Industrial basic research expenditures climbed to $684 million in 1974, an increase of 10 percent, the largest since 1962. The chemicals industry, which performs almost 40 percent of all basic research in industry, led the way with a 20-percent increase. This reflected an increase in both Federal and company support of basic research in the industrial chemicals industry, with particular emphasis on energy and environmental research.

Between 1973 and 1974 funds for applied research in industry rose by 11 percent to $4.1 billion. Significant increases were recorded in aircraft and missiles, 19 percent, petroleum, 18 percent, and chemicals, 14 percent.

Industry spent $17.5 billion for development in 1974, 6 percent more than in 1973. Industry's two major development performers, aircraft and missiles and electrical equipment, showed increases of 3 percent and 4 percent, respectively, and accounted for more than one-half of the total. Machinery, the third-largest performer, increased development expenditures by 15 percent.

Because development spending accounts for such a large portion of total industrial R&D spending, the relatively higher percentage increases in industry's basic and applied research expenditures in 1974 did not significantly alter the distribution.

R&D Scientists and Engineers

Industry employed 357,400 FTE R&D scientists and engineers in January 1975, compared with 357,900 in January 1974. About two-thirds of all R&D scientists and engineers in the country work in industrial laboratories. All but four of the major industrial groupings reported decreases between January 1974 and January 1975, ranging from 2 percent to 15 percent, with the chemicals and machinery industries experiencing the largest absolute declines. Increases were limited to the aircraft and missiles and motor vehicles industries, 6 percent each, and to the electrical equipment and communication industry, 1 percent. Textiles and apparels reported no change.

The 1974 survey of industrial research and development is part of a comprehensive program undertaken and sponsored by the National Science Foundation to measure R&D activities in industrial firms, universities and colleges, nonprofit institutions, and government agencies. Industry data were collected and compiled by the Bureau of the Census, U.S. Department of Commerce. Complete results of the 1974 industrial survey and historical R&D data will appear in *Research and Development in Industry, 1974*, to be available in the summer of 1976 from the Superintendent of Documents, U.S. Government Printing Office.

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