Report on Survey of Domestic Bioindustry based on 2017

2018. 12.

MINISTRY OF TRADE, INDUSTRY & ENERGY
Korea Biotechnology Industry Organization

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I. Survey Overview

1 Survey Overview

A. Data Sources

○ Division of Bio-nano, Ministry of Trade, Industry and Energy (www.motie.go.kr)

○ Statistical Sources : Korea Biotechnology Industry Organization (www.koreabio.org)

B. Type of Statistics and Authorized Number

○ Type of Statistics : General·Survey Statistics

○ Authorized Number: No. 115015

○ Authorized Date : October 30th, 2003

C. Survey Period

○ Survey Baseline Date: December 31, 2017

○ Targeted Survey Period : January 1, 2017 ~ December 31, 2017

○ Conducting Survey Period : May 31, 2018 ~ November 15, 2018

D. Scope

○ Based on 'classification scheme of bioindustry (KS J 1009, recognized by Korean Agency for Technology and Standards, Ministry of Trade, Industry and Energy on January 2008/revised in Dec. 29, 2016)' which established the scope and definition of the domestic biotechnology and bioindustry in the survey baseline year, the scope of the survey refers to domestic businesses engaged in the activities related to biotechnology. The activities related to biotechnology refers to the following.

- Using biotechnology as the main technology in the research and development phases, although it uses non-biotechnology in the production phase
- Using biotechnology in the manufacturing, production and service (including research and development) phases
- Producing machine, equipment, or plant that are used in the

biotechnological process of the research and development phase or the production phase

- Selling the above products after importing

※ The survey includes companies resulted in sales through the activities stated above as well as companies pushing forward the research development in the survey baseline year.

E. Survey Targets

○ The survey primarily selected bioindustry's fact-finding companies of 2016 among domestic companies falling into the range of the survey as survey targets. The survey then selected corresponding companies using the bio cluster-related companies per geography of December, 2017, other registered company data of Korea Biotechnology Industry Organization, and company yearbooks.

F. Survey Units

○ The survey units refers to companies that sell products or services which went through the production process of value-adding after the assembled capital equipment or raw materials were bought under the control of the entrepreneur.

○ The survey units include public enterprises (state-owned enterprises, public enterprises), public - private companies, the private companies (private enterprises, collective enterprises, partnership, joint venture, anonymous company, Co., Ltd., Co., Ltd., co-operatives).

○ In case the company has more than two businesses, the survey unit included the sum of the corresponding business' results and received the responses based on the bioindustry results among the overall industrial activities.

G. Methodology and Approach

○ Survey Methodology : Via mail, fax, e-mail, telephone, face-to-face interview

○ Survey Approach : Researcher → Research Company → Korea Biotechnology Industry Organization → Ministry of Trade, Industry and Energy

H. Announcement of Results

○ Announcement Period : Once a year

○ Form of Announcement : Publishment of the Report on Fact Finding Survey of Domestic Bioindustry

2 Background and Purpose

○ Ministry of Trade, Industry and Energy and Korea Biotechnology Industry Organization have been conducting fact finding survey of domestic bioindustry since 2003 to build groundwork for economic analysis, international comparison and establishment of related nurturing policies through analyzing overall status of bioindustry and its actual condition.

○ The 'Report on Fact Finding Survey of Domestic Bioindustry based on 2017' that started its survey conduct from May, 2018 aims to increase the successful rate as complete enumeration survey and to grasp more accurate status of domestic bioindustry.

○ This survey aims to analyze bioindustry's economic feasibility through grasping sales and financial status and to establish bio-related nurturing policies through studying accurate actual condition of domestic bioindustry.

○ Ministry of Trade, Industry and Energy and Korea Biotechnology Industry Organization aims to contribute to the development of domestic bioindustry through the results of this survey.

3 Methodology

Target	Company representatives or managers in Bioindustry such as Biopharmaceutical·Biochemical and bioenergy ·Biofood· Bioenvironmental·Biomedical equipment·Bioinstrument and bioequipment·Bioresource·Bioservice
Area	Nation-wide(17 areas including Seoul and 6 Metropolitan cities)
Methodology	Research was conduced via mail, fax, e-mail, telephone, face-to-face interview by researcher
Data-mining tool	Structured Questionnaire
Size of population	1,044 Companies (Among primarily selected 1,065 companies, 21 closed-down)
Size of valid sample	984 Companies(94.3% of the population)

**** Classification of 'No Response' in last 3 years of our survey***

Year	Size of population	Valid response cases	No response cases	Type of No response			
				Refusal	Not in the office	Not connected	Shutdown (during surveyed year)
2015	1,034	978 (95%)	56	16	13	22	5
2016	1,044	980 (94%)	64	15	16	20	13
2017	1,044	984 (94%)	60	11	17	23	9

4 Contents

Category	Main Contents of the Survey
Company Information	- Name of Company, Name of Representative - Business Registration Number, Corporate-parent (Group) Name - Phone, Establishment Date - Address - Respondent Information
General Status	- Capital, Capital Ratio of Net Worth - Number of Workers - Existence of exclusive business, type of company, place of business - Items in the income statement (sales, cost of goods sold, selling expenses & administrative expenses, tax, etc)
Status of Bio Industry	- Core business - Manpower status - R&D cost and Facility Investment cost - Cooperation with Other Organizations - Phase of Growth - Period Resulted in Sales - Product, Service, Commerce Technology (Resulted in Sales, Export·Import)

5 Terminology

A. General Status

○ Selected Companies

① Venture Company : Refers to companies that are selected for meeting the requirements of the venture capital investment, investment in research and development, and companies developing new technologies and technology assessment companies according to ‘Act on Special Measures for the Promotion of Venture Businesses’.

② INNO-BIZ : Refers to companies that are selected for Small and Medium Business Administration's 'Fostering Business for technology-innovative (INNO-BIZ) Small and Medium Businesses'.

③ Listed Company : Refers to companies that meet the listing requirements which are being able to sell the issued stocks in the Kosdaq market or the stock market.

○ Capital : Refers to the current amount of capital that is paid by the corporation (headquarter).

○ Capital Ratio of Net Worth : Refers to the ratio of equity capital (total amount of capital-liabilities) on the total capital (=total amount of capital+liabilities=total assets).

B. Manpower Status

○ Received responses from three groups among bioindustry workers: research, production, and others including sales/administrative.

① Research : Refers to research and development manpower in bioindustry.

② Production : Refers to manpower engaged in production, facilities and quality management in bioindustry. (excluding manpower

in research center)

③ Others including sales/administrative : Refers to all manpower except research and production manpower in bioindustry.

C. R&D and Sales

○ R&D Cost : Refers to company's total cost spent in research activities to develop new products or new technology for the past year of 2017. It refers to sales cost in income statement and manufacturing statement, ordinary development expense and investment cost for management, land and equipment acquisition cost related to R&D in balance sheet.

① R&D Cost : Includes self R&D cost (labor costs, material costs and other expenses), commissioned research and development costs, cost for technology implementation

② Facility Investment Cost : Includes purchase cost of machinery, land and building

○ Resulting in Sales

① Selling complete product that was produced in the business

② Selling complete product which was outsourced by other businesses using raw material or half-finished products

③ Refers to providing services and sales resulting from transfer of technology. It includes all the results of domestic sales and export activities

D. Classification Scheme of Bioindustry and Biotechnology

1) Classification Scheme of Bioindustry

○ In case of classification scheme of bioindustry, the Korean Agency for Technology and Standards established national standard KS J 1009(Bioindustry Classification Code) on January 31, 2008 by reflecting

the business results of Ministry of Trade, Industry and Energy's 'Building groundwork for standardization of biotechnology and industrial products' and the second detail topic 'Building standard classification scheme of bioindustry/biotechnology and analyzing structure of the bioindustry'.

- Korean Agency for Technology and Standards revised the classification as of Dec. 29, 2016 to reflect 5 years of rapid growth of the biochemical technology and bioproducts and increase applicability of statistics.

<Overview of Bioindustry's Classification Scheme>

■ **Purpose of Classification**

○ To clarify the scope of bioindustry

- Defined companies that uses biotechnology in the research and development, manufacturing, production, and service phases

○ To propose standardized evidences that can be used for bioindustry-related statistics and institutions without confusion

- Creating industrial statistics such as company profits created from using biotechnology

○ To build groundwork for analysis such as economic structure, industrial structure, and correlation with other industries

○ To secure the connectivity with the classification scheme of international bioindustry

- Creating groundwork for comparing and analyzing the statistical data of the international bioindustry

■ **Target and Standard of Classification**

○ Industrial activities conducted by companies using biotechnology

○ Characteristics of products (produced goods or provided service) which use biotechnology in the research and development, production and service phases

- The function and the market of the products

■ **Classification Scheme**

○ Consisted of 8 upper classifications and 51 middle classifications

- The upper classifications are categorized by KS J 1009(Bioindustry Classification Code)

- The middle classifications are categorized by goods sold using biotechnology or provided service using biotechnology. These are categorized according to their correlation with industrial activities of corresponding upper classification.

>> <Table 1-1> Classification Scheme of Bioindustry

Code	Name of Industrial Classification
1	**Biopharmaceutical Industry**
1010	Bio-antibiotics
1020	Biologically manufactured low molecular medicine
1030	Vaccines
1040	Hormones
1050	Therapeutic antibodies and cytokines
1060	Blood products
1070	Cell-based therapeutics
1080	Gene therapeutics
1090	Biological diagnostic products
1100	Enzyme and live bacteria medicine
1110	Biomaterial-based medicine
1120	Veterinary biopharmaceuticals
1000	Other veterinary biopharmaceuticals
2	Biochemical and bioenergy industry
2010	Biopolymers
2020	Industrial enzymes and reagents
2030	Enzymes and reagents for research
2040	Biocosmetics and home & personal care chemicals
2050	Biological agrochemicals and fertilizers
2060	Biofuel
2000	Other biochemicals and bioenergy
3	**Biofood Industry**
3010	Functional health foods
3020	Food-grade microorganisms & enzymes
3030	Food additives
3040	Fermented foods
3050	Feed additives
3000	Other biofoods
4	**Bioenvironmental Industry**
4010	Biological treatment agents and systems
4020	Materials and equipments for bio immobilization
4030	Bioenvironmental agents and systems for treatment and recycle
4040	Measuring apparatus and service for environmental pollution and assessment
4000	Other bioenvironmental products and services

>> <Table 1-1> Classification Scheme of Bioindustry(Cont'd)

Code	Name of Industrial Classification
5	**Biomedical equipment industry**
5010	Biosensors
5020	In-vitro diagnostics
5030	Medical devices using biosensors and/or biomarkers
5000	Other biomedical equipment
6	**Bioinstrument and bioequipment industry**
6010	Gene/protein/peptide analysis, synthesis and manufacturing instruments
6020	Cell analysis and cultivation equipments
6030	Multi-functional and other bioanalysis instruments
6040	R&D and manufacturing equipments
6050	Bioprocess equipment parts
6000	Other bioinstruments and bioequipments
7	**Bioresource industry**
7010	Seeds and seedlings
7020	Genetically Modified Organisms for use as food, feed or processing
7030	Other bioresources
7000	Bioservice industry
8	**Bioservice industry**
8010	Bio consignment production & procuration services
8020	Bio diagnostic and analytical service
8030	R&D services
8040	Other R&D services
8050	Processing treatment & warehousing services
8000	Other bioservices

※ Refer to <Appendix 1> for the explanation on classification scheme

2) Classification Scheme of Biotechnology

○ In case of the classification scheme of biotechnology, it provides 13 sectors biotechnology classification code according to KS J 1009(Bioindustry Classification Code) which is recognized as national standard by the Korean Agency for Technology and Standards in January 31, 2008. This reflected the business results of Ministry of Trade, Industry and Energy's 'Building groundwork for standardization of biotechnology and industrial products' and the second detail topic 'Building standard classification scheme of bioindustry/biotechnology and analyzing structure of the bioindustry'.

- Korean Agency for Technology and Standards revised the classification as of Dec. 29, 2016 to reflect 5 years of rapid growth of the biochemical technology and bioproducts and increase applicability of statistics

<Overview of Biotechnology's Classification Scheme>

■ **Purpose of Classification**

- ○ To define the scope of the domestic bioindustry
- ○ To analyze the usage condition of biotechnology in the domestic industry

■ **Target and Standard of Classification**

- ○ To establish the classification scheme of biotechnology used in industries
- ○ To emphasize the technology used in the current bioindustry and the research development field
- ○ To reflect the development vision of the future bioindustry and biotechnology

■ **Classification Scheme**

- ○ Consisted of 2 classifications (Upper · Middle). There are 13 upper classifications and 68 middle classifications.
- ○ The upper classification includes the technological scope of the corresponding middle classifications. It is consisted of items that can easily implement and respond to specific details of technology.
- ○ The middle classification limits the technological scope of the upper classification. It is consisted of items that can encompass related new technologies into the list-based definitions.
- ○ Each of the 68 middle classification has corresponding list-based definition which explains the definition and the scope of the middle classification's technology. This list-based definition is consisted of items that allows duplication among middle classifications and focuses on technological names used in industry and the research and development field.

>> <Table 1-2> Classification Scheme of Biotechnology

Code	Name of Technological Classification
A	**Genetic engineering**
A1	Gene manipulation
A2	Gene expression and regulation
A3	Gene application
A4	Gene therapy
A0	Genetic engineering, n.e.s.
B	**Protein engineering**
B1	Protein structure analysis
B2	Protein function analysis
B3	Complex protein engineering
B4	Peptide engineering
B5	Protein application
B0	Protein engineering, n.e.s.
C	**Other macromolecule engineering**
C1	Lipid engineering
C2	Carbohydrate engineering
C0	Macromolecule engineering, n.e.s.
D	**Therapeutic cell and tissue engineering**
D1	Therapeutics cell utilization
D2	Bioenvironment regulation
D3	Functional biomaterial development
D4	Cell engineering
D5	Tissue engineering
D0	Cell and tissue engineering, n.e.s.
E	**Systems biology and bioinformatics**
E1	Gene sequence analysis
E2	Functional genomics
E3	Proteomics
E4	Bioinformatics
E0	Systems biology and bioinformatics, n.e.s.
F	**Metabolic engineering**
F1	Metabolite production
F2	Applications of metabolic engineering
F3	Understanding the metabolism and metabolic pathways
F0	Metabolic engineering, n.e.s.
G	**Bioprocess**
G1.	Fermentation engineering
G2.	Cell culture engineering
G3.	Biotransformation
G4.	Bioseparation engineering
G5.	Industrialization
G0.	Bioprocess, n.e.s.

>> <Table 1-2> Classification Scheme of Biotechnology(Cont'd)

Code	Name of Technological Classification
H	**Bioresource production and utilization**
H1	Plant resource utilization technology
H2	Animal resource utilization technology
H3	Microbial resource utilization technology
H4	Insect resource utilization technology
H5	Marine/fresh water organism technology
H6	Food engineering
H7	Biomaterializing technology
H8	Biodiversity conservation
H0	Bioresource production and utilization, n.e.s.
I	**Environmental biotechnology and bioenergy technology**
I1	Clean technology
I2	Environmental pollution control and management technology
I3	Bioenergy technology
I0	Environmental biotechnology and bioenergy technology, n.e.s.
J	**Nanobiotechnology**
J1	Nano-biodevice fabrication
J2	Nanobiomaterial technology
J3	Nano drug delivery system
J4	BioNEMS(Nanoelectromechanical systems, nano-LOC(lab-on-a-chip)
J0	Nanobiotechnology, n.e.s.
K	**Bioelectronics**
K1	Biosensor fabrication
K2	Bioelectronic device fabrication
K3	Biochip fabrication
K4	Microfluidics
K0	Bioelectronics, n.e.s.
L	**Biosafety and efficacy evaluation**
L1	Safety evaluation
L2	Safety management
L3	Environmental assessment
L4	Biohazard management
L5	Efficacy evaluation
L0	Biosafety and efficacy evaluation, n.e.s.
M	**Other biotechnology**
M1	Combinatorial biology
M2	Drug delivery
M3	Immunotherapy technology
M0	Biotechnology, n.e.s.

※ Refer to <Appendix 1> for the explanation on classification scheme

【Special Notes on Statistical Data】

1) Due to the revision of the bioindustrial classification scheme, the results for 2016 may differ from the previous results.

2) The missing values (no response, unsureness and none of the above) were excluded from the statistical calculation. (Statistical analysis was conducted based on 100% data with the missing value excluded.)

3) The sum of detail items and the total sum may not be identical as all the statistical values are rounded values.

4) This report calculates down to one place of decimals and related symbols are as the following:
「-」: none of the above
「0.0」: less than the unit

5) Any inquiries on this report should be contacted to the Bio Industry Policy unit of the Korea Biotechnology Industry Organization. (Phone : 031-628-0040, 0019)

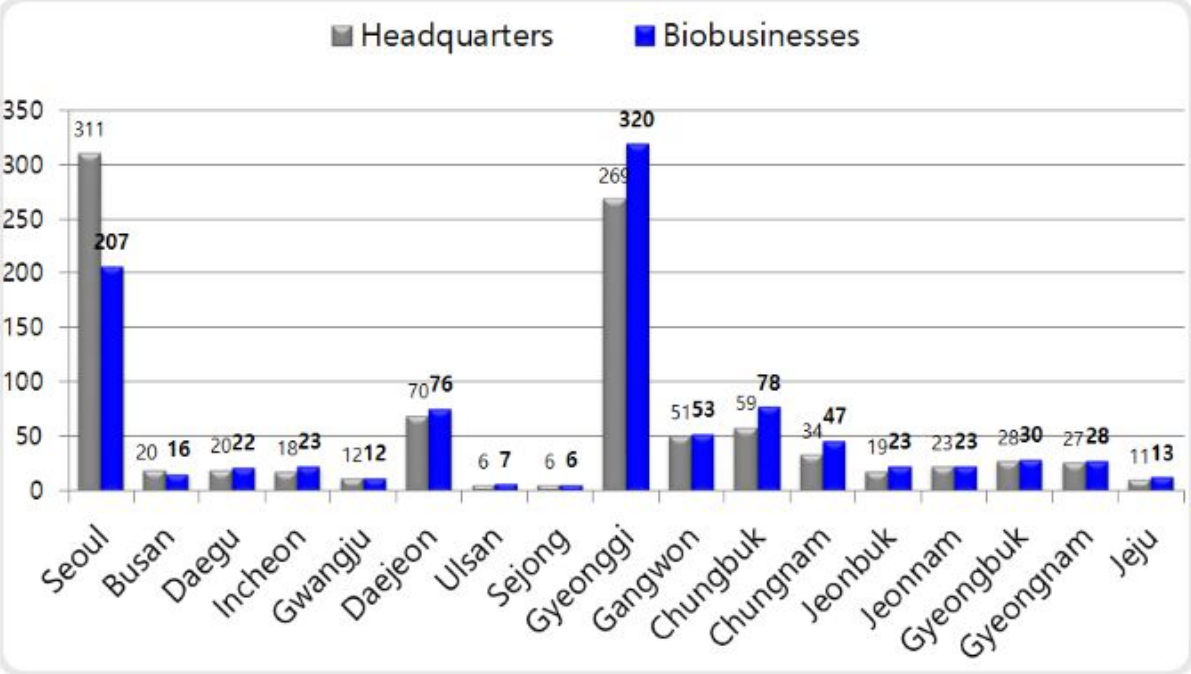
II. Key Findings

1 General Status of Bioindustry

A. Bioindustry's Distribution per Place

○ Headquarters and biobusinesses of domestic bioindustry are mostly located in Seoul and Gyeonggi province. There are 311 headquarters in Seoul, and 320 biobusinesses in Gyeonggi.

<Figure 2-1> Bioindustry's Distribution per Place (Unit : number of companies)



* Place of biobusinesses were analyzed according to the following order: factory > research center > headquarter.

<Table 2-1> Bioindustry's Distribution per Place (Unit : number of companies)

Industrial Category	Total	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan	Sejong
Total	984	207	16	22	23	12	76	7	6
Biopharmaceutical Industry	322	97	4	6	11	1	17	-	1
Biochemical and bioenergy industry	201	26	3	2	3	2	29	3	3
Biofood Industry	189	19	7	5	3	2	7	-	2
Bioenvironmental Industry	75	5	1	6	3	4	4	3	-
Biomedical equipment industry	66	19	-	2	1	1	4	-	-
Bioinstrument and bioequipment industry	57	14	-	1	-	1	8	-	-
Bioresource industry	20	2	1	-	-	-	2	1	-
Bioservice industry	54	25	-	-	2	1	5	-	-

Industrial Category	Gyeonggi	Gangwon	Chungbuk	Chungnam	Jeonbuk	Jeonnam	Gyeongbuk	Gyeongnam	Jeju
Total	320	53	78	47	23	23	30	28	13
Biopharmaceutical Industry	126	8	28	14	3	-	3	2	1
Biochemical and bioenergy industry	55	10	14	12	6	10	13	7	3
Biofood Industry	46	17	23	14	7	9	9	12	7
Bioenvironmental Industry	24	8	4	1	4	2	2	4	-
Biomedical equipment industry	20	9	2	4	1	-	2	1	-
Bioinstrument and bioequipment industry	28	-	1	2	-	2	-	-	-
Bioresource industry	5	1	3	-	1	-	1	2	1
Bioservice industry	16	-	3	-	1	-	-	-	1

* The result analyzed the results of 1 core business that was selected for each company.

** Place of biobusinesses were analyzed according to the following order: factory > research center > headquarter.

○ TOP3 provinces for domestic bioindustry's businesses are as the following:
Biopharmaceutical Industry: Gyeonggi 39.1% > Seoul 30.1% > Chungbuk 8.7%

Biochemical and boienergy Industry : Gyeonggi 27.4% > Daejeon 14.4% > Seoul 12.9%

Biofood Industry : Gyeonggi 24.3% > Chungbuk 12.2% > Seoul 10.1%

Bioenvironmental Industry : Gyeonggi 32.0% > Gangwon 10.7% > Deagu 8.0%

Biomdical equipment industry : Seoul 30.3% > Gyeonggi 28.8% > Gangwon 13.6%

Bioinstrument and bioequipment industry : Gyeonggi 49.1% > Seoul 24.6% > Daejeon 14.0%

Bioresource Industry : Gyeonggi 25.0% > Chungbuk 15.0% > Seoul/Daejeon/Gyeongnam 10.0%

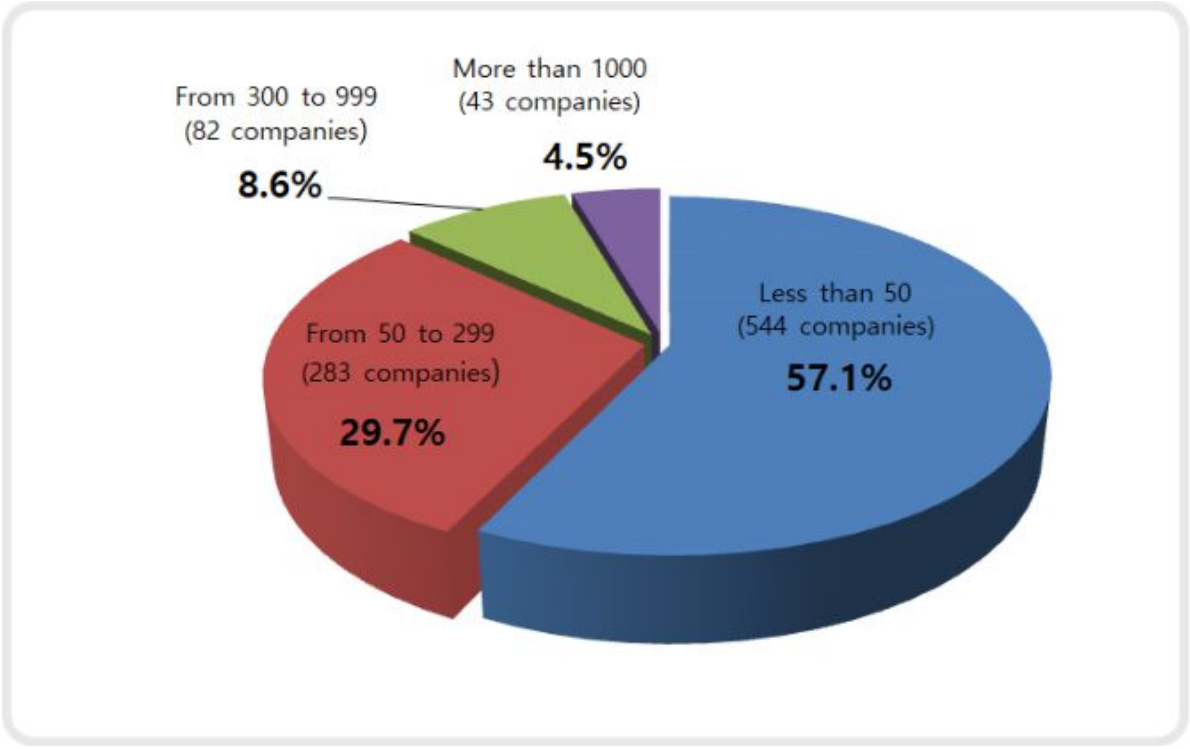
Bioservice Industry : Seoul 46.3% > Gyeonggi 29.6% > Daejeon 9.3%

B. Bioindustry's Distribution per Size of Workers

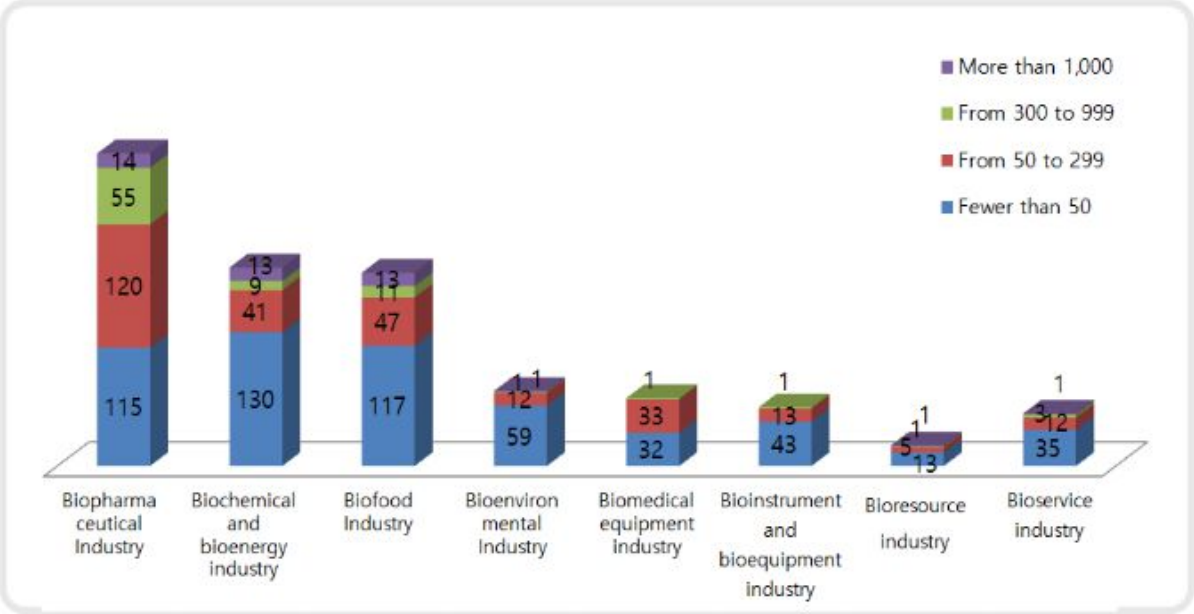
○ There are 544 companies (57.1%) that belongs to 'less than 1~50 workers' among total size of workers. (Excluded 32 no response cases)

○ There are 43 companies (4.5%) that have more than 1,000 workers.

<Figure 2-2> Bioindustry's Distribution per Size of Workers



<Figure 2-3> Bioindustry's Size of Workers (Unit : number of companies)



* Companies that did not have information on the size of workers were excluded from the statistical data.

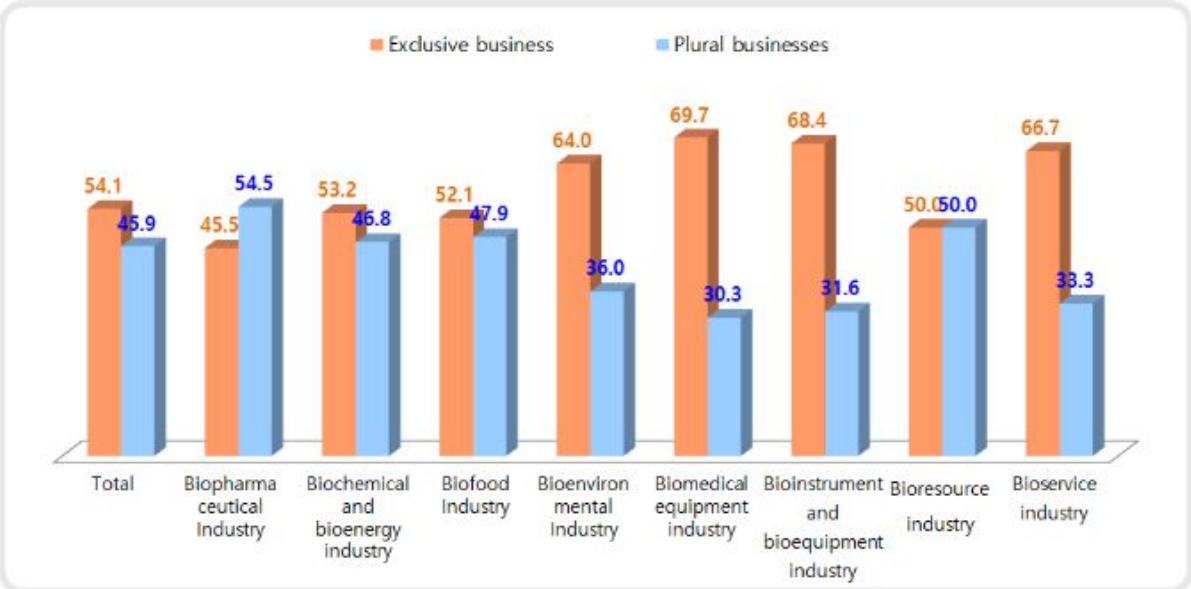
C. Bioindustry's Distribution on the Existence of Other Businesses

○ Bioindustry's existence of other businesses refers to the existence of factories, research centers or stores in other location.

○ Companies that do not have factories, research center or stores in other location are categorized as 'exclusive business'. Companies that have factories, research centers or stores in other location are categorized as 'plural businesses'.

○ Among 975 bioindustry companies, 527 companies (54.1%) are 'exclusive business' and 448 companies (45.9%) are 'plural businesses' according to the survey. (Excluding 9 unclassified companies)

<Figure 2-4> Bioindustry's Existence of Other Businesses (Unit : %)



* Excluded samples that could not classify their operation status as either exclusive or plural

D. Bioindustry's Financial Analysis

○ The total capital of bioindustry is surveyed as 16.1 billion won and the ratio of net worth is 54%.

○ Companies in biochemical and bioenergy industry had higher average amount of capital reaching 34.2 billion won. Companies in biopharmaceutical, biomedical equipment and bioservice industry had higher value compared to other bioindustries with average ratio of net worth reaching 58% each.

<Table 2-2> Biotechnology Industry's Financial Standing Analysis by Category

(Unit : No, %, million Won)

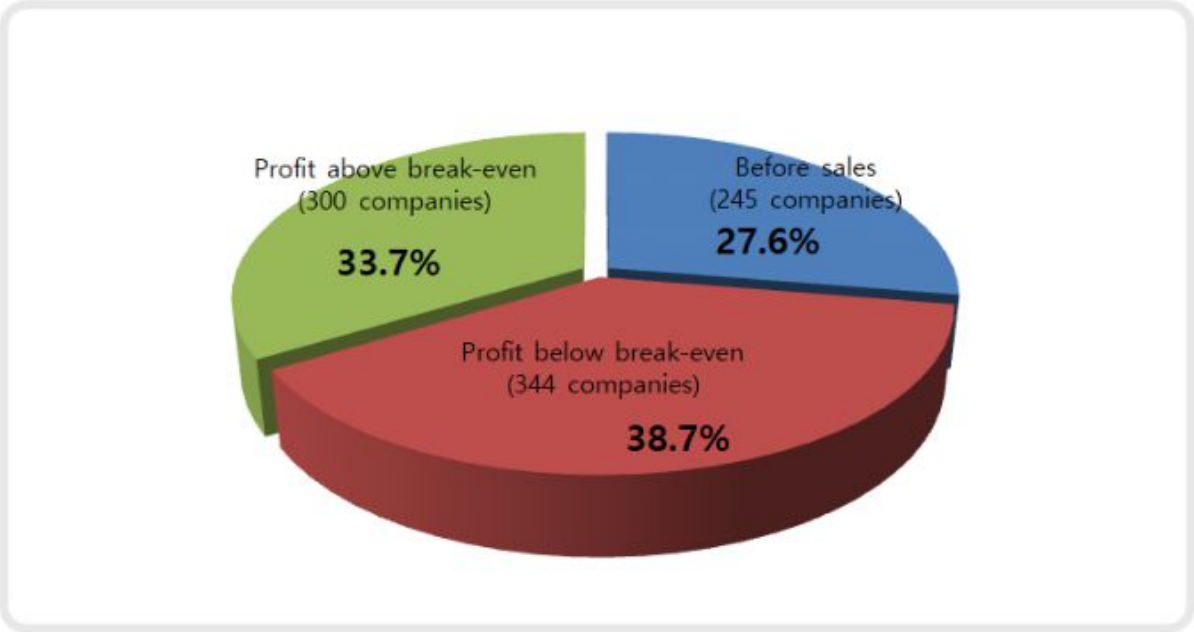
Industrial Category	No. of companies	Capital			Ratio of Net worth		
		Minimum	Maximum	Average	Minimum	Maximum	Average
Total	**984**	**1**	**1,488,993**	**16,073**	**-1,044**	**100**	**54**
Biopharmaceutical Industry	322	100	391,406	13,036	-135	99	58
Biochemical and bioenergy industry	201	30	1,488,993	34,200	-1,044	99	47
Biofood Industry	189	30	625,562	17,705	-244	100	52
Bioenvironmental Industry	75	50	10,846	1,330	-17	98	55
Biomedical equipment industry	66	50	59,863	4,500	-5	97	58
Bioinstrument and bioequipment industry	57	1	14,000	1,623	-105	100	48
Bioresource industry	20	53	167,456	21,929	-85	98	46
Bioservice industry	54	5	165,413	6,669	-46	100	58

E. Type of Biobusiness' sales generation in Bioindustry

○ The result for type of biobusiness' revenue includes responses from 889 companies out of 984 total participants, of which 95 were non-responses.

○ Among 889 companies, 245 companies (27.6%) belonged to the phase of 'before sales' in 2017, and among 644 companies that resulted in sales, 344 companies(38.7%) belonged to 'below BEP'.

<Figure 2-5> Type of Biobusiness' sales generation in Bioindustry

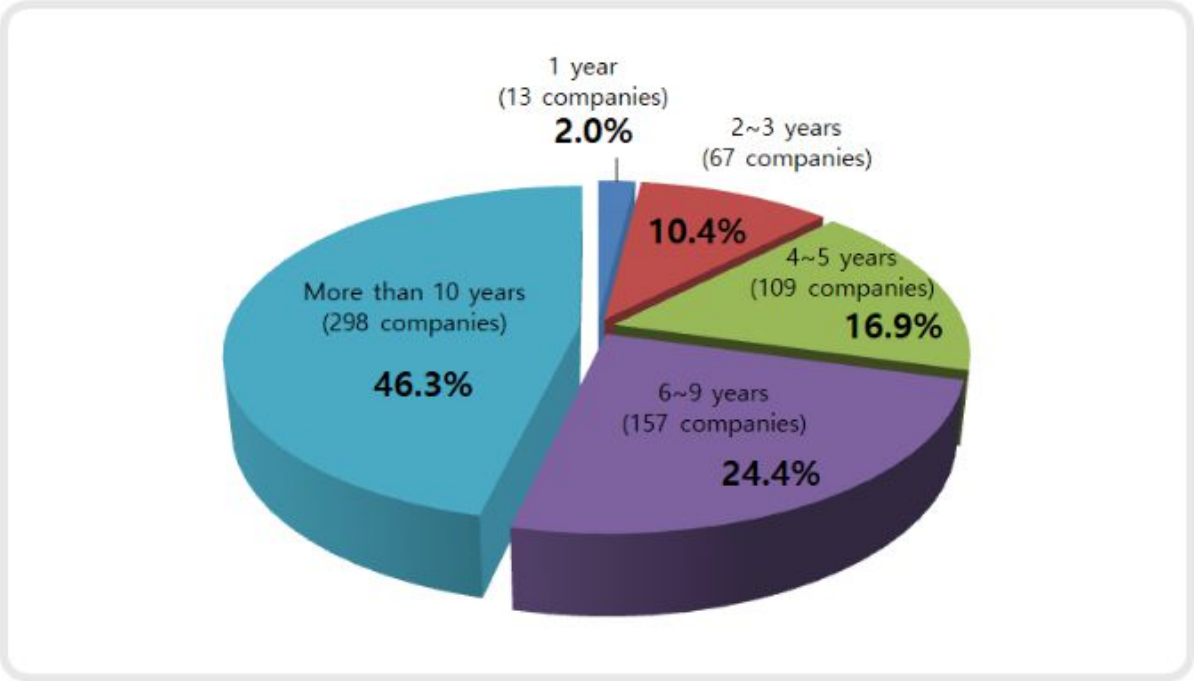


* Excluded unclassified samples

○ Among 644 companies that resulted in sales in 2017, 13 companies (2.0%) had their first sales in 2017.

○ There are 298 companies (46.4%) that resulted in sales for more than 10 years.

<Figure 2-6> Bioindustry's Sales Period



2 Manpower Status of Bioindustry

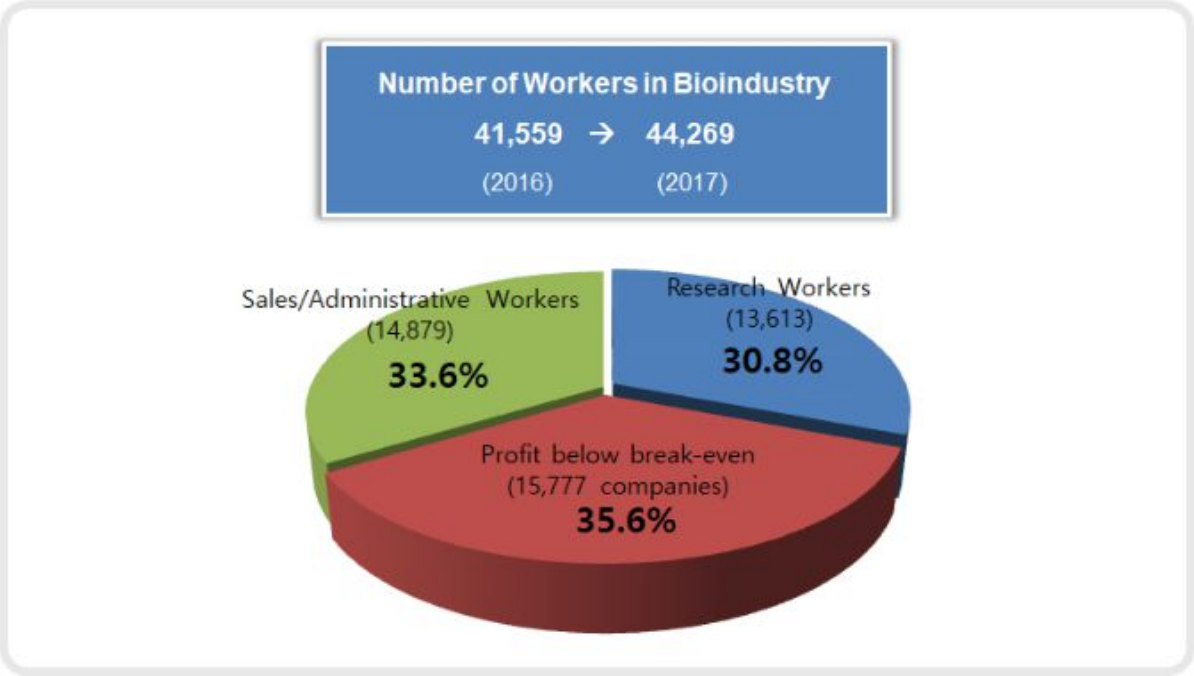
A. Manpower Status of 2017

1) Manpower Status per Category

○ Among 984 domestic bioindustry companies in 2017, there was an increase of 2,710 workers compared to 2016, reaching 44,269 workers and there is an average of 45 workers per company.

○ Manpower of bioindustry consists of 13,613 research workers (30.8%), 15,777 production workers (35.6%), 14,879 sales/administrative workers (33.6%).

<Figure 2-7> 2017 Bioindustry's Distribution of Manpower

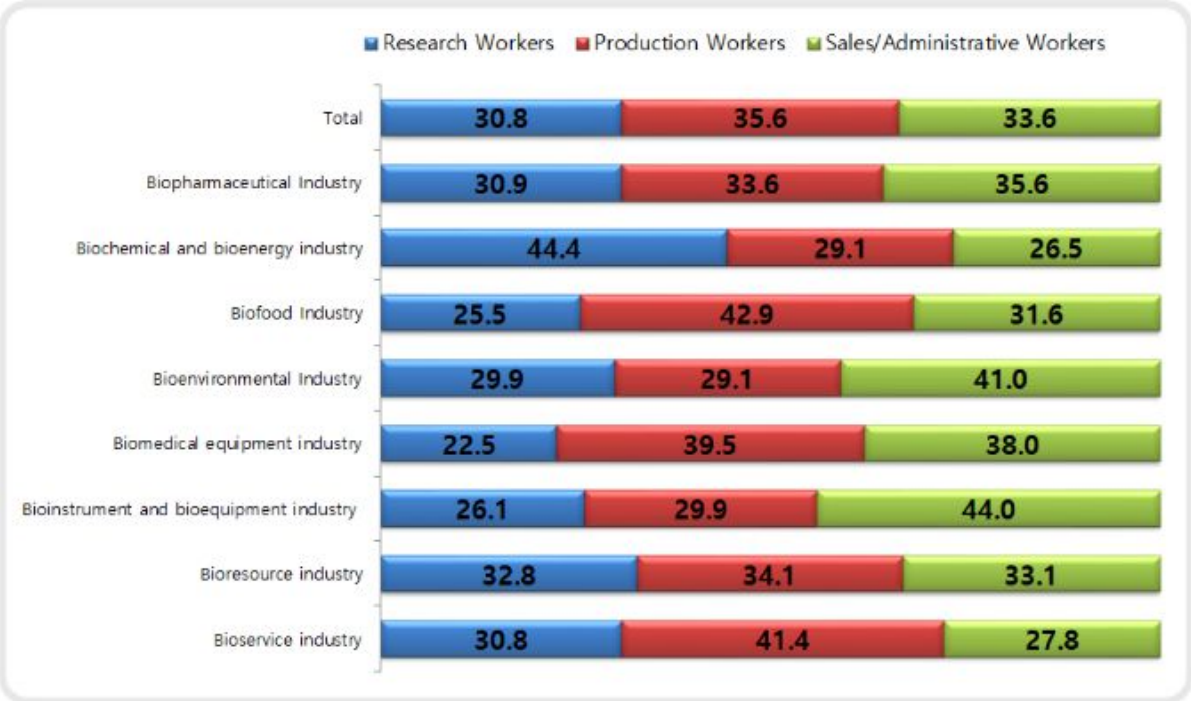


<Table 2-3> 2017 Bioindustry's Manpower Distribution

(Unit : number of companies, workers, %)

Industrial Category		No. of Companies	Research workers	Production workers	Sales/administrative workers	Total	Distribution Ratio
Total	No. of Employees	984	13,613	15,777	14,879	44,269	100.0
	Distribution Ratio	100.0	30.8	35.6	33.6	100.0	
Biopharmaceutical Industry		322	6,326	6,875	7,283	20,484	46.3
Biochemical and bioenergy industry		201	2,233	1,465	1,331	5,029	11.4
Biofood Industry		189	1,682	2,835	2,084	6,601	14.9
Bioenvironmental Industry		75	354	344	486	1,184	2.7
Biomedical equipment industry		66	866	1,525	1,466	3,857	8.7
Bioinstrument and bioequipment industry		57	322	369	543	1,234	2.8
Bioresource industry		20	327	340	330	997	2.3
Bioservice industry		54	1,503	2,024	1,356	4,883	11.0

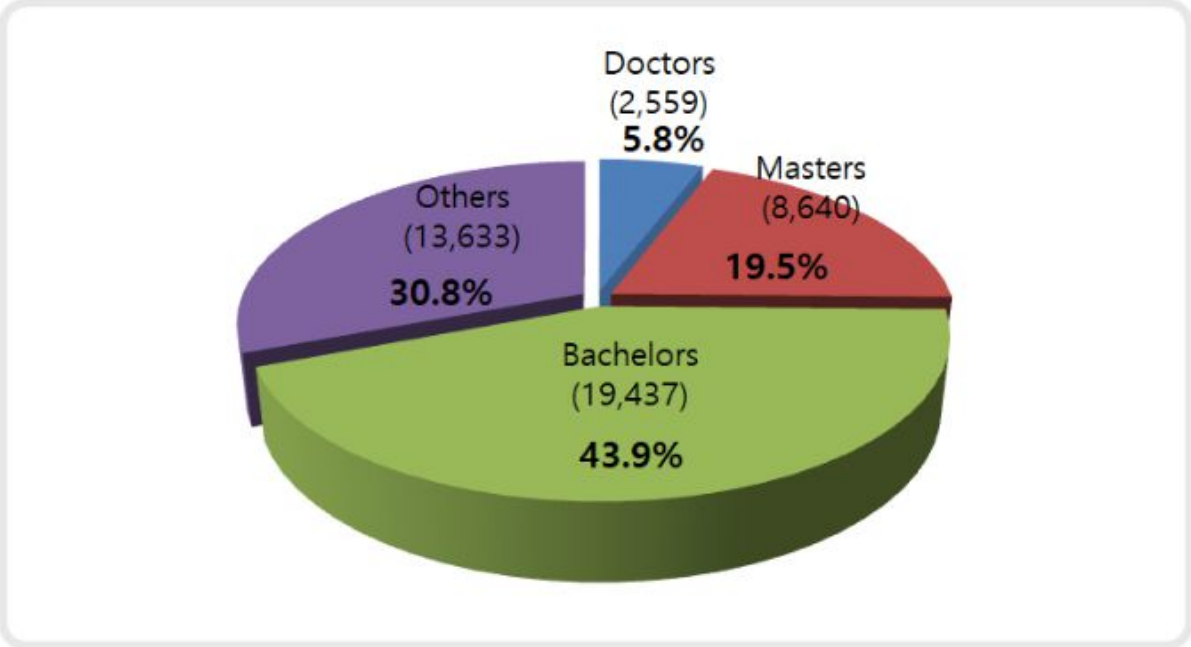
<Figure 2-8> Bioindustry's Manpower Proportion of 2017 (Unit : %)



2) Manpower Status per Academic Degree

○ Among bioindustry manpower in 2017, workers with bachelor's degree were the largest in number, reaching 19,437 people (43.9%). Workers with master's degree ranked second with 8,640 workers (19.5%), and workers with doctor's degree the last with 2,427 workers (5.8%).

<Figure 2-9> Bioindustry's Academic Degree Proportion of Workers of 2017



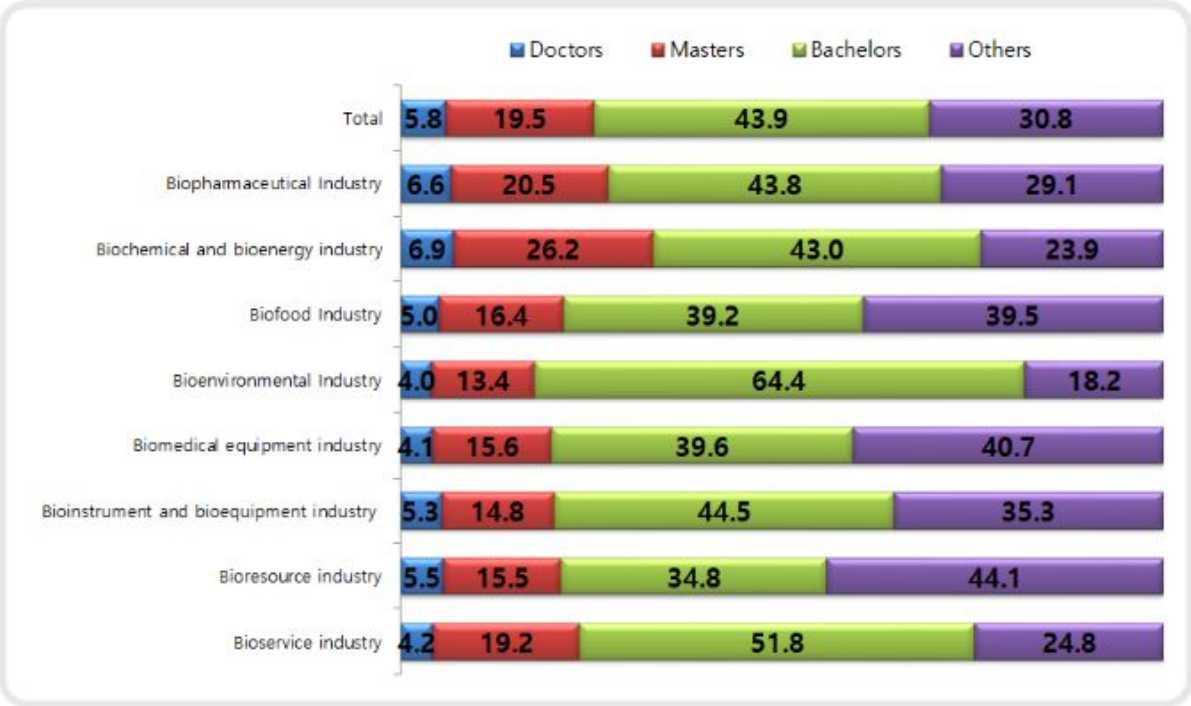
<Table 2-4> 2017 Bioindustry's Distribution of Academic Degree

(Unit : number of people, %)

Industrial Category		Doctor	Master	Bachelor	Others	Total	Distribution Ratio
Total	No. of Employees	2,559	8,640	19,437	13,633	44,269	100.0
	Distribution Ratio	5.8	19.5	43.9	30.8	100.0	
Biopharmaceutical Industry		1,353	4,204	8,972	5,955	20,484	46.3
Biochemical and bioenergy industry		345	1,318	2,163	1,203	5,029	11.4
Biofood Industry		329	1,081	2,585	2,606	6,601	14.9
Bioenvironmental Industry		47	159	762	216	1,184	2.7
Biomedical equipment industry		158	603	1,528	1,568	3,857	8.7
Bioinstrument and bioequipment industry		66	183	549	436	1,234	2.8
Bioresource industry		55	155	347	440	997	2.3
Bioservice industry		206	937	2,531	1,209	4,883	11.0

○ Portion of elite manpower such as workers with masters or doctors degree is relatively high in biochemical and bioenergy industry(33.1%) and in biopharmaceutical industry(27.1%).

<Figure 2-10> Bioindustry's Academic Degree Proportion of 2017 (Unit : %)



3) Manpower Distribution by Area

○ Gyeonggi area held 30.7% of total bioindustry's manpower in 2017, which account for 13,593 workers in numbers. Followed areas that ranked high of possession of bioindustry's manpower are Chungbuk (7,800 people), Seoul(5,485 people) and Incheon(5,214 people).

< Talbe 2-5 > 2017 Bioindustry's Manpower Distribution by Area

(Unit : number of people, %)

Area		Doctor	Master	Bachelor	Others	Total	Distribution Ratio
Total	No. of Employees	2,559	8,640	19,437	13,633	44,269	100.0
	Distribution Ratio	5.8	19.5	43.9	30.8	100.0	
Seoul		432	1,196	2,970	887	5,485	12.4
Busan		12	39	155	199	405	0.9
Daegu		17	54	221	1,359	1,651	3.7
Incheon		297	1,060	2,531	1,326	5,214	11.8
Gwangju		6	19	36	5	66	0.1
Daejeon		189	400	705	369	1,663	3.8
Ulsan		6	22	149	60	237	0.5
Sejong		10	89	264	156	519	1.2
Gyeonggi		872	3,124	5,461	4,136	13,593	30.7
Gangwon		135	423	1,107	1,105	2,770	6.3
Chungbuk		324	1,445	3,684	2,347	7,800	17.6
Chungnam		101	327	467	602	1,497	3.4
Jeonbuk		43	101	389	328	861	1.9
Jeonnam		23	57	186	121	387	0.9
Gyeongbuk		46	180	701	349	1,276	2.9
Gyeongnam		20	70	289	203	582	1.3
Jeju		26	34	122	81	263	0.6

B. Recent Trend of Bioindustry Manpower Status

1) 2015~2017 Bioindustry's trend of manpower status

① Bioindustry's Trend of manpower status

○ The manpower of bioindustry in 2017 had an increase of 2,710 workers(6.5%) compared to 2016, reaching 44,269 workers.

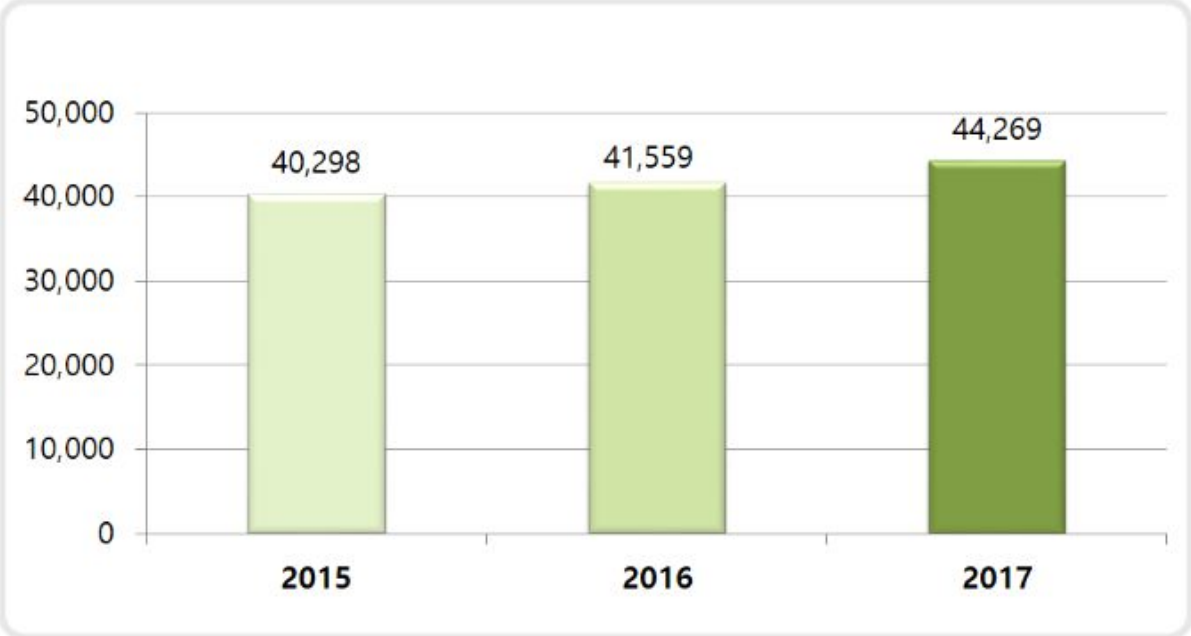
<Table 2-6> 2015~2017 Bioindustry's Change in Manpower

(Unit : number of people, %)

Classification	2015	2016	2017	Annual Average Rate of change
No. of Employees	40,298	41,559	44,269	4.8
Rate of Change	6.6	3.1	6.5	

<Figure 2-11> 2015~2017 Bioindustry's Trend of Manpower

(Unit : number of people)



② Bioindustry's Trend in Academic Degree of Manpower

○ Compared to 2016, in 2017 the proportion of bioindustry workers with doctor's, master's and bachlor's degrees increased 5.8%, 0.5%, 9.2% respectively.

○ Increase in the number of workers were highest in workers with bachelor's degrees, increasing by 1,632 compared to the previous year.

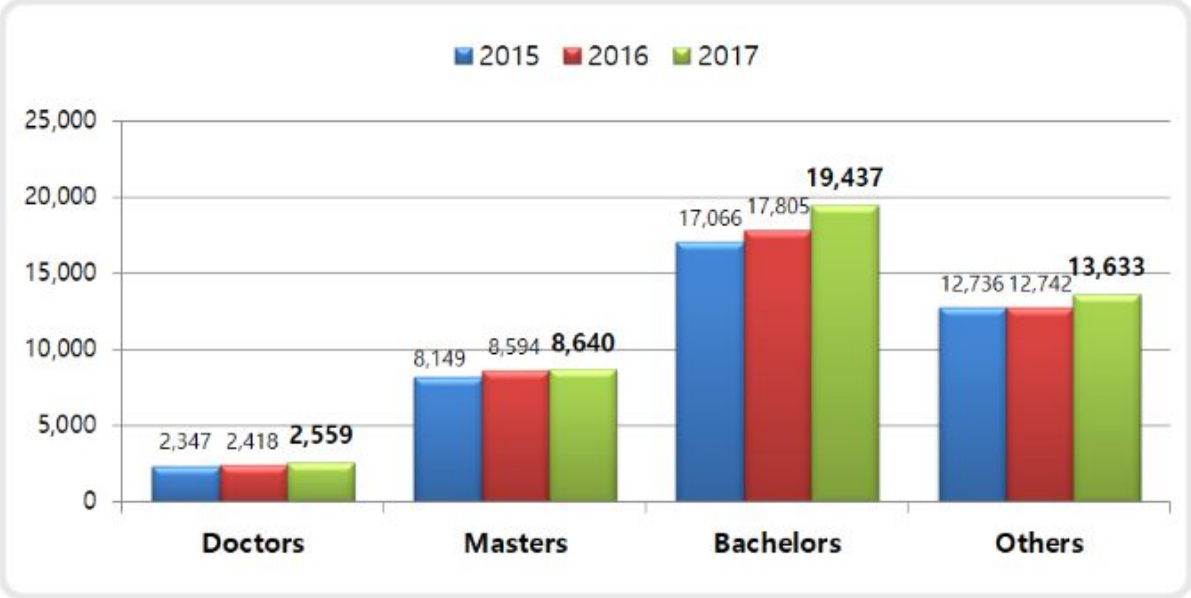
<Table 2-7> 2015~2017 Bioindustry's Trend in Academic Degree of Manpower

(Unit : number of people, %)

Degree	2015		2016		2017		Variation from the year before		Annual Average Rate of change
	No. of Employees	Distribution Ratio	No. of Employees	Distribution Ratio	No. of Employees	Distribution Ratio	No. of Employees	Rate of Change	
Total	40,298	100.0	41,559	100.0	44,269	100.0	2,710	6.5	4.8
Doctor	2,347	5.8	2,418	5.8	2,559	5.8	141	5.8	4.4
Master	8,149	20.2	8,594	20.7	8,640	19.5	46	0.5	3.0
Bachelor	17,066	42.3	17,805	42.8	19,437	43.9	1,632	9.2	6.7
Others	12,736	31.6	12,742	30.7	13,633	30.8	891	7.0	3.5

<Figure 2-12> 2015~2017 Bioindustry's Trend in Academic Degree of Manpower

(Unit : number of people)



2) 2013~2017 Bioindustry's Trend in Academic Degree of Manpower

① Bioindustry's Trend of Manpower status

○ For the past 5 years, Bioindustry Manpower continued to increase.

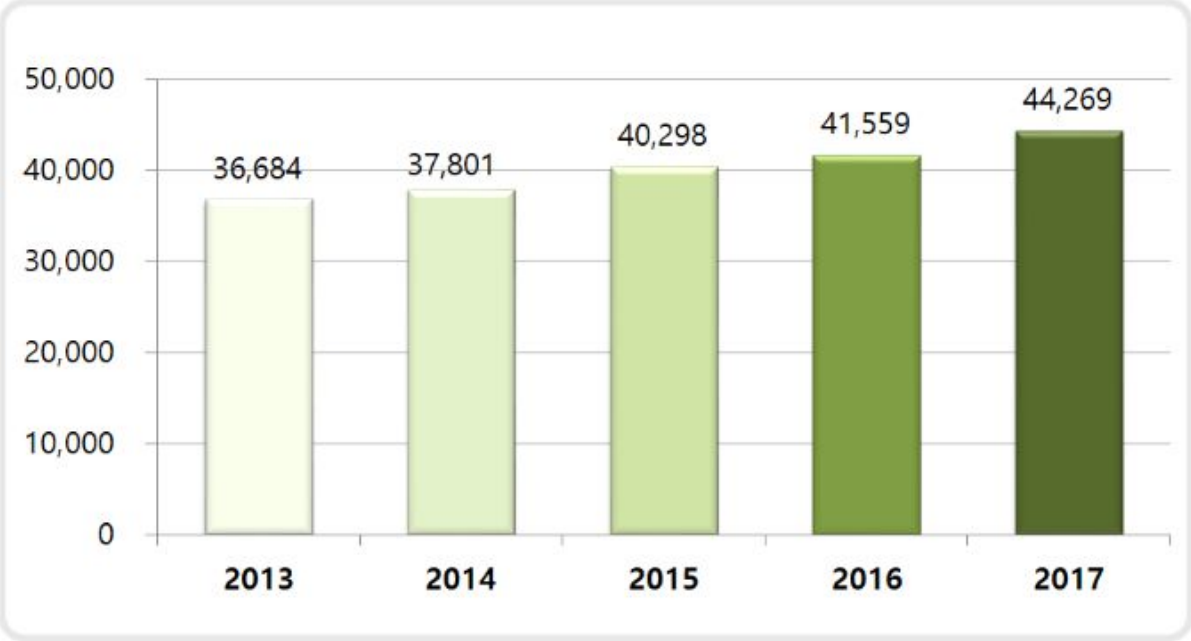
<Table 2-8> 2013~2017 Bioindustry's Change in Manpower (%)

(Unit : number of people, %)

Classification	2013	2014	2015	2016	2017	Annual Average Rate of Change
No. of Employees	36,684	37,801	40,298	41,559	44,269	4.8
Rate of Change	-2.4	3.0	6.6	3.1	6.5	

<Figure 2-13> 2013~2017 Bioindustry's Trend of Manpower

(Unit : number of people)



② Bioindustry's Trend in Academic Degree of Manpower

○ In 2013 to 2017, number of employees with either bachelor, master, and doctor degree continued to steadily increase. Employees with bachelors increased the most by 6.4%, followed by doctor's 5.3% and master's by 3.9%.

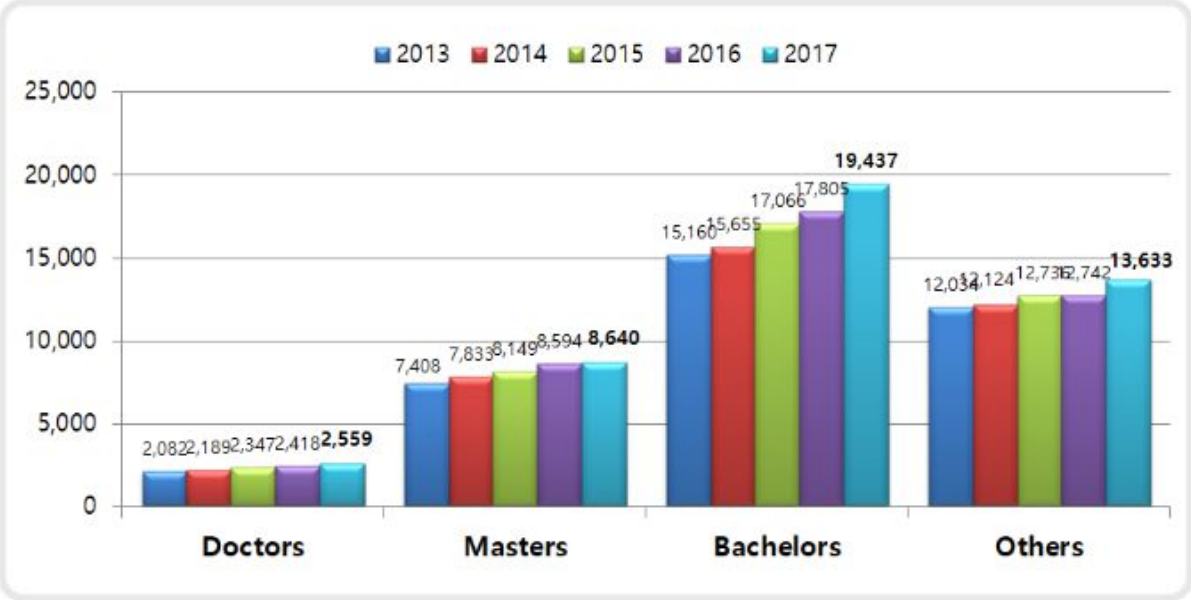
<Table 2-9> 2013 ~ 2017 Bioindustry's Trend in Academic Degree of Manpower

(Unit : number of people, %)

Degree	2013		2014		2015		2016		2017		Variation from the year before		Annual Average Rate of Change
	No. of Employees	Distribution Ratio	No. of Employees	Distribution Ratio	No. of Employees	Distribution Ratio	No. of Employees	Distribution Ratio	No. of Employees	Distribution Ratio	No. of Employees	Rate of Change	
Total	**36,684**	**100.0**	**37,801**	**100.0**	**40,298**	**100.0**	**41,559**	**100.0**	**44,269**	**100.0**	**2,710**	**6.5**	**4.8**
Doctor	2,082	5.7	2,189	5.8	2,347	5.8	2,418	**5.8**	2,559	5.8	141	5.8	5.3
Master	7,408	20.2	7,833	20.7	8,149	20.2	8,594	20.7	8,640	19.5	46	0.5	3.9
Bachelor	15,160	41.3	15,655	41.4	17,066	42.3	17,805	42.8	19,437	43.9	1,632	9.2	6.4
Others	12,034	32.8	12,124	32.1	12,736	31.6	12,742	30.7	13,633	30.8	891	7.0	3.2

<Figure 2-14> 2013~2017 Bioindustry's Trend in Academic Degree of Manpower

(Unit : number of people)



3 Investment Status of Bioindustry

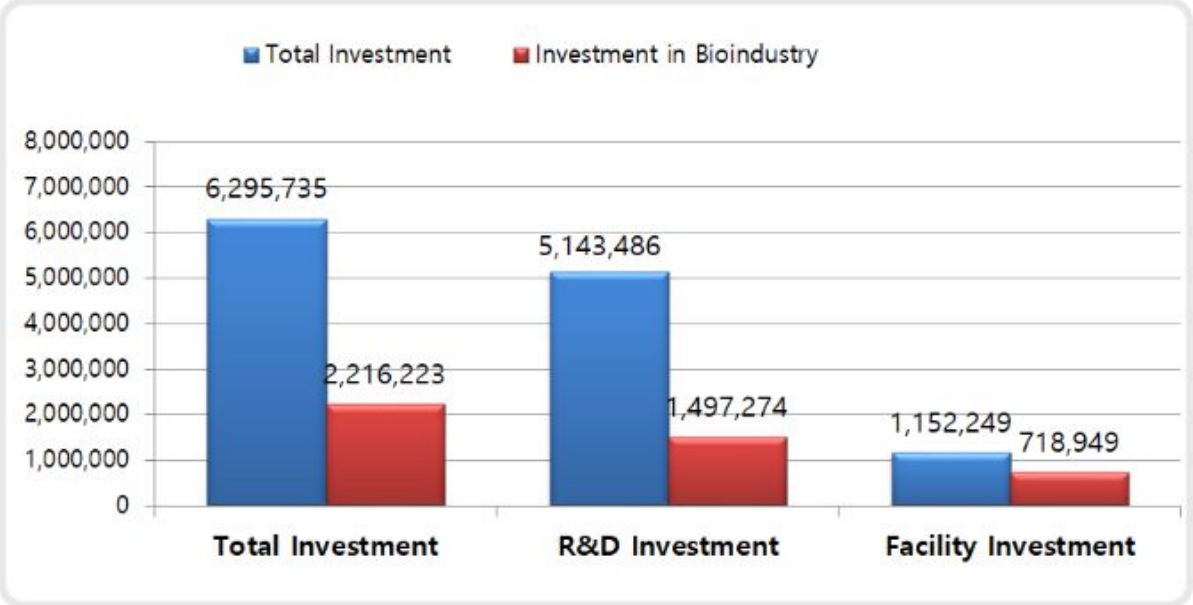
A. Bioindustry's Investment Status of 2017

○ The total amount of investment bioindustry companies made for the past year of 2017 reached 6 trillion and 295.7 billion won, and the investment cost on bioindustry turned out to be 35.2% of the total investment fee reaching 2 trillion and 216.2 billion won.

○ The R&D cost in bioindustry turned out to be 29.1% of the total R&D cost reaching 1 trillion and 497.3 billion won, and the facility investment cost in bioindustry took 62.4% of the total facility investment cost reaching 718.9 billion won.

<Figure 2-15> 2017 Total Investment cost and Investment in Bioindustry

(Unit: million Won)



○ Among bioindustries, the total investment was highest in biopharmaceutical industry reaching 1 trillion and 526 billion won(68.9%) and then the following highest industries were bioservice industry reaching 238.5 billion won (10.8%), biochemical and bioenergy industry reaching 178.4 billion won(8.0%). These three core bioindustries took 87.7% of bioindustry's the total investment cost.

○ Among bioindustries, the total R&D cost was highest in biopharmaceutical industry reaching 1 trilion 115 billion won(74.5%) and then the following highest industries were biochemcial and bioenergy reaching 116.5 billion won(7.8%) and biofood industry reaching 112.1 billion won(7.5%). These three core bioindustries took 89.7% of bioindustry's the total R&D cost.

○ Among bioindustry companies, the average amount of R&D cost was highest in biopharmaceutical industry reaching 3.5 billion won and then the following highest industries were bioresource industry with 1.1 billion won, bioservice industry with 1.0 billion won and Biomedical equipment industry with 0.9 billion won.

○ Among bioindustries, the total facility investment cost was highest in biopharmaceutical industry reaching 410.9 billion won(57.2%) and then the following highest industry was bioservice industry reaching 186.8 billion won(26%).

○ Among bioindustry companies, the average amount of facility investment cost was highest in bioservice industry reaching 3.5 billion won and then the following highest industries were biopharmaceutical industry with 1.3 billion won and biomedical equipment industry with 0.6 billion won.

<Table 2-10> 2017 Bioindustry's Size of Investment (Unit : number of companies, million Won)

Industrial Category	No. of companies	R&D Investment		Facility Investment		Total Investment	
		Total	Average	Total	Average	Total	Average
Total	**984**	**1,497,274**	**1,521.6**	**718,949**	**730.6**	**2,216,223**	**2,252.3**
Biopharmaceutical Industry	322	1,115,040	3,462.9	410,924	1,276.2	1,525,964	4,739.0
Biochemical and bioenergy industry	201	116,512	579.7	61,885	307.9	178,397	887.5
Biofood Industry	189	112,139	593.3	10,765	57.0	122,904	650.3
Bioenvironmental Industry	75	9,904	132.1	1,718	22.9	11,622	155.0
Biomedical equipment industry	66	57,161	866.1	41,328	626.2	98,489	1,492.3
Bioinstrument and bioequipment industry	57	12,654	222.0	2,227	39.1	14,881	261.1
Bioresource industry	20	22,163	1,108.2	3,341	167.1	25,504	1,275.2
Bioservice industry	54	51,701	957.4	186,761	3,458.5	238,462	4,416.0

○ Size of overall R&D investment was highest in Incheon, Gyeonggi and Chungbuk area, while that of facility investment was highest in Incheon area.

○ Average size of R&D investment was highest in Incheon area where it reached 16.9 billion won, while that of facility investment was highest in Incheon to reach 12.3 billion won.

< Table 2-11 > 2017 Bioindustry's Size of Investment by Area

(Unit : number of companies, million Won)

Area	No. of companies	R&D Investment		Facility Investment		Total Investment	
		Total	Average	Total	Average	Total	Average
Total	**984**	**1,497,274**	**1,521.6**	**718,949**	**730.6**	**2,216,223**	**2,252.3**
Seoul	207	139,333	673.1	58,746	283.8	198,079	956.9
Busan	16	38,240	2,390.0	1,098	68.6	39,338	2,458.6
Daegu	22	2,788	126.7	310	14.1	3,098	140.8
Incheon	23	389,778	16,946.9	283,634	12,331.9	673,412	29,278.8
Gwangju	12	663	55.3	215	17.9	878	73.2
Daejeon	76	46,365	610.1	52,521	691.1	98,886	1,301.1
Ulsan	7	1,418	202.6	300	42.9	1,718	245.4
Sejong	6	28,057	4,676.2	1,600	266.7	29,657	4,942.8
Gyeonggi	320	487,778	1,524.3	115,644	361.4	603,422	1,885.7
Gangwon	53	47,944	904.6	49,696	937.7	97,640	1,842.3
Chungbuk	78	214,652	2,751.9	129,308	1,657.8	343,960	4,409.7
Chungnam	47	31,579	671.9	5,882	125.1	37,461	797.0
Jeonbuk	23	15,524	675.0	2,166	94.2	17,690	769.1
Jeonnam	23	3,944	171.5	6,489	282.1	10,433	453.6
Gyeongbuk	30	38,037	1,267.9	5,239	174.6	43,276	1,442.5
Gyeongnam	28	6,993	249.8	767	27.4	7,760	277.2
Jeju	13	4,181	321.6	5,334	410.3	9,515	731.9

B. Recent Trend of Investment Status

1) 2015~2017 Bioindustry's Trend of Investment

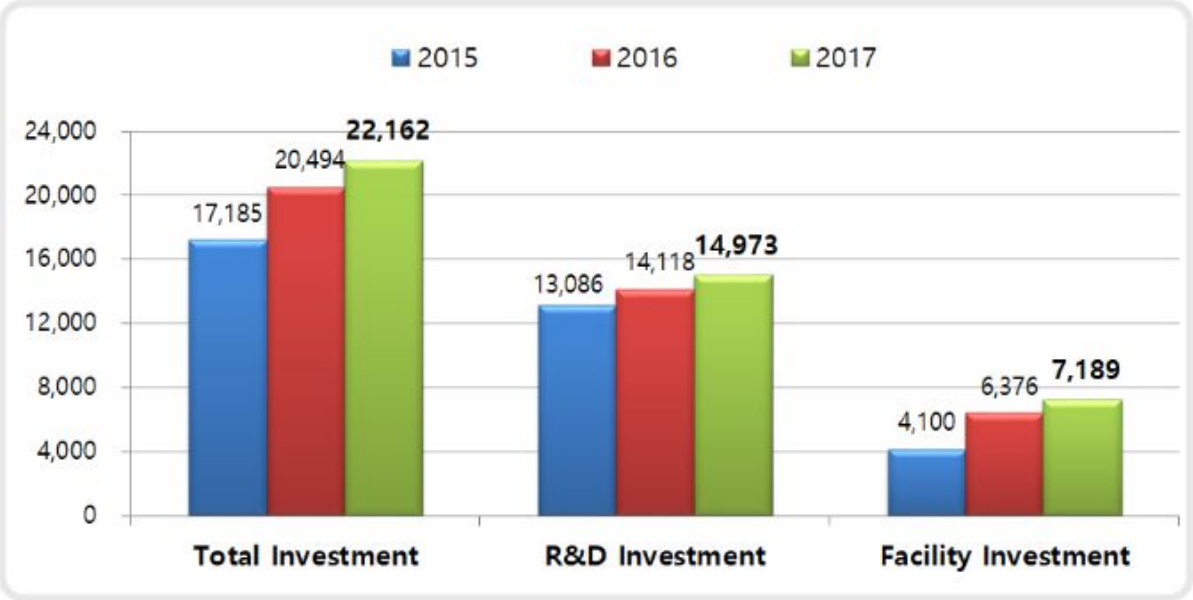
○ The R&D investment and facility investment proportion in bioindustry was 7.0% and 32.4% respectively, and has continuously increased for the past 3 years.

<Table 2-12> 2015~2017 Bioindustry's Trend of Investment

(Unit : one hundred million Won, %)

Classification		2015	2016	2017	Annual Average Rate of Change
Total Investment	Amount	17,185	20,494	22,162	13.6
	Rate of Change	-6.3	19.3	8.1	
R&D Investment	Amount	13,086	14,118	14,973	7.0
	Rate of Change	4.8	7.9	6.1	
Facility Investment	Amount	4,100	6,376	7,189	32.4
	Rate of Change	-30.0	55.5	12.8	

<Figure 2-16> 2015~2017 Bioindustry Investment Trend (Unit : one hundred million Won)



○ In comparison to 2016, overall size of investment for 2017 increased the most in biopharmaceutical industry by 21.7%; however, decreased sharply by 31.1% in the bioservice industry.

<Table 2-13> 2015~2017 Bioindustry's Trend in Overall Size of Investment

(Unit : million Won, %)

Industrial Category	2015		2016		2017		Variation from the year before	Annual Average Rate of Change
	Investment Amount	Distribution Ratio	Investment Amount	Distribution Ratio	Investment Amount	Distribution Ratio		
Total	**1,718,520**	**100.0**	**2,049,417**	**100.0**	**2,216,223**	**100.0**	**8.1**	**13.6**
Biopharmaceutical Industry	1,344,870	78.3	1,253,438	61.2	1,525,964	68.9	21.7	6.5
Biochemical and bioenergy industry	137,158	8.0	162,176	7.9	178,397	8.0	10.0	14.0
Biofood Industry	100,891	5.9	113,818	5.6	122,904	5.5	8.0	10.4
Bioenvironmental Industry	10,976	0.6	10,874	0.5	11,622	0.5	6.9	2.9
Biomedical equipment industry	23,851	1.4	122,189	6.0	98,489	4.4	-19.4	103.2
Bioinstrument and bioequipment industry	19,916	1.2	15,525	0.8	14,881	0.7	-4.1	-13.6
Bioresource industry	25,120	1.5	25,288	1.2	25,504	1.2	0.9	0.8
Bioservice industry	55,738	3.2	346,109	16.9	238,462	10.8	-31.1	106.8

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

○ For the past 3 years, biomedical equipment industry showed the highest increase in R&D investment cost by 58.5%, with bioservice industry and biofood industry increasing by 17.6% and 13.1% respectively. However, R&R investment decreased in the bioinstrument and bioequipment industry and biodchemical and bioenergy industry each by 17.0% and 0.9%.

○ For the past 3 years biomedical equipment industry and bioservice industry showed a high increase in facility investment cost by 516.6%, 219.1% respecitvely, whereas faciliry investmenet cost decreased in biofood industry(9.8%), bioresource industry(9.2%) and bioenvironmental industry(2.1%).

<Table 2-14> 2015~2017 Bioindustry's Trend of R&D and Facility Investment Cost

(Unit : million Won, %)

Industrial Category	2015		2016		2017		Variation from the year before		Annual Average Rate of Change	
	R&D	Facility	R&D	Facility	R&D	Facility	R&D	Facility	R&D	Facility
Total	**1,308,558**	**409,962**	**1,411,799**	**637,618**	**1,497,274**	**718,949**	**6.1**	**12.8**	**7.0**	**32.4**
Biopharmaceutical Industry	993,413	351,457	1,045,478	207,960	1,115,040	410,924	6.7	97.6	5.9	8.1
Biochemical and bioenergy industry	118,701	18,457	113,666	48,510	116,512	61,885	2.5	27.6	-0.9	83.1
Biofood Industry	87,672	13,219	104,276	9,542	112,139	10,765	7.5	12.8	13.1	-9.8
Bioenvironmental Industry	9,183	1,793	9,152	1,722	9,904	1,718	8.2	-0.2	3.9	-2.1
Biomedical equipment industry	22,764	1,087	56,086	66,103	57,161	41,328	1.9	-37.5	58.5	516.6
Bioinstrument and bioequipment industry	18,363	1,553	11,953	3,572	12,654	2,227	5.9	-37.7	-17.0	19.7
Bioresource industry	21,064	4,056	22,263	3,025	22,163	3,341	-0.4	10.4	2.6	-9.2
Bioservice industry	37,398	18,340	48,925	297,184	51,701	186,761	5.7	-37.2	17.6	219.1

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

2) 2013~2017 Bioindustry's Trend of Investment

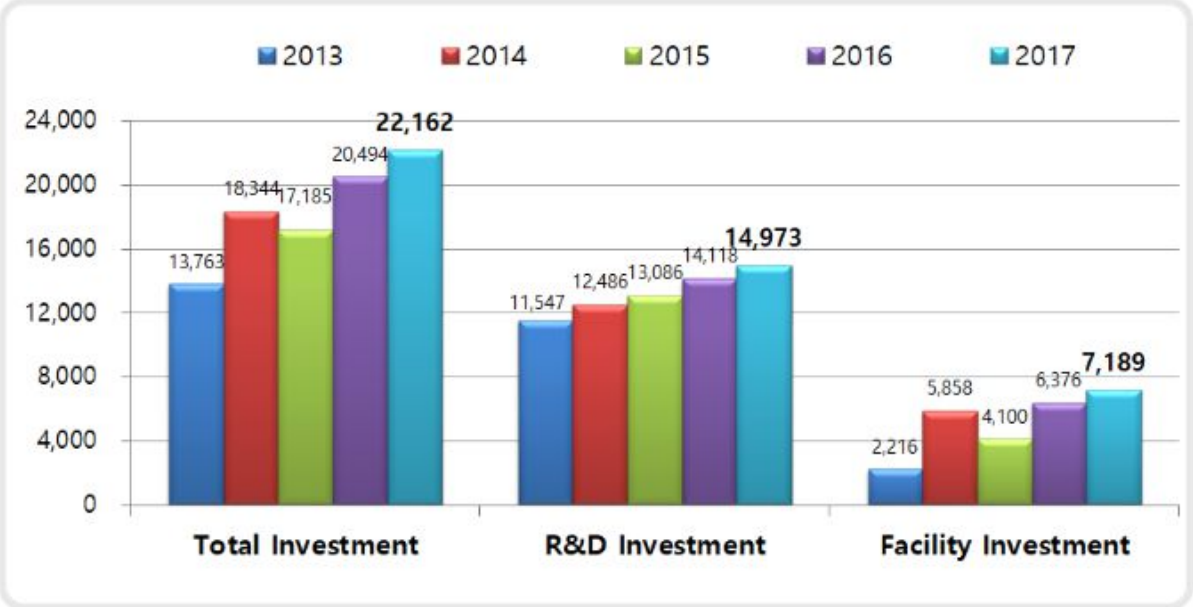
○ Total size of investment in bioindustry increased continuously by 12.6%, and in 2017 it increased by 8.1% compared to its previous year.

<Table 2-15> 2013~2017 Bioindustry's Trend of Investment

(Unit : one hundred million Won, %)

Classification		2013	2014	2015	2016	2017	Annual Average Rate of Change
Total Investment	Amount	13,763	18,344	17,185	20,494	22,162	12.6
	Rate of Change	-11.2	33.3	-6.3	19.3	8.1	
R&D Investment	Amount	11,547	12,486	13,086	14,118	14,973	6.7
	Rate of Change	14.6	8.1	4.8	7.9	6.1	
Facility Investment	Amount	2,216	5,858	4,100	6,376	7,189	34.2
	Rate of Change	-59.1	164.3	-30.0	55.5	12.8	

<Figure 2-17> 2013~2017 Bioindustry Investment Trend (Unit : one hundred million Won)



○ For investment in bioindustry since 2013, the investment in biopharmaceutical industry continuously accounts for approx. 60% or more of total investment.

○ In 2017, biopharmaceutic industry increased the most by 21.7% compared to the previous year, whereas the proportion in the bioservice industry decreased sharply by 31.1%.

<Table 2-16> 2013~2017 Bioindustry's Trend in Overall Size of Investment

(Unit : million Won, %)

Industrial Category	2013		2014		2015		2016		2017		Variation from the year before	Annual Average Rate of Change
	Investment Amount	Distribution Ratio	Investment Amount	Distribution Ratio	Investment Amount	Distribution Ratio	Investment Amount	Distribution Ratio	Investment Amount	Distribution Ratio		
Total	**1,376,336**	**100.0**	**1,834,358**	**100.0**	**1,718,520**	**100.0**	**2,049,417**	**100.0**	**2,216,223**	**100.0**	**8.1**	**12.6**
Biopharmaceutical Industry	1,020,871	74.2	1,490,557	81.3	1,344,870	78.3	1,253,438	61.2	1,525,964	68.9	21.7	10.6
Biochemical and bioenergy industry	110,416	8.0	111,254	6.1	137,158	8.0	162,176	7.9	178,397	8.0	10.0	12.7
Biofood Industry	123,621	9.0	109,002	5.9	100,891	5.9	113,818	5.6	122,904	5.5	8.0	-0.1
Bioenvironmental Industry	12,596	0.9	11,254	0.6	10,976	0.6	10,874	0.5	11,622	0.5	6.9	-2.0
Biomedical equipment industry	22,579	1.6	24,199	1.3	23,851	1.4	122,189	6.0	98,489	4.4	-19.4	44.5
Bioinstrument and bioequipment industry	20,038	1.5	21,025	1.1	19,916	1.2	15,525	0.8	14,881	0.7	-4.1	-7.2
Bioresource industry	22,938	1.7	22,635	1.2	25,120	1.5	25,288	1.2	25,504	1.2	0.9	2.7
Bioservice industry	43,277	3.1	44,432	2.4	55,738	3.2	346,109	16.9	238,462	10.8	-31.1	53.2

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

○ For the past 5 years, annual average rate of R&D investment was the highest in biomedical equipment industry (by 28.8%), followed by bioservice industry (by 11.9%) and biopharmaceutical industry(by 7.1%).

○ Annual average rate of facility investment increased the highest in biomedical equipment industry (by 118.6%), followed by bioservice industry (by 106.2%), biochemical and bioenergy industry(by 42.1%).

<Table 2-17> 2013~2017 Bioindustry's Trend of R&D and Facility Investment Cost

(Unit : one hundred million Won, %)

Industrial Category	2013		2014		2015		2016		2017		Variation from the year before		Annual Average Rate of Change	
	R&D	Facility	R&D	Facility	R&D	Facility	R&D	Facility	R&D	Facility	R&D	Facility	R&D	Facility
Total	**11,547**	**2,216**	**12,486**	**5,858**	**13,086**	**4,100**	**14,118**	**6,376**	**14,973**	**7,189**	**6.1**	**12.8**	**6.7**	**34.2**
Biopharmaceutical Industry	8,475	1,734	9,464	5,442	9,934	3,515	10,455	2,080	11,150	4,109	6.7	97.6	7.1	24.1
Biochemical and bioenergy industry	952	152	972	140	1,187	185	1,137	485	1,165	619	2.5	27.6	5.2	42.1
Biofood Industry	1,082	154	957	133	877	132	1,043	95	1,121	108	7.5	12.8	0.9	-8.6
Bioenvironmental Industry	107	19	96	17	92	18	92	17	99	17	8.2	-0.2	-2.0	-2.2
Biomedical equipment industry	208	18	229	13	228	11	561	661	572	413	1.9	-37.5	28.8	118.6
Bioinstrument and bioequipment industry	186	15	198	12	184	16	120	36	127	22	5.9	-37.7	-9.2	11.2
Bioresource industry	208	21	202	24	211	41	223	30	222	33	-0.4	10.4	1.6	11.8
Bioservice industry	330	103	368	76	374	183	489	2,972	517	1,868	5.7	-37.2	11.9	106.2

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

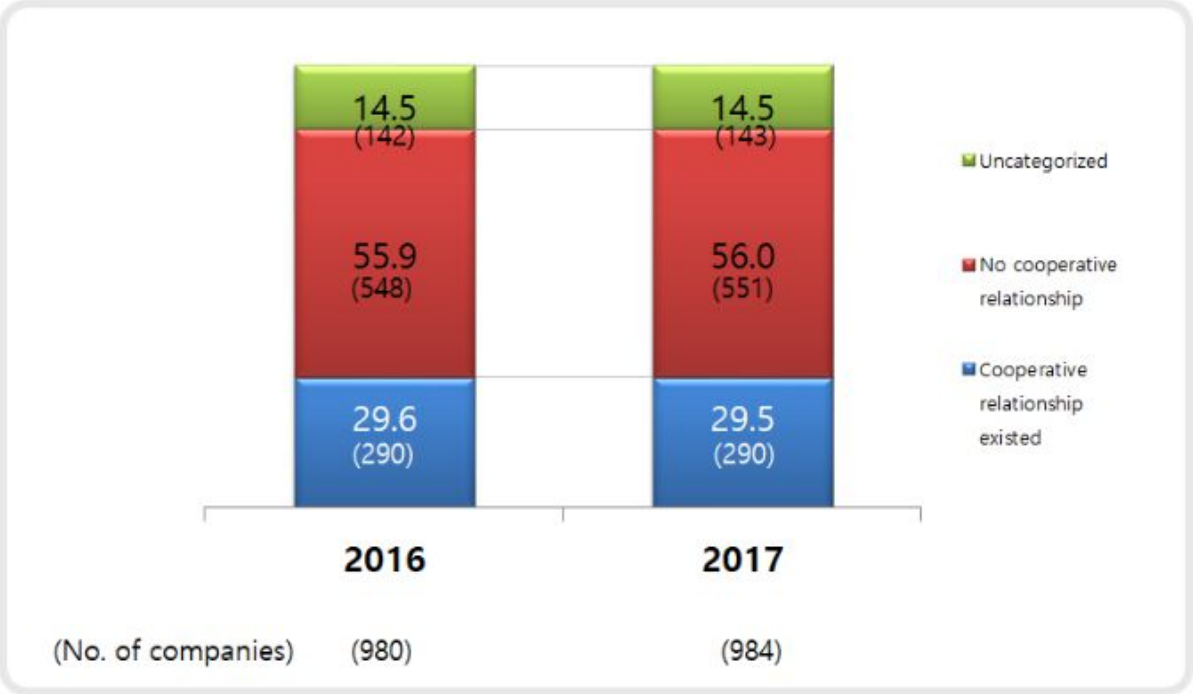
4 Cooperation with Other Organizations

A. Cooperation Types

1) Cooperative Relationship with Other Organizations

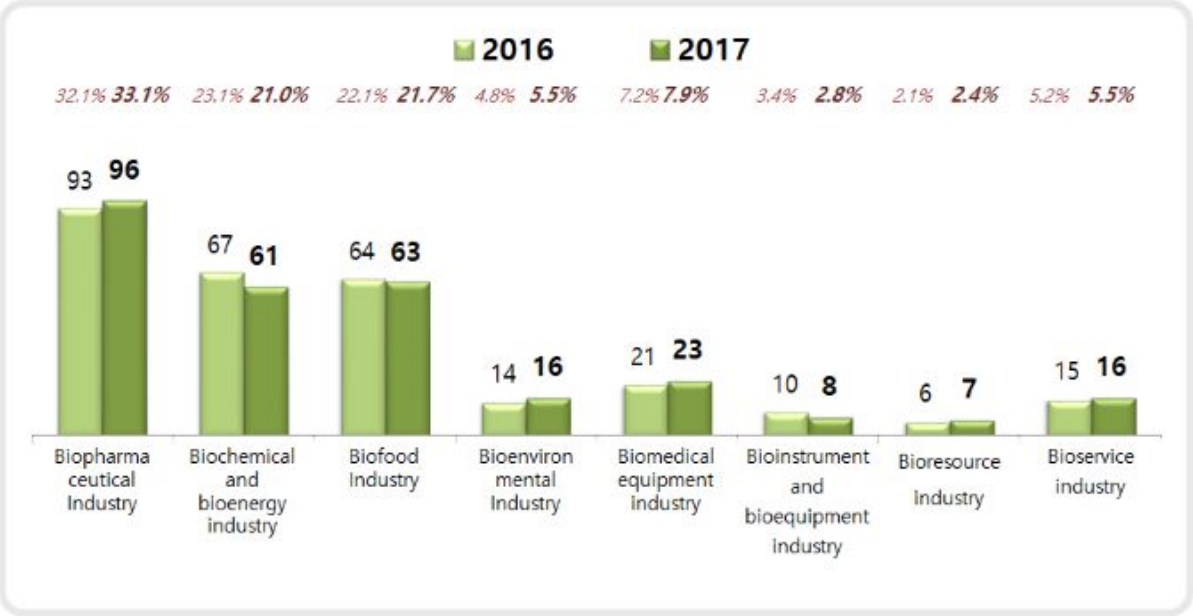
○ Of 984 companies in total, 290 companies, 29.5%, have cooperative relationships with other organizations as of 2017.

< Figure 2-18 > Cooperative Relationship with Other Organizations



○ By bioindustrial categories, cooperative relationship was established in larger numbers in the order of biopharmaceutical, biochemical and bioenergy and biofood industries. The total number of cooperative relationships in the three industrial categories put together is 220, which is 75.9% of 290 companies holding cooperative relationships.

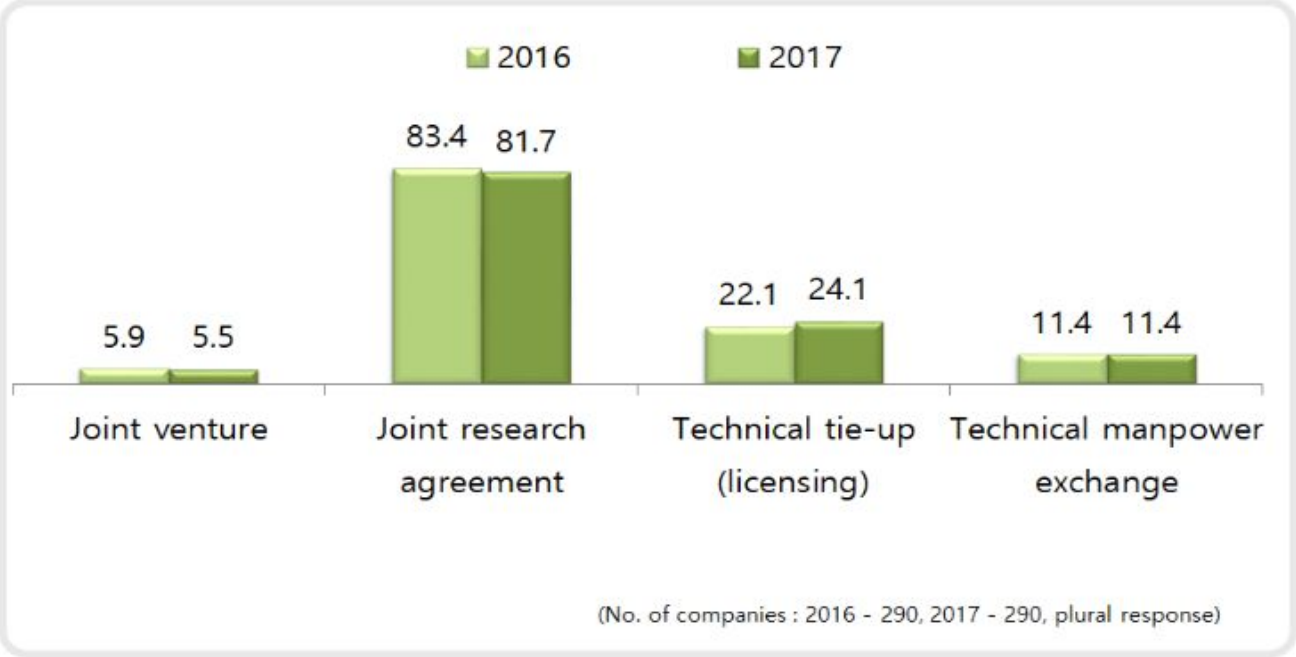
< Figure 2-19 > No. of Companies Holding Cooperative Relationships by Bioindustrial Category



2) Types of Cooperative Relationship with Other Organizations

○ Based on 290 companies, the most frequently found type of cooperative relationship was joint R&D contract at 81.7%. It was followed by technical tie-up and licensing (24.1%), domestic and international technical manpower exchange (11.4%) and joint investment (5.5%).

< Figure 2-20 > Types of Cooperative Relationship with Other Organizations



* Based on companies with cooperative relationships.
Multiple responses accepted.

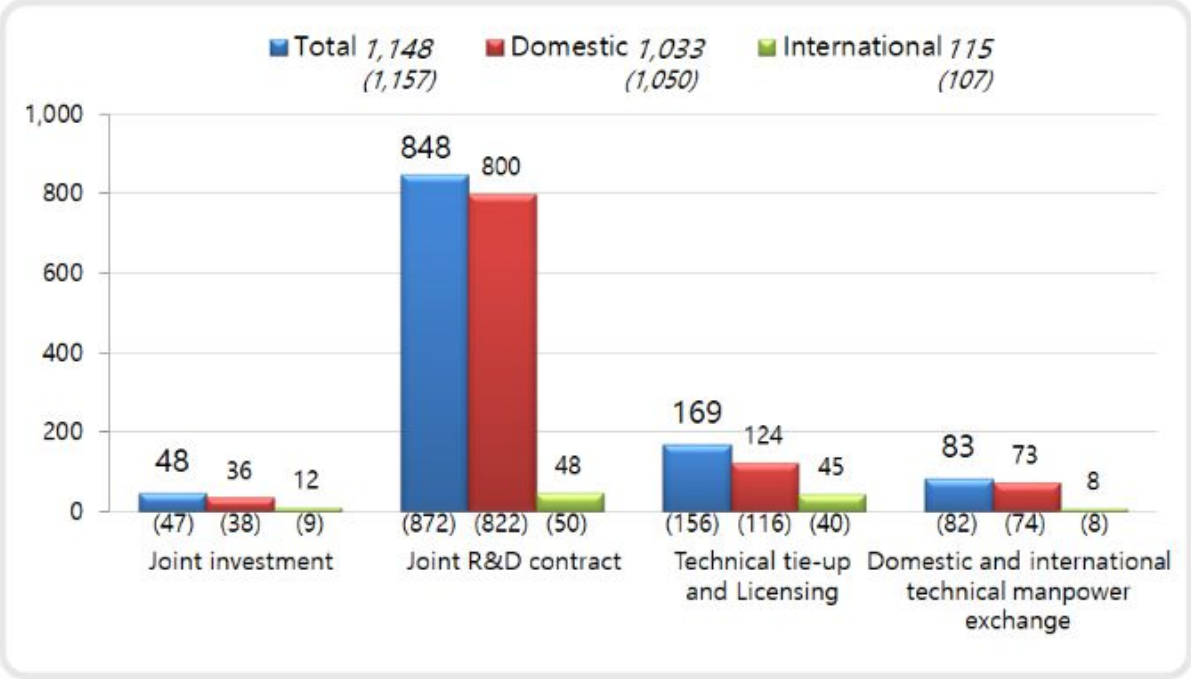
3) Number of Cooperation Cases by Cooperative Relationship Type

○ The total number of cooperative relationships of 290 companies is 1,148 which is broken down into 1,033 cooperative relationships in Korea (90.0%) and 115 abroad (10.0%).

○ The number of joint R&D contracts is 800 in Korea and 48 in abroad (848 in total). This is the most frequently found cooperative relationship type.

< Figure 2-21 > No. of Cooperation Cases by Cooperative Relationship Type

(Unit : Cases)



* Based on 290 companies with cooperative relationships.
  Multiple responses accepted.
* Numbers in brackets are based on 2016 results.

○ The number of cooperation cases by bioindustrial category and cooperation type is 398 in biopharmaceutical industry. This accounts for 34.7% of 1,148 cases in total.

○ The number of cooperation cases in biofood and biochemical and bioenergy industries are 252 (22.0%) and 228 (19.9%) respectively. Number of cooperation cases by above mentioned 3 industries covers about 76.5% of total cases.

< Table 2-18 > No. of Cooperation Cases by Bioindustrial Category and Cooperation Type

(Unit : Cases)

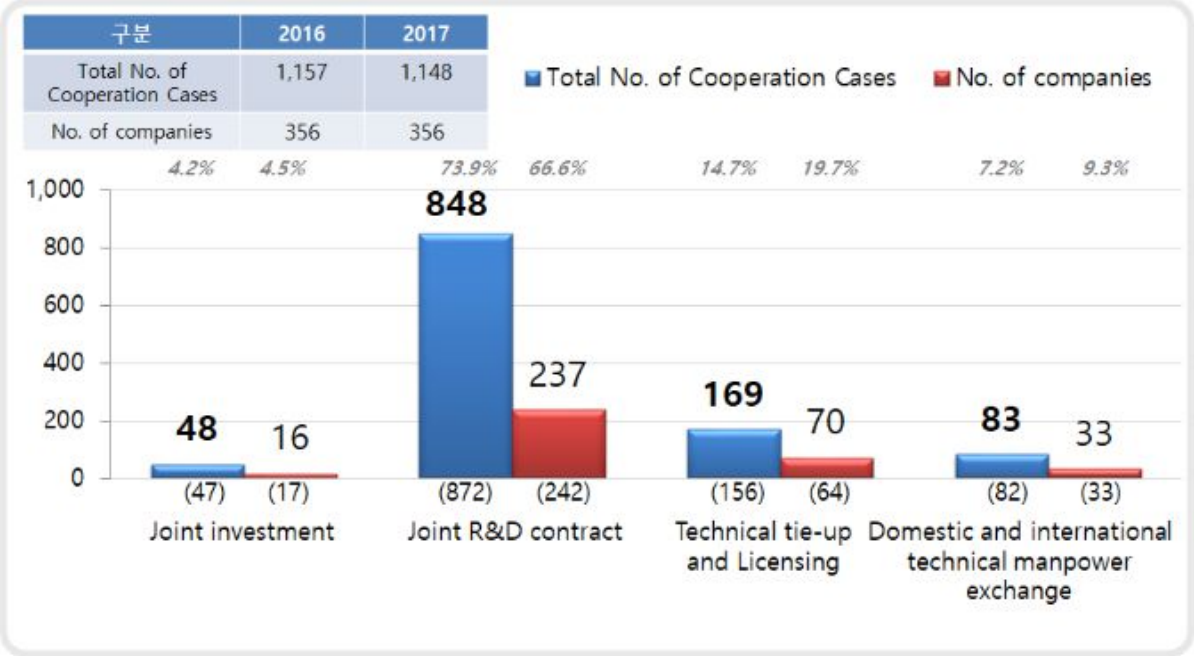
Industrial Category	2016		2017		Cooperation Type			
	Total	%	Total	%	Joint Investment	Joint R&D Contract	Technical Tie-up and Licensing	Technical Manpower Exchange
Total	**1,157**	**(100.0%)**	**1,148**	**(100.0%)**	**48**	**848**	**169**	**83**
Biopharmaceutical Industry	418	(36.1%)	398	(34.7%)	36	261	88	13
Biochemical and bioenergy industry	237	(20.5%)	228	(19.9%)	1	168	33	26
Biofood Industry	269	(23.2%)	252	(22.0%)	2	227	14	9
Bioenvironmental Industry	33	(2.9%)	32	(2.8%)	1	19	8	4
Biomedical equipment industry	100	(8.6%)	136	(11.8%)	-	88	23	25
Bioinstrument and bioequipment industry	22	(1.9%)	21	(1.8%)	-	18	-	3
Bioresource industry	21	(1.8%)	22	(1.9%)	-	20	2	-
Bioservice industry	57	(4.9%)	59	(5.1%)	8	47	1	3

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

4) Number of Partners by Cooperative Relationship Type

○ As for cooperation types, 237 companies have established joint R&D contract relationships and the count of cooperation was found to be 848. It is identified that a company holding a joint R&D contract relationship has conducted an average of 3.6 cooperation cases arithmetically.

< Figure 2-22 > No. of Partners by Cooperative Relationship Type (Unit : Cases, Count)



* Based on 290 companies with cooperative relationships.
  Multiple responses accepted.
* Numbers in brackets are based on 2016 results.

○ The number of companies holding cooperative relationships was the largest at 127 in biopharmaceutical industry. It was followed by biochemical and bioenergy and biofood industries.

< Table 2-19 > No. of Partners by Bioindustrial Category and Cooperation Type

(Unit: Count)

Industrial Category	2016		2017		Cooperation Type			
	Companies in Total	%	Companies in Total	%	Joint Investment	Joint R&D Contract	Technical Tie-up and Licensing	Technical Manpower Exchange
Total	**356**	**(100.0%)**	**356**	**(100.0%)**	**16**	**237**	**70**	**33**
Biopharmaceutical Industry	124	(34.8%)	127	(35.7%)	10	75	33	9
Biochemical and bioenergy industry	82	(23.0%)	77	(21.6%)	1	53	16	7
Biofood Industry	72	(20.2%)	72	(20.2%)	2	53	10	7
Bioenvironmental Industry	18	(5.1%)	19	(5.3%)	1	12	4	2
Biomedical equipment industry	25	(7.0%)	27	(7.6%)	-	18	4	5
Bioinstrument and bioequipment industry	10	(2.8%)	8	(2.2%)	-	7	-	1
Bioresource industry	7	(2.0%)	8	(2.2%)	-	6	2	-
Bioservice industry	18	(5.1%)	18	(5.1%)	2	13	1	2

B. Cooperation Stages

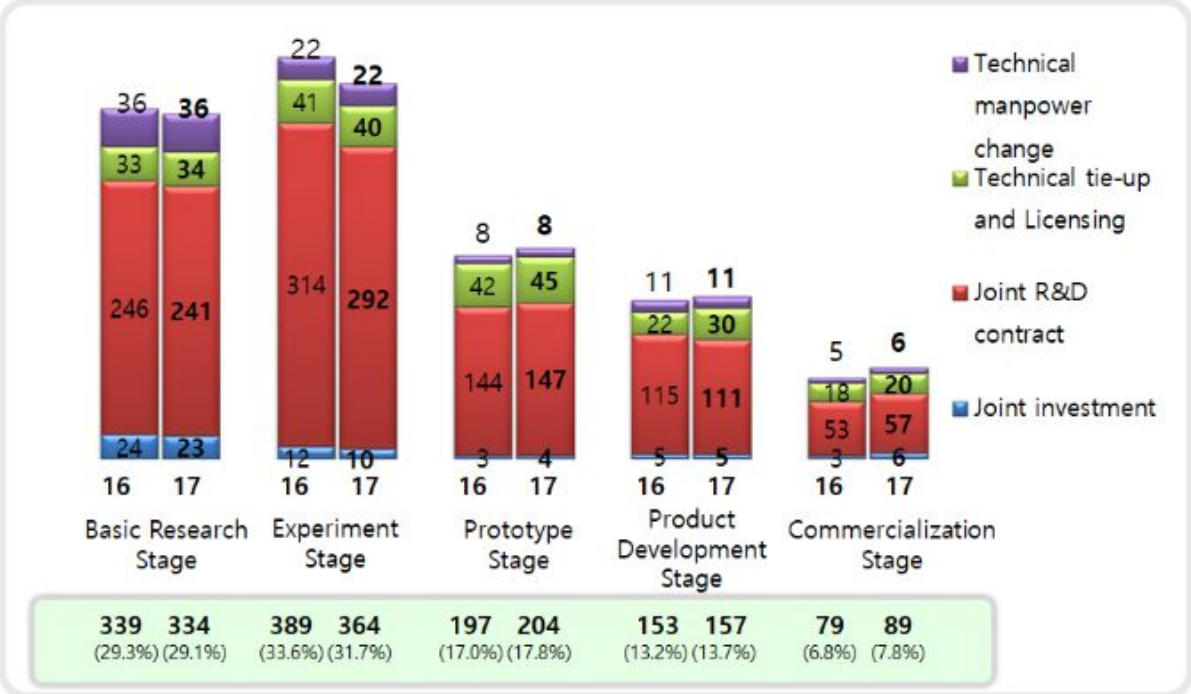
1) Number of Cooperation Cases by Cooperation Stage

○ As per cooperation stage, 1,148 cooperation cases, the largest, were completed in the experiment stage, which is 31.7% of 1,148 cases(364 cases) in total. It was followed by 29.1% in basic research stage(334 cases).

○ In commercialization stage, the final stage, 89 cases (7.8%) were completed, which is a relatively smaller number. This indicates that the companies cooperate frequently with other organizations in basic research and experiment stages, the initial stages.

○ Compared to its previous year, portion of cooperation cases in prototype stage and product development stage slightly increased.

< Figure 2-23 > No. of Cooperation Cases by Cooperation Stage (Unit : Cases)



* Based on 290 companies with cooperative relationships.
Multiple responses accepted.

< Table 2-20 > No. of Cooperation Cases by Cooperation Stage (Unit : Cases)

Classification	Cooperative Relationships in Total	Domestic					Overseas				
		Total	Joint Investment	Joint R&D	Technical Tie-up	Technical Manpower Exchange	Total	Joint Investment	Joint R&D	Technical Tie-up	Technical Manpower Exchange
Total of 2016	**1,157**	**1,050**	38	822	116	74	**107**	9	50	40	8
Total of 2017	**1,148**	**1,033**	**36**	**800**	**124**	**73**	**115**	**12**	**48**	**45**	**10**
Basic Research Stage	334	315	21	230	30	34	19	2	11	4	2
Experiment Stage	364	341	7	279	35	20	23	3	13	5	2
Prototype Stage	204	162	2	133	21	6	42	2	14	24	2
Product Development Stage	157	144	4	106	24	10	13	1	5	6	1
Commercialization Stage	89	71	2	52	14	3	18	4	5	6	3

○ By industry classification, no. of cooperations cases were most frequent in experiment stage for biopharmaceutical industry, biofood industry, and biochemical and bioenergy industry, while it occurred more frequent in basic research stage in biomedical equipment and bioservice industry.

< Table 2-21 > No. of Cooperation Cases by Bioindustrial Category and Cooperation Stage (Unit : Cases)

Industrial Category	Companies in Total	Companies with Cooperative Relationships	Cooperation Stage						
			Basic Research Stage	Experiment Stage	Prototype Stage	Product Development Stage	Commercialization Stage	Total	
Total	**984**	**290**	**334**	**364**	**204**	**157**	**89**	**1,148**	**(100.0%)**
Biopharmaceutical Industry	322	96	104	137	86	50	21	398	(34.7%)
Biochemical and bioenergy industry	201	61	50	60	47	37	34	228	(19.9%)
Biofood Industry	189	63	54	116	27	42	13	252	(22.0%)
Bioenvironmental Industry	75	16	10	6	6	3	7	32	(2.8%)
Biomedical equipment industry	66	23	62	23	20	19	12	136	(11.8%)
Bioinstrument and bioequipment industry	57	8	11	5	2	3	-	21	(1.8%)
Bioresource industry	20	7	9	8	4	1	-	22	(1.9%)
Bioservice industry	54	16	34	9	12	2	2	59	(5.1%)

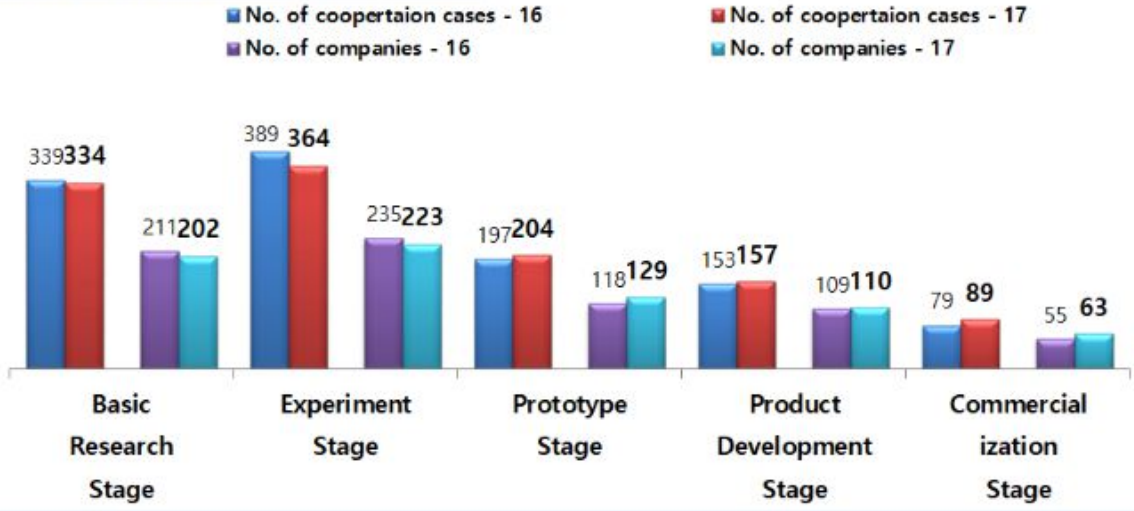
2) Number of Partners by Cooperation Stage

○ The number of companies with cooperative relationships by stage including those that made multiple responses is 727. By stage, 223 companies (30.7%) are in experiment stage.

○ When cooperation case and company number percentages are compared, the percentage of company count is lower than the rate of cooperation cases in basic research and experiment stages. This indicates that the average cooperation cases per company are larger in the initial stages of cooperation than the later stages.

< Figure 2-24 > No. of Partners by Cooperation Stage (Unit : Cases, Count)

구분	2016	2017
Total No. of Cooperation Cases	1,157	1,148
No. of companies	723	727



* Based on 290 companies with cooperative relationships.
Multiple responses accepted.

< Table 2-22 > No. of Partners by Cooperation Stage (Unit : Cases, Count)

Classification		Total	Basic Research	Experimental	Prototype	Product Development	Commercialization
No. of cases	Domestic	1,033	315	341	162	144	71
	Overseas	115	19	23	42	13	18
Total		**1,148**	**334**	**364**	**204**	**157**	**89**
Percentage		100.0	29.1	31.7	17.8	13.7	7.8
No. of companies	Domestic	646	184	207	109	99	47
	Overseas	81	18	16	20	11	16
Total		**727**	**202**	**223**	**129**	**110**	**63**
Percentage		100.0	27.8	30.7	17.7	15.1	8.7

○ As for the number of partners by bioindustrial category and cooperation stage, there was a total of 556 partners in biopharmaceutical, biochemical and bioenergy and biofood industries(76.5% of all partners).

○ In biopharmaceutical and biofood industries, the no. of cooperation was found to be high in experiment stage.

< Table 2-23 > No. of Partners by Bioindustrial Category and Cooperation Stage (Unit : Count)

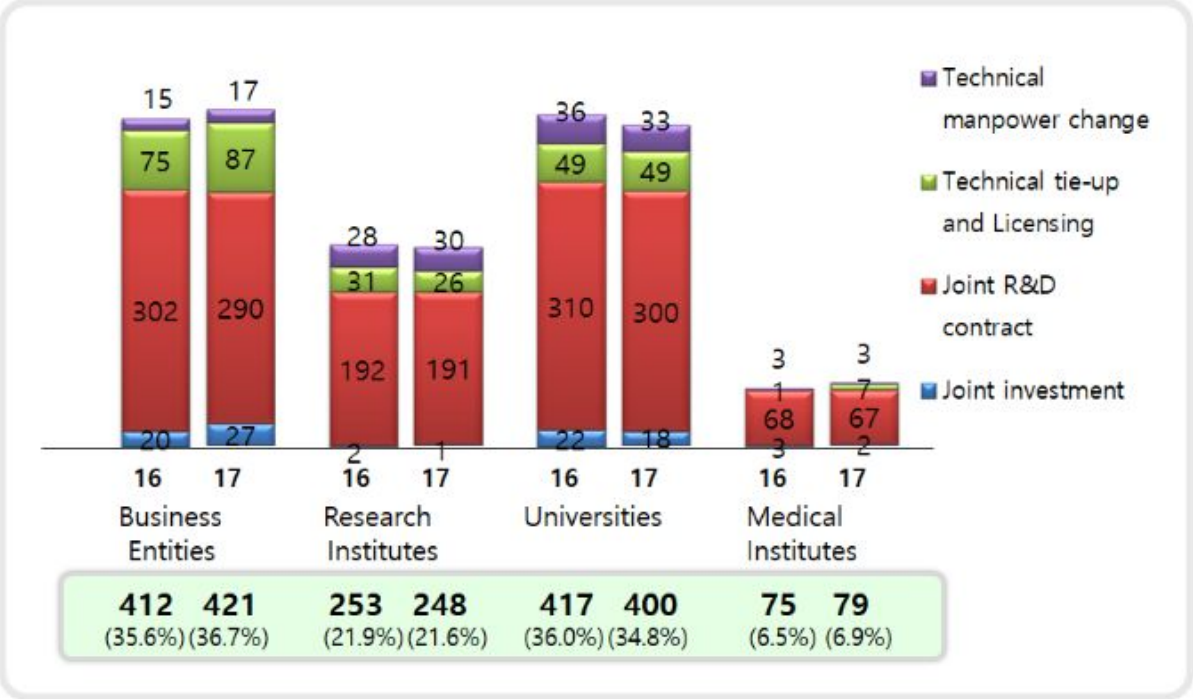
Industrial Category	2016		2017		Cooperation Stage				
	Companies in Total	%	Companies in Total	%	Basic Research	Experimental	Prototype	Product Development	Commercialization
Total	**723**	**(100.0%)**	**727**	**(100.0%)**	**202**	**223**	**129**	**110**	**63**
Biopharmaceutical Industry	261	(36.1%)	263	(36.2%)	71	91	48	33	20
Biochemical and bioenergy industry	160	(22.1%)	149	(20.5%)	38	42	27	27	15
Biofood Industry	153	(21.2%)	144	(19.8%)	34	50	20	28	12
Bioenvironmental Industry	29	(4.0%)	27	(3.7%)	7	6	6	3	5
Biomedical equipment industry	53	(7.3%)	74	(10.2%)	21	15	14	15	9
Bioinstrument and bioequipment industry	17	(2.4%)	17	(2.3%)	9	4	2	2	-
Bioresource industry	20	(2.8%)	21	(2.9%)	8	8	4	1	-
Bioservice industry	30	(4.1%)	32	(4.4%)	14	7	8	1	2

C. Cooperating Organizations

1) Number of Cooperation Cases by Cooperating Organization

○ By cooperating organization, the number of cooperation cases with Business entities were the largest at 421, which is 36.7% of 1,148 cases in total. It was followed by 400 cooperation cases with Universities (34.8%), research institutes (248) and medical institutes (79).

< Figure 2-25 > No. of Cooperation Cases by Cooperating Organization (Unit : Cases)



* Based on 290 companies with cooperative relationships.
Multiple responses accepted.

< Table 2-24 > No. of Cooperation Cases by Cooperating Organization (Unit : Cases)

Classification	Cooperative Relationships in Total	Domestic					Overseas				
		Total	Joint Investment	Joint R&D	Technical Tie-up	Technical Manpower Exchange	Total	Joint Investment	Joint R&D	Technical Tie-up	Technical Manpower Exchange
Total	1,148	1,033	36	800	124	73	115	12	48	45	10
Business Entities	421	341	15	262	53	11	80	12	28	34	6
Small and Medium-scale Venture Companies	292	234	12	169	42	11	58	7	23	22	6
Middle-standing Companies	94	82	1	74	7	-	12	1	3	8	-
Large Enterprises	35	25	2	19	4	-	10	4	2	4	-
Research Institutes	248	231	1	183	18	29	17	-	8	8	1
Government-invested Research Institutes	186	175	1	141	16	17	11	-	3	8	-
Private Research Institutes	62	56	-	42	2	12	6	-	5	-	1
Universities	400	386	18	291	47	30	14	-	9	2	3
Medical Institutes	79	75	2	64	6	3	4	-	3	1	-

○ By bioindustrial category, the number of cooperation cases in biopharmaceutical and biofood industry were the largest with business entities. However, the cases of cooperation with in biochemical and bioenergy industries was relatively larger with research Institutes.

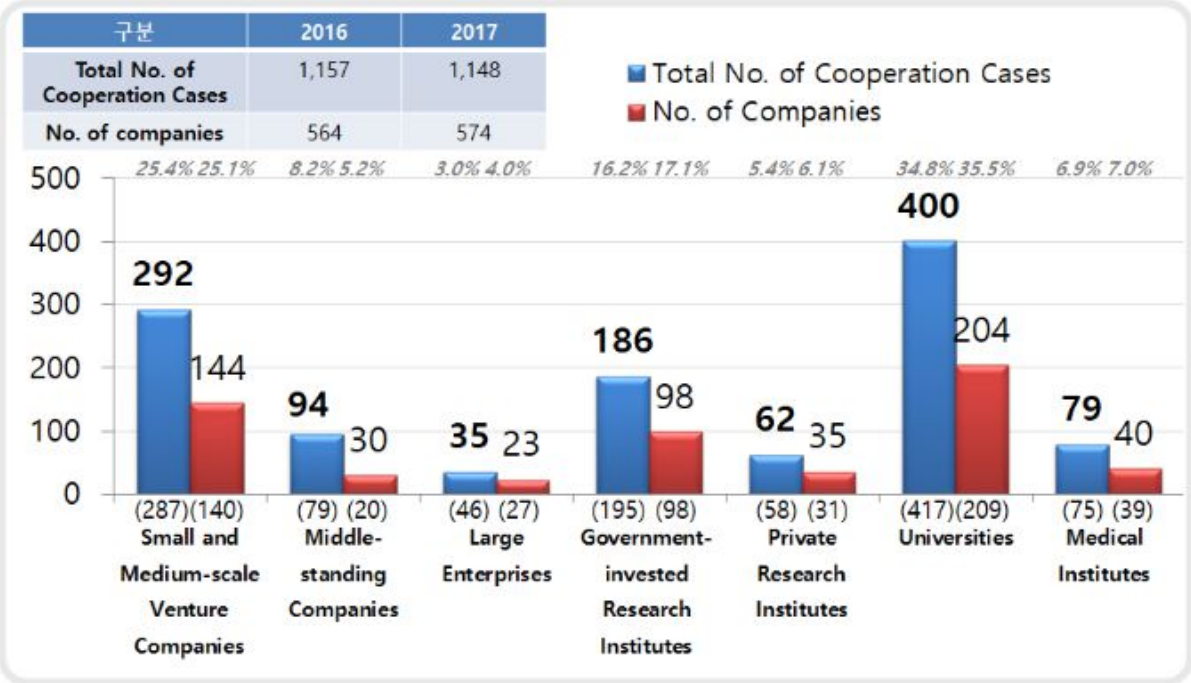
< Table 2-25 > No. of Cooperation Cases by Bioindustrial Category and Cooperating Organization (Unit : Cases)

Industrial Category	Companies in Total	Companies with Cooperative Relationships	Cooperating Organization					
			Business Entities	Research Institutes	Universities	Medical Institutes	Total	
Total	984	290	421	248	400	79	1,148	(100.0%)
Biopharmaceutical Industry	322	96	158	53	148	39	398	(34.7%)
Biochemical and bioenergy industry	201	61	65	90	72	1	228	(19.9%)
Biofood Industry	189	63	110	29	105	8	252	(22.0%)
Bioenvironmental Industry	75	16	14	9	9	-	32	(2.8%)
Biomedical equipment industry	66	23	35	43	41	17	136	(11.8%)
Bioinstrument and bioequipment industry	57	8	7	7	5	2	21	(1.8%)
Bioresource industry	20	7	7	3	9	3	22	(1.9%)
Bioservice industry	54	16	25	14	11	9	59	(5.1%)

2) Number of Partners by Cooperating Organization

○ The number of bio-companies holding cooperative relationships with universities is 204. It was found that an average of 2 cooperation cases was completed per each of these companies.

< Figure 2-26 > No. of Partners by Cooperating Organization (Unit : Cases, Count)



* Based on 290 companies with cooperative relationships.
  Multiple responses accepted.
* Numbers in brackets are based on 2016 results.

○ By bioindustrial category, the number of partners in biopharmaceutical industry was the largest with business entities. However, the partners of cooperation in biofood industries were relatively larger with universities.

< Table 2-26 > No. of Partners by Bioindustrial Category and Cooperating Organization (Unit : Cases)

Industrial Category	Companies in Total	Companies with Cooperative Relationships	Cooperating Organization					
			Business Entities	Research Institutes	Universities	Medical Institutes	Total	
Total	**984**	**290**	**197**	**133**	**204**	**40**	**574**	**(100.%)**
Biopharmaceutical Industry	322	96	88	39	64	18	209	(36.4%)
Biochemical and bioenergy industry	201	61	31	39	42	1	113	(19.7%)
Biofood Industry	189	63	33	19	52	6	110	(19.2%)
Bioenvironmental Industry	75	16	9	7	9	0	25	(4.4%)
Biomedical equipment industry	66	23	15	16	16	9	56	(9.8%)
Bioinstrument and bioequipment industry	57	8	4	4	4	1	13	(2.3%)
Bioresource industry	20	7	6	2	8	2	18	(3.1%)
Bioservice industry	54	16	11	7	9	3	30	(5.2%)

< Table 2-27 > Domestic and Overseas Cooperative Relationships and Cooperating Organizations

(Unit : Cases, Count, %)

Classification			Total	Venture Companies	Middle-standing Companies	Large Enterprises	Government-invested Research Institutes	Private Research Institutes	Universities	Medical Institutes
Joint investment	Total Investments	Domestic	36	12	1	2	1	-	18	2
		Overseas	12	7	1	4	-	-	-	-
		Subtotal	48	19	2	6	1	-	18	2
	No. of Companies	Domestic	16	6	1	2	1	-	5	1
		Overseas	10	7	1	2	-	-	-	-
		Subtotal	26	13	2	4	1	-	5	1
Joint R&D contract	Total Investments	Domestic	800	169	74	19	141	42	291	64
		Overseas	48	23	3	2	3	5	9	3
		Subtotal	848	192	77	21	144	47	300	67
	No. of Companies	Domestic	373	74	16	11	76	25	139	32
		Overseas	30	11	2	2	3	4	6	2
		Subtotal	403	85	18	13	79	29	145	34
Technical tie-up and Licensing	Total Investments	Domestic	124	42	7	4	16	2	47	6
		Overseas	45	22	8	4	8	-	2	1
		Subtotal	169	64	15	8	24	2	49	7
	No. of Companies	Domestic	75	24	4	3	11	2	30	1
		Overseas	23	10	6	3	1	-	2	1
		Subtotal	98	34	10	6	12	2	32	2
Technical manpower change	Total Investments	Domestic	73	11	-	-	17	12	30	3
		Overseas	10	6	-	-	-	1	3	-
		Subtotal	83	17	-	-	17	13	33	3
	No. of Companies	Domestic	38	7	-	-	6	3	19	3
		Overseas	9	5	-	-	-	1	3	-
		Subtotal	47	12	-	-	6	4	22	3
Cooperation Cases in Total			**1,148**	**292**	**94**	**35**	**186**	**62**	**400**	**79**
Percentage			**100.0**	**25.4**	**8.2**	**3.0**	**16.2**	**5.4**	**34.8**	**6.9**
Companies in Total			**574**	**144**	**30**	**23**	**98**	**35**	**204**	**40**
Percentage			**100.0**	**25.1**	**5.2**	**4.0**	**17.1**	**6.1**	**35.5**	**7.0**

3) Cooperating Organizations by Scale of Workers

○ The number of cooperation cases between a small and medium-scale venture company with 1 - 299 workers and a same small and medium-scale venture company (with 1 - 299 workers) is large at 247 (129 cases+118 cases).

○ The numbers of cooperation cases between a bioindustrial company with 1 - less than 50 workers and a university is large at 166(161 domestic cases).

< Table 2-28 > Cooperating Organizations by Scale of Workers (Unit : Count)

Classification		Cooperative Relationships in Total	Business Entities				Research Institutes			Universities	Medical Institutes
			Total	Venture Companies	Middle-standing Companies	Large Enterprises	Total	Government-invested Research Institutes	Private Research Institutes		
Total	Total	1,148	421	292	94	35	248	186	62	400	79
	1 – less than 50 workers	444	150	129	15	6	107	83	24	166	21
	50 – 299	394	140	118	10	12	78	57	21	137	39
	300 - 999	128	37	26	5	6	25	22	3	53	13
	1,000 or more	182	94	19	64	11	38	24	14	44	6
Domestic	Total	1,033	341	234	82	25	231	175	56	386	75
	1 – less than 50 workers	399	122	102	14	6	97	73	24	161	19
	50 – 299	358	113	96	6	11	74	56	18	133	38
	300 - 999	117	29	22	1	6	25	22	3	51	12
	1,000 or more	159	77	14	61	2	35	24	11	41	6
Overseas	Total	115	80	58	12	10	17	11	6	14	4
	1 – less than 50 workers	45	28	27	1	-	10	10	-	5	2
	50 –299	36	27	22	4	1	4	1	3	4	1
	300 - 999	11	8	4	4	-	0	-	-	2	1
	1,000 or more	23	17	5	3	9	3	-	3	3	-

※ 1-less than 50 workers : 544 companies. 50-299 : 283 companies. 300–999 : 82 companies. 1,000 or more : 43 companies.

5 Supply and Demand Status of Bioindustry

A. Bioindustry's Supply and Demand Status of 2017

○ Total size of supply in 2017 bioindustry reached 11trillion 772 billion won and has increased by 9% for the past 3 years.

○ Production within total supply is 86% in portion, and its amount is 10 trillion 126.4 billion won. Size of import is 1 trillon 645.6 billion won (14.0% in portion).

○ Total size of domestic demand is 6 trillion 622.3 billion won, which occupies 56.3% of total supply and total size of export is 5 trillion 149.7 billion won and it occupies 43.7% of total supply.

<Table 2-29> 2015~2017 Bioindustry's Trend of Supply and Demand

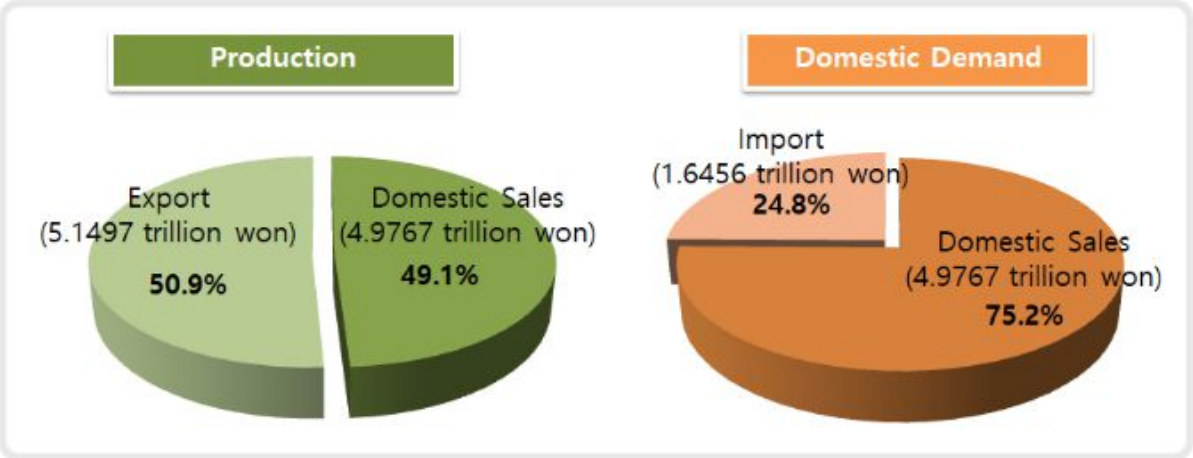
(Unit : one hundred million Won)

Year	Supply				Total	Demand			
	Production		Import			Domestic Demand		Export	
	Amount	Distribution Ratio	Amount	Distribution Ratio		Amount	Distribution Ratio	Amount	Distribution Ratio
2015	85,039	85.8	14,087	14.2	99,126	56,266	56.8	42,861	43.2
2016	92,611	86.4	14,597	13.6	107,208	60,898	56.8	46,310	43.2
2017	101,264	86.0	16,456	14.0	117,720	66,223	56.3	51,497	43.7
Annual Average Rate of Change	9.1		8.1		9.0	8.5		9.6	

○ The production size of domestic bioindustry in 2017 reached 10 trillion and 126.4 billion won. Among them, the domestic sales took 49.1% with 4 trillion and 976.7 billion won and the export took, 50.9% with 5 trillion and 149.7 billion won.

○ The size of domestic demand due to domestic sales and import reached 6 trillion and 622.3 billion won. Among them, the domestic sales took 75.2% with 4 trillion and 976.7 billion won and the import took 24.8% with 1 trillion and 645.6 billion won.

<Figure 2-27> 2017 Bioindustry's Size of Production and Domestic Demand



○ The production size of biopharmaceutical industry reached 3 trillion and 850.1 billion won which is 38.0% of the total industry, and biofood industry took 30.5% with 3 trillion and 88.9 billion won. The two industries took up 68.5% of total production.

○ The biopharmaceutical industry reaching 3 trillion and 205.6 billion won which is 48.4% and the biochemical and bioenergy industry reaching 1 trillion and 426.4 billion won which is 21.5% took 69.9% of the bioindustry's domestic demand market.

<Table 2-30> 2017 Bioindustry's Status of Production and Domestic Demand

(Unit : million Won, %)

Industrial Category	Production				Domestic Demand			
	Domestic Sales	Export	Total	Distribution Ratio	Domestic Sales	Import	Total	Distribution Ratio
Total	**4,976,744**	**5,149,675**	**10,126,419**	**100.0**	**4,976,744**	**1,645,554**	**6,622,298**	**100.0**
Biopharmaceutical industry	1,788,874	2,061,269	3,850,143	38.0	1,788,874	1,416,683	3,205,556	48.4
Biochemical and bioenergy industry	1,343,138	113,281	1,456,419	14.4	1,343,138	83,288	1,426,426	21.5
Biofood Industry	1,208,702	1,880,163	3,088,865	30.5	1,208,702	46,050	1,254,752	18.9
Bioenvironmental Industry	29,024	412	29,436	0.3	29,024	220	29,244	0.4
Biomedical equipment industry	131,150	473,537	604,687	6.0	131,150	32,229	163,379	2.5
Bioinstrument and bioequipment industry	66,024	46,945	112,969	1.1	66,024	51,406	117,430	1.8
Bioresource industry	149,053	21,219	170,272	1.7	149,053	6,301	155,354	2.3
Bioservice industry	260,779	552,849	813,628	8.0	260,779	9,377	270,157	4.1

○ Size of supply and domestic demand in Gyeonggi area occupies 41.7%, 29.1% each in total industry and is the highest compared to other areas.

< Table 2-31 > 2017 Bioindustry's Status of Production and Domestic Demand by Area

(Unit : million Won, %)

Area	Production				Domestic Demand			
	Domestic Sales	Export	Total	Distribution Ratio	Domestic Sales	Import	Total	Distribution Ratio
Total	**4,976,744**	**5,149,675**	**10,126,419**	**100.0**	**4,976,744**	**1,645,554**	**6,622,298**	**100.0**
Seoul	283,093	136,368	419,461	4.1	283,093	1,210,143	1,493,236	22.5
Busan	816	-	816	0.0	816	-	816	0.0
Daegu	49,248	42,460	91,707	0.9	49,248	-	49,248	0.7
Incheon	26,124	1,663,377	1,689,500	16.7	26,124	63,791	89,914	1.4
Gwangju	3,424	988	4,412	0.0	3,424	-	3,424	0.1
Daejeon	101,820	18,458	120,278	1.2	101,820	60,379	162,199	2.4
Ulsan	182,792	3,338	186,130	1.8	182,792	-	182,792	2.8
Sejong	27,920	170	28,090	0.3	27,920	1,131	29,051	0.4
Gyeonggi	1,805,704	2,419,827	4,225,531	41.7	1,805,704	121,495	1,927,199	29.1
Gangwon	122,947	302,876	425,823	4.2	122,947	15,091	138,038	2.1
Chungbuk	1,393,420	495,528	1,888,948	18.7	1,393,420	146,200	1,539,620	23.2
Chungnam	93,322	8,812	102,134	1.0	93,322	16,740	110,062	1.7
Jeonbuk	198,625	27,005	225,630	2.2	198,625	-	198,625	3.0
Jeonnam	216,362	686	217,048	2.1	216,362	-	216,362	3.3
Gyeongbuk	445,049	9,523	454,572	4.5	445,049	2,300	447,349	6.8
Gyeongnam	14,255	19,979	34,234	0.3	14,255	8,285	22,540	0.3
Jeju	11,823	281	12,104	0.1	11,823	-	11,823	0.2

B. Recent Trend of Supply and Demand Status

1) 2015~2017 Trend of Supply and Demand Status

○ Bioindustry's trend of production from 2015 to 2017 continues to increase.

○ For the average variation rate per year since 2015, the supply and demand marked 9.0%, production 9.1%, and domestic demand 8.5%.

<Table 2-32> 2015~2017 Bioindustry's Trend of Production and Domestic Demand

(Unit : one hundred million Won, %)

Classification		2015	2016	2017	Annual Average Rate of Change
Supply and Demand (Production+Import)	Investment Amount	99,126	107,208	117,720	9.0
	Distribution Ratio	10.0	8.2	9.8	
Production (Domestic Sales+Export)	Investment Amount	85,039	92,611	101,264	9.1
	Distribution Ratio	11.8	8.9	9.3	
Domestic Demand (Domestic Sales+Import)	Investment Amount	56,266	60,898	66,223	8.5
	Distribution Ratio	0.4	8.2	8.7	

<Figure 2-28> 2015~2017 Bioindustry's Trend of Production and Domestic Demand

(Unit : one hundred million Won)

○ The production sector increased by 9.3% in 2017 compared to 2016, and Bioservice industry reached the highest growth rate with 39.3%.

○ Total supply of biopharmaceutical industry and biofood industry, which occupies a large portion in the total industry, increased by 9.5% and 5.8% each.

○ Domestic demand increased by 8.7% in 2017 compared to 2016, and the proportion of increase was largest in the order of biopharmaceutical industry(11.3%), biochemical and energy industry(11.1%) and bioservice industry(10.1%).

<Table 2-33> 2015~2017 Bioindustry's Trend of Supply and Demand by Category

(Unit : one hundred million Won, %)

Industrial Category	Production					Domestic Demand				
	2015	2016	2017	Variation from the year before	Annual Average Rate of Change	2015	2016	2017	Variation from the year before	Annual Average Rate of Change
Total	**85,039**	**92,611**	**101,264**	**9.3**	**9.1**	**56,266**	**60,898**	**66,223**	**8.7**	**8.5**
Biopharmaceutical Industry	34,639	35,176	38,501	9.5	5.4	27,550	28,793	32,056	11.3	7.9
Biochemical and bioenergy industry	5,737	13,335	14,564	9.2	59.3	5,262	12,836	14,264	11.1	64.6
Biofood Industry	32,174	29,182	30,889	5.8	-2.0	13,279	12,331	12,548	1.8	-2.8
Bioenvironmental Industry	306	295	294	-0.1	-1.9	304	293	292	-0.1	-2.0
Biomedical equipment industry	1,602	5,895	6,047	2.6	94.3	315	1,502	1,634	8.8	127.6
Bioinstrument and bioequipment industry	1,626	1,199	1,130	-5.7	-16.6	1428	1,163	1,174	1	-9.3
Bioresource industry	6,468	1,689	1,703	0.8	-48.7	6,083	1,527	1,554	1.7	-49.5
Bioservice industry	2,487	5,842	8,136	39.3	80.9	2,043	2,453	2,702	10.1	15.0

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

2) 2013~2017 Trend of Supply and Demand

○ Bioindustry's trend of supply and demand for 5 years from 2013 to 2017 can be summarized as follows: Bioindustry's production continues to increase with 7.8% annual average rate of change. Domestic demand increased upto 2013, with a slight decrease by 2.3% in 2014, but continuously increased afterwards with 3.7% annual average rate of change.

<Table 2-34> 2013~2017 Bioindustry's Trend of Supply and Demand

(Unit : one hundred million Won, %)

Classification		2013	2014	2015	2016	2017	Annual Average Rate of Change
Supply and Demand (Production+Import)	Investment Amount	88,980	90,076	99,126	107,208	117,720	7.2
	Distribution Ratio	3.8	1.2	10.0	8.2	9.8	
Production (Domestic Sales+Export)	Investment Amount	75,108	76,070	85,039	92,611	101,264	7.8
	Distribution Ratio	5.1	1.3	11.8	8.9	9.3	
Domestic Demand (Domestic Sales+Import)	Investment Amount	57,337	56,024	56,266	60,898	66,223	3.7
	Distribution Ratio	3.7	-2.3	0.4	8.2	8.7	

<Figure 2-29> 2013~2017 Bioindustry's Trend of Supply and Demand

(Unit : one hundred million Won)

<Table 2-35> 2013~2017 Bioindustry's Trend of Supply and Demand by Category

(Unit : one hundred million Won, %)

Industrial Category	Production							Domestic Demands						
	2013	2014	2015	2016	2017	Variation from the year before	Annual Average Rate of Change	2013	2014	2015	2016	2017	Variation from the year before	Annual Average Rate of Change
Total	**75,108**	**76,070**	**85,039**	**92,611**	**101,264**	**9.3**	**7.8**	**57,337**	**56,024**	**56,266**	**60,898**	**66,223**	**8.7**	**3.7**
Biopharmaceutical Industry	27,635	28,709	34,639	35,176	38,501	9.5	8.6	28,490	27,514	27,550	28,793	32,056	11.3	3.0
Biochemical and bioenergy industry	5,622	5,484	5,737	13,335	14,564	9.2	26.9	5,147	4,972	5,262	12,836	14,264	11.1	29.0
Biofood Industry	30,211	30,392	32,174	29,182	30,889	5.8	0.6	13,666	14,032	13,279	12,331	12,548	1.8	-2.1
Bioenvironmental Industry	301	306	306	295	294	-0.1	-0.6	303	306	304	293	292	-0.1	-0.9
Biomedical equipment industry	1,517	1,543	1,602	5,895	6,047	2.6	41.3	373	363	315	1,502	1,634	8.8	44.7
Bioinstrument and bioequipment industry	1,216	1,255	1,626	1,199	1,130	-5.7	-1.8	1,294	1,203	1,428	1,163	1,174	1	-2.4
Bioresource industry	6,659	6,217	6,468	1,689	1,703	0.8	-28.9	6,504	5,870	6,083	1,527	1,554	1.7	-30.1
Bioservice industry	1,947	2,161	2,487	5,842	8,136	39.3	43.0	1,560	1,764	2,043	2,453	2,702	10.1	14.7

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

6 Domestic Sales of Bioindustry

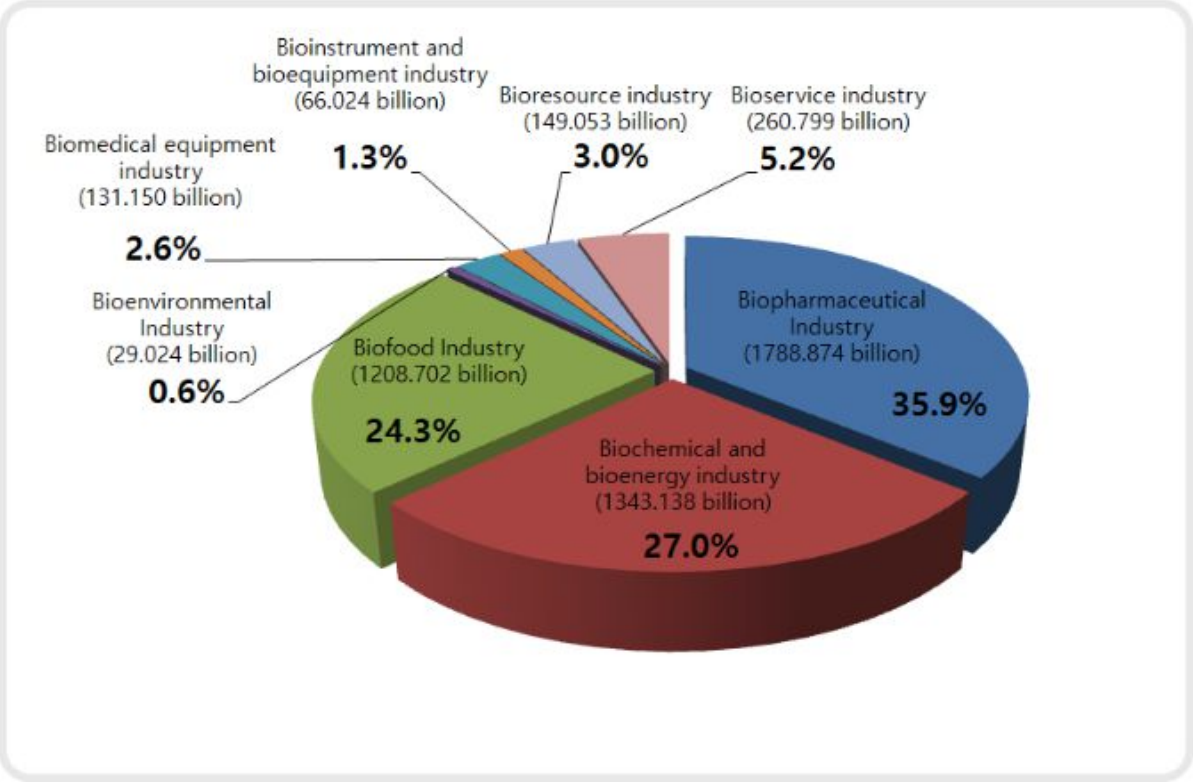
A. Domestic Sales Status of 2017

○ The size of bioindustry's domestic sales in 2017 reached 4 trillion and 976.7 billion won and biopharmaceutical industry took the largest proportion among them with 1 trillion and 788.9 billion won(35.9%).

○ The following largest industries were biochemical and bioenergy industry with 1 trillion 343.1 billion won(27.0%) and biofood industry with 1 trillion and 208.9 billion won(24.3%).

○ Biopharmaceutical industry, biochemical and bioenergy industry, and biofood industry took 87.2% of the total market for the bioindustry's domestic sales in 2017.

<Figure 2-30> 2017 Bioindustry's Size of Domestic Sales by Category



○ [Table 2-36] shows the domestic bioproducts or bioservices that have more than 1.0% domestic sales among 51 domestic bioproducts and bioservices, according to the size. Biofuel's size of domestic sales took 18.2% of the total bioindustry with 907.2 billion won.

○ The following largest bioproducts or bioservices were feed additives(12.7%), Other biopharmaceuticals(11.9%), Vaccines(7.8%) and Hemotherapeutics(7.0%). Among the TOP5 products, 3 items belonged to biofood industry.

<Table 2-36> 2017 Main Bioproduct's Size of Domestic Sales (Unit : million Won, %)

Ranking	Code	Product Name	Domestic Sales	Distribution Ratio
1	2060	Biofuel	907,204	18.2
2	3050	Feed additives	631,240	12.7
3	1000	Other biopharmaceuticals	590,260	11.9
4	1030	Vaccines	389,996	7.8
5	1060	Hemotherapeutics	349,533	7.0
6	2040	Biocosmetics and home & personal care chemicals	336,770	6.8
7	3010	Functional health foods	310,588	6.2
8	3030	Food additives	168,896	3.4
9	1040	Hormones	142,913	2.9
10	7010	Seeds and seedlings	124,677	2.5
11	5020	In-vitro Diagnostics	102,078	2.1
12	8030	R&D Service	100,915	2.0
13	1120	Veterinary biopharmaceuticals	91,053	1.8
14	1110	Biomaterial-based medications	85,651	1.7
15	3040	Fermented foods	82,557	1.7
16	8020	Bio Diagnostic and Analytical Services	76,890	1.5

B. Recent Trend of Domestic Sales Status

1) 2015~2017 Trend of Domestic Sales Status

○ The size of bioindustry's domestic sales in 2017 increased by 346.6 billion won(7.5%) with 4 trillion and 976.7 billion won.

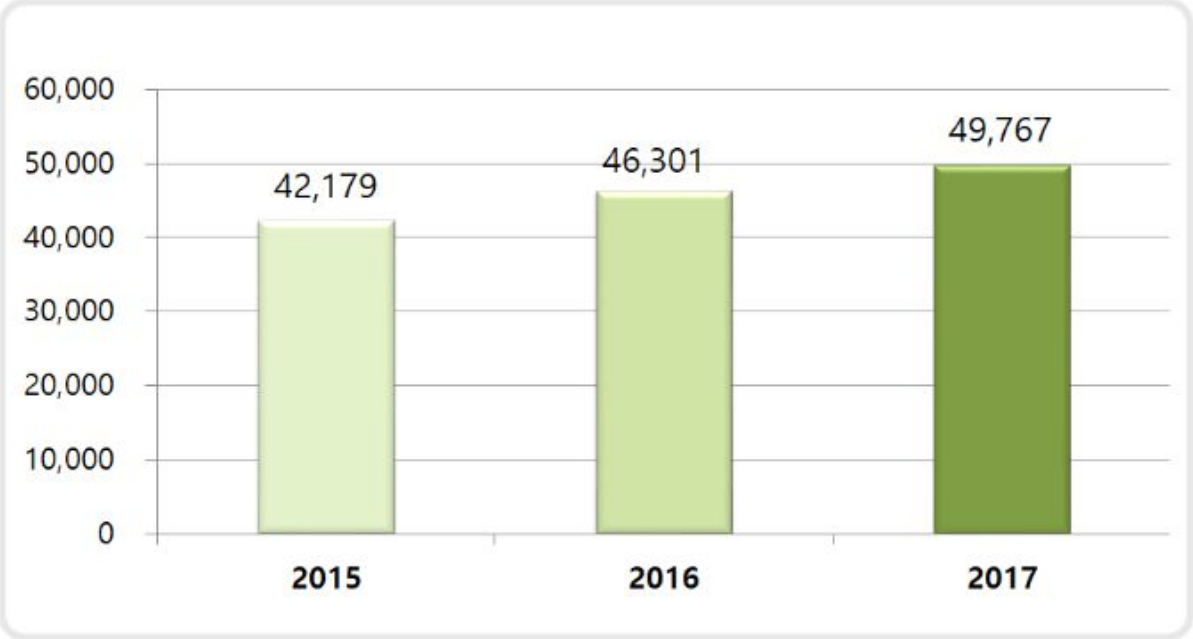
<Table 2-37> 2015~2017 Bioindustry's Trend of Domestic Sales

(Unit : one hundred million Won, %)

Classification		2015	2016	2017	Annual Average Rate of Change
Domestic Sales	Amount of money	42,179	46,301	49,767	8.6
	Rate of Change	0.4	9.8	7.5	

<Figure 2-31> 2015~2017 Bioindustry's Trend of Domestic Sales

(Unit : one hundred million Won)



○ The growth size of biopharmaceutical industry increased by 9.0% with 148.1 billion won compared to 2016, consisting largest proportion of 35.9% in the bioindustry.

○ Domestic sales volume of biochemical and bioenergy industry increased the largest as compared to 2016 by 12.4% and domestic sales volume of biofood industry increased by a small portion of 1.4%.

<Table 2-38> 2015~2017 Bioindustry's Trend of Domestic Sales by Category

(Unit : million Won, %)

Industrial Category	2015		2016		2017		Variation from the year before		Annual Average Rate of Change
	Domestic Sales	Distribution Ratio	Domestic Sales	Distribution Ratio	Domestic Sales	Distribution Ratio	Domestic Sales	Rate of Change	
Total	4,217,863	100.0	4,630,133	100.0	4,976,744	100.0	346,611	7.5	8.6
Biopharmaceutical Industry	1,534,788	36.4	1,640,767	35.4	1,788,874	35.9	148,107	9.0	8.0
Biochemical and bioenergy industry	438,539	10.4	1,194,963	25.8	1,343,138	27.0	148,175	12.4	75.0
Biofood Industry	1,291,411	30.6	1,191,934	25.7	1,208,702	24.3	16,768	1.4	-3.3
Bioenvironmental Industry	30,311	0.7	29,047	0.6	29,024	0.6	-23	-0.1	-2.1
Biomedical equipment industry	30,774	0.7	117,952	2.5	131,150	2.6	13,198	11.2	106.4
Bioinstrument and bioequipment industry	89,044	2.1	63,815	1.4	66,024	1.3	2,209	3.5	-13.9
Bioresource industry	600,073	14.2	147,258	3.2	149,053	3.0	1,795	1.2	-50.2
Bioservice industry	202,923	4.8	244,397	5.3	260,779	5.2	16,382	6.7	13.4

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

2) 2013~2017 Trend of Domestic Sales

○ For the past 5 years, annual average rate of change in bioindustry's trend of domestic sales showed 3.4%.

○ Total size of domestic sales continued to increase up to 2013 but slightly decreased in 2014 by 3.3% compared to its previous year, but has grown after 2014 and total size remains above 4 trillion won.

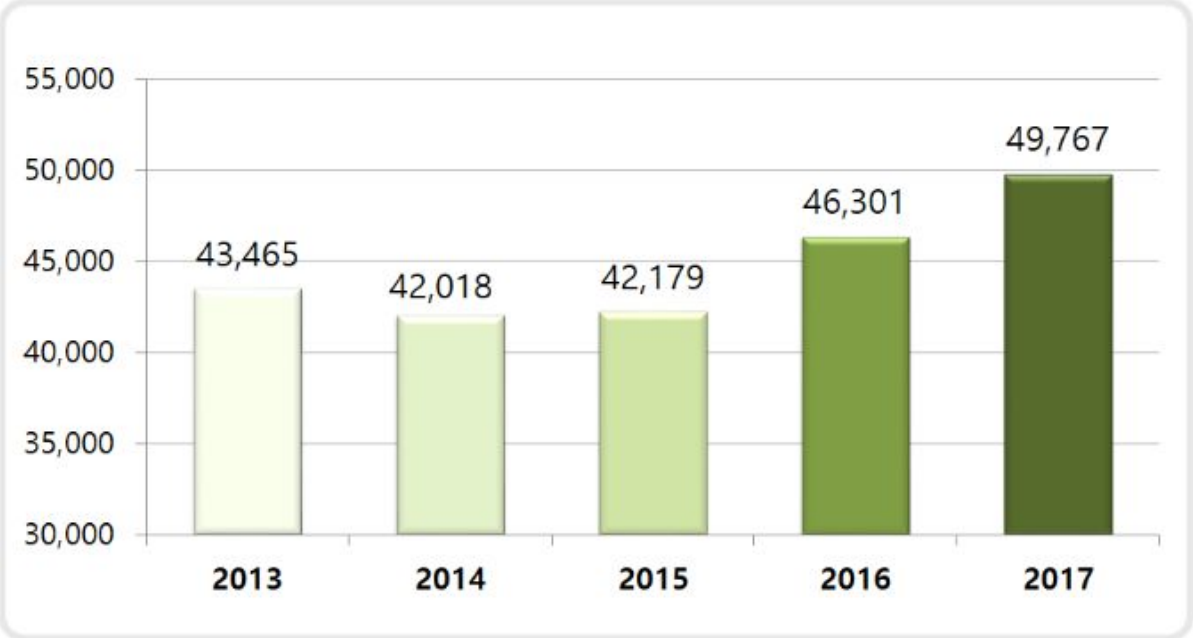
<Table 2-39> 2013~2017 Bioindustry's Trend of Domestic Sales

(Unit : one hundred million Won, %)

Classification		2013	2014	2015	2016	2017	Annual Average Rate of Change
Domestic Sales	Amount of money	43,465	42,018	42,179	46,301	49,767	3.4
	Rate of Change	6.1	-3.3	0.4	9.8	7.5	

<Figure 2-32> 2013~2017 Bioindustry's Trend of Domestic Sales

(Unit : one hundred million Won)



<Table 2-40> 2013~2017 Bioindustry's Trend of Domestic Sales by Category

(Unit : million Won, %)

Industrial Category	2013		2014		2015		2016		2017		Variation from the year before		Annual Average Rate of Change
	Domestic Sales	Distribution Ratio	Domestic Sales	Distribution Ratio	Domestic Sales	Distribution Ratio	Domestic Sales	Distribution Ratio	Domestic Sales	Distribution Ratio	Domestic Sales	Rate of Change	
Total	**4,346,527**	**100**	**4,201,792**	**100**	**4,217,863**	**100**	**4,630,133**	**100**	**4,976,744**	**100**	**346,611**	**7.5**	**3.4**
Biopharmaceutical Industry	1,627,163	37.4	1,528,742	36.4	1,534,788	36.4	1,640,767	35.4	1,788,874	35.9	148,107	9.0	2.4
Biochemical and bioenergy industry	451,091	10.4	416,107	9.9	438,539	10.4	1,194,963	25.8	1,343,138	27.0	148,175	12.4	31.4
Biofood Industry	1,338,933	30.8	1,372,073	32.7	1,291,411	30.6	1,191,934	25.7	1,208,702	24.3	16,768	1.4	-2.5
Bioenvironmental Industry	30,093	0.7	30,412	0.7	30,311	0.7	29,047	0.6	29,024	0.6	-23	-0.1	-0.9
Biomedical equipment industry	35,814	0.8	35,550	0.8	30,774	0.7	117,952	2.5	131,150	2.6	13,198	11.2	38.3
Bioinstrument and bioequipment industry	72,391	1.7	65,549	1.6	89,044	2.1	63,815	1.4	66,024	1.3	2,209	3.5	-2.3
Bioresource industry	637,245	14.7	578,470	13.8	600,073	14.2	147,258	3.2	149,053	3.0	1,795	1.2	-30.5
Bioservice industry	153,797	3.5	174,888	4.2	202,923	4.8	244,397	5.3	260,779	5.2	16,382	6.7	14.1

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

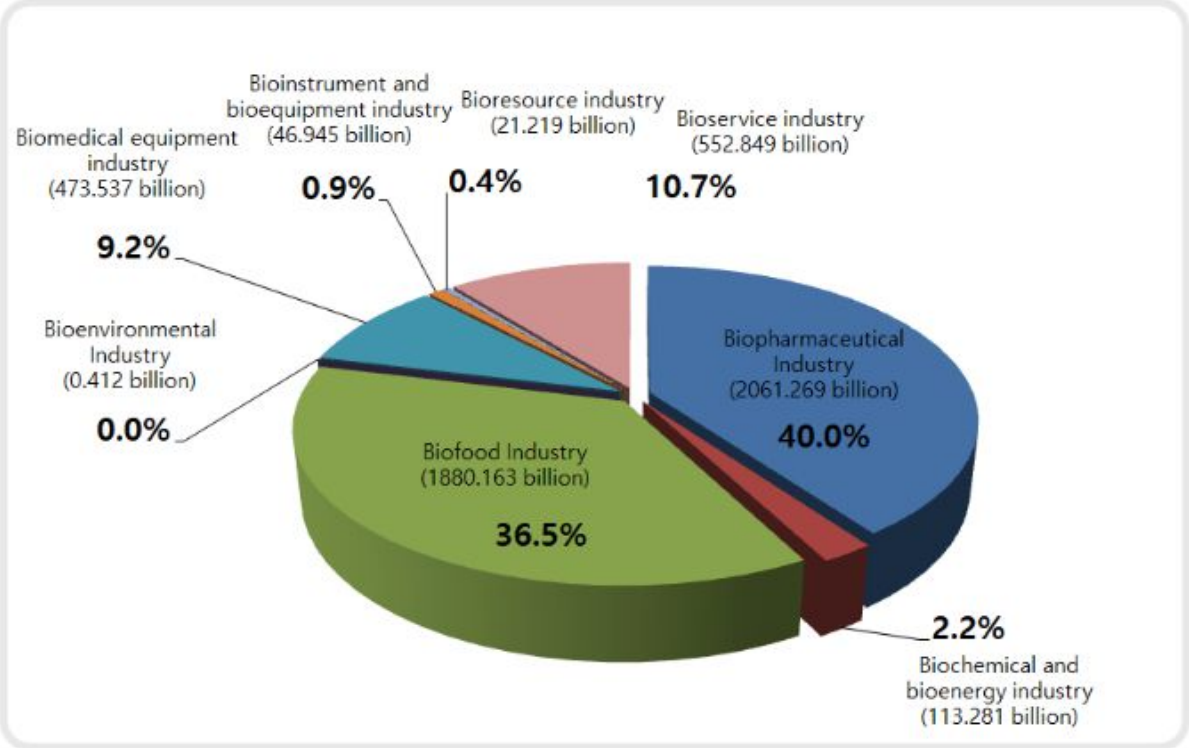
7 Export Status of Bioindustry

A. Export Status of 2017

○ The size of bioindustry's export in 2017 reached 5 trillion and 149.7 billion won.

○ Biopharmaceutical industry took the largest proportion with 2 trillion and 61.3 billion won(40.0%) and the following largest industry was biofood industry with 1 trillion and 880.2 billion won(36.5%) according to the bioindustry's size of export by category.

<Figure 2-33> 2017 Bioindustry's Size of Export by Category



○ [Table 2-41] shows domestic bioproducts or bioservices that have more than 1.0% export according to the size. 13 products showed more than 1.0% of exports.

○ Feed additives ranked the highest amount of export with 1 trillion and 431.2 billion won(27.8%) and the following largest were Therapeutic antibodies and cytokines(23.4%), Bio Consignment production & procuration Services(9.1), In-vitro Diagnostics(8.5%) and Food additives(7.7%). Among the TOP5 products, 2 items belonged to biofood industry.

<Table 2-41> 2016 Main Bioproduct's Export (Unit : million Won, %)

Ranking	Code	Product Name	Domestic Sales	Distribution Ratio
1	3050	Feed additives	1,431,200	27.8
2	1050	Therapeutic antibodies and cytokines	1,203,690	23.4
3	8010	Bio Consignment production & procuration Services	466,534	9.1
4	5020	In-vitro Diagnostics	439,075	8.5
5	3030	Food additives	395,399	7.7
6	1000	Other biopharmaceuticals	207,252	4.0
7	1030	Vaccines	192,696	3.7
8	1110	Biomaterial-based medications	145,835	2.8
9	1060	Hemotherapeutics	100,504	2.0
10	1010	Bio-antibiotics	97,050	1.9
11	1040	Hormones	83,850	1.6
12	8020	Bio Diagnostic and Analytical Services	68,723	1.3
13	2040	Biocosmetics and home & personal care chemicals	65,607	1.3

B. Recent Trend of Export Status

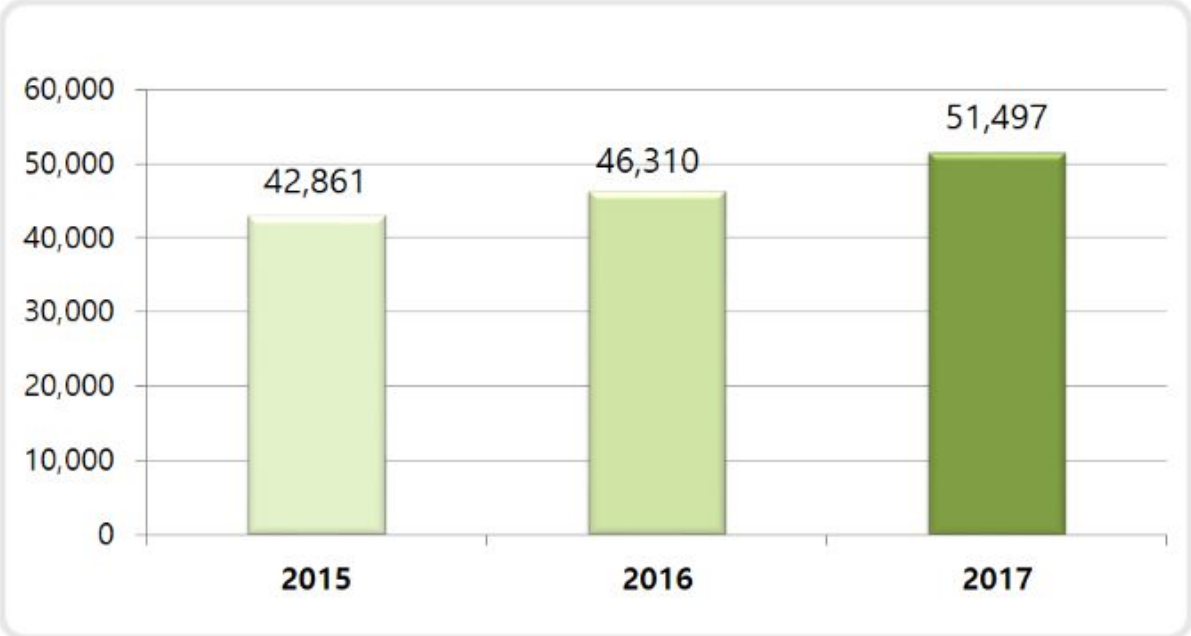
1) 2015~2017 Trend of Export

○ The amount of bioindustry's export in 2017 increased by 518.7 billion won(11.2%) with 5 trillion and 149.7 billion won compared to 2016.

<Table 2-42> 2015~2017 Bioindustry's Trend of Export (Unit : one hundred million Won, %)

Classification		2015	2016	2017	Annual Average Rate of Change
Export	Amount	42,861	46,310	51,497	9.6
	Rate of Change	25.9	8.0	11.2	

<Figure 2-34> 2015~2017 Bioindustry's Trend of Export (Unit : one hundred million Won)



○ The amount of biopharmaceutical's export in 2017 increased by 184.4 billion won(9.8%) compared to the previous year with a total of 2 trillion 61.3 billion won. Biofood industry's export in 2017 increased by 153.9 billion won (8.9%) with a total of 1 trillion 880.2 billion won.

○ Bioservice industry grew by 62.7% compared to the previous year due to export increase in the Bio Consignment production & procuration Services

<Table 2-43> 2015~2017 Bioindustry's Trend of Export by Category

(Unit : million Won, %)

Industrial Category	2015		2016		2017		Variation from the year before		Annual Average Rate of Change
	Amount of Export	Distribution Ratio	Amount of Export	Distribution Ratio	Amount of Export	Distribution Ratio	Amount of Export	Rate of Change	
Total	4,286,059	100.0	4,631,006	100.0	5,149,675	100.0	518,668	11.2	9.6
Biopharmaceutical Industry	1,929,129	45.0	1,876,861	40.5	2,061,269	40.0	184,408	9.8	3.4
Biochemical and bioenergy industry	135,203	3.2	138,493	3.0	113,281	2.2	-25,212	-18.2	-8.5
Biofood Industry	1,925,962	44.9	1,726,230	37.3	1,880,163	36.5	153,934	8.9	-1.2
Bioenvironmental Industry	303	0.0	432	0.0	412	0.0	-20	-4.6	16.6
Biomedical equipment industry	129,425	3.0	471,503	10.2	473,537	9.2	2,034	0.4	91.3
Bioinstrument and bioequipment industry	73,548	1.7	56,036	1.2	46,945	0.9	-9,092	-16.2	-20.1
Bioresource industry	46,741	1.1	21,641	0.5	21,219	0.4	-422	-2.0	-32.6
Bioservice industry	45,749	1.1	339,810	7.3	552,849	10.7	213,039	62.7	247.6

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

2) 2013~2017 Trend of Export

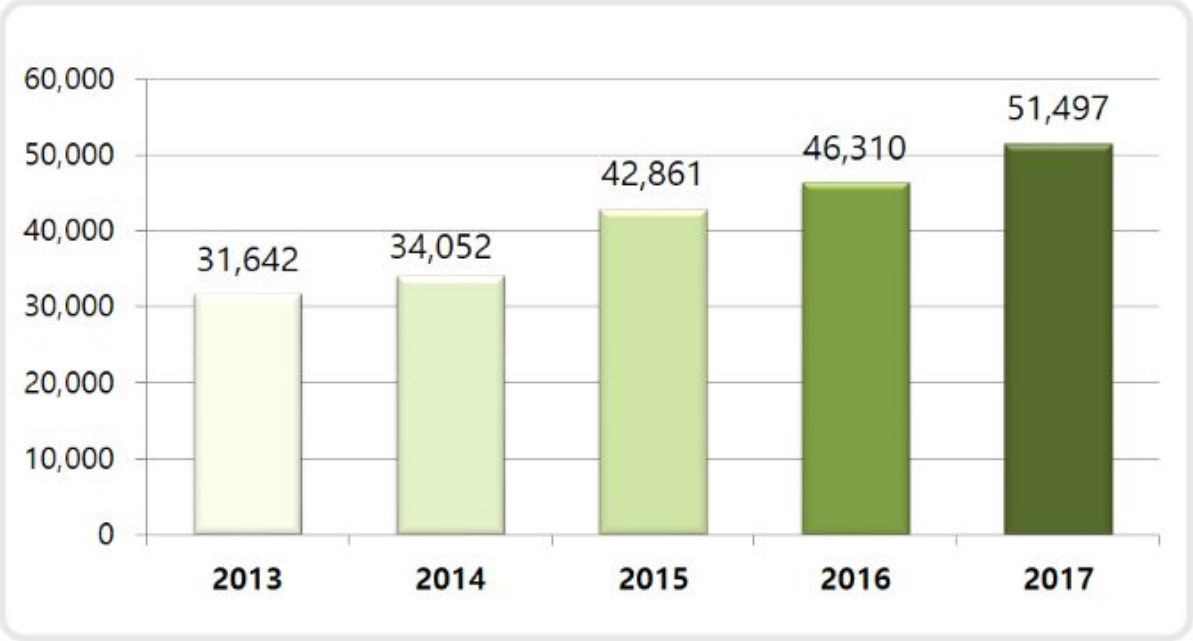
○ Total size of export continued to increase since 2013 with 12.9% annual average rate per year, and total size of export increased by 11.2% in 2017 compared to the previous year 2016.

<Table 2-44> 2013~2017 Bioindustry's Trend of Export

(Unit : one hundred million Won, %)

Classification		2013	2014	2015	2016	2017	Annual Average Rate of Change
Export	Amount	31,642	34,052	42,861	46,310	51,497	12.9
	Rate of Change	3.8	7.6	25.9	8.0	11.2	

<Figure 2-35> 2013~2017 Bioindustry's Trend of Export (Unit : one hundred million Won)



<Table 2-45> 2013~2017 Bioindustry's Trend of Export by Category

(Unit : million Won, %)

Industrial Category	2013		2014		2015		2016		2017		Variation from the year before		Annual Average Rate of Change
	Amount of Export	Distribution Ratio	Amount of Export	Distribution Ratio	Amount of Export	Distribution Ratio	Amount of Export	Distribution Ratio	Amount of Export	Distribution Ratio	Domestic Sales	Rate of Change	
Total	**3,164,248**	**100**	**3,405,174**	**100**	**4,286,059**	**100**	**4,631,006**	**100**	**5,149,675**	**100**	**518,668**	**11.2**	**12.9**
Biopharmaceutical Industry	1,136,385	35.9	1,342,190	39.4	1,929,129	45	1,876,861	40.5	2,061,269	40.0	184,408	9.8	16.1
Biochemical and bioenergy industry	111,110	3.5	132,339	3.9	135,203	3.2	138,493	3.0	113,281	2.2	-25,212	-18.2	0.5
Biofood Industry	1,682,131	53.2	1,667,157	49	1,925,962	44.9	1,726,230	37.3	1,880,163	36.5	153,934	8.9	2.8
Bioenvironmental Industry	12	0	192	0	303	0	432	0.0	412	0.0	-20	-4.6	142.1
Biomedical equipment industry	115,882	3.7	118,782	3.5	129,425	3	471,503	10.2	473,537	9.2	2,034	0.4	42.2
Bioinstrument and bioequipment industry	49,177	1.6	59,997	1.8	73,548	1.7	56,036	1.2	46,945	0.9	-9,092	-16.2	-1.2
Bioresource industry	28,690	0.9	43,272	1.3	46,741	1.1	21,641	0.5	21,219	0.4	-422	-2.0	-7.3
Bioservice industry	40,861	1.3	41,244	1.2	45,749	1.1	339,810	7.3	552,849	10.7	213,039	62.7	91.8

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

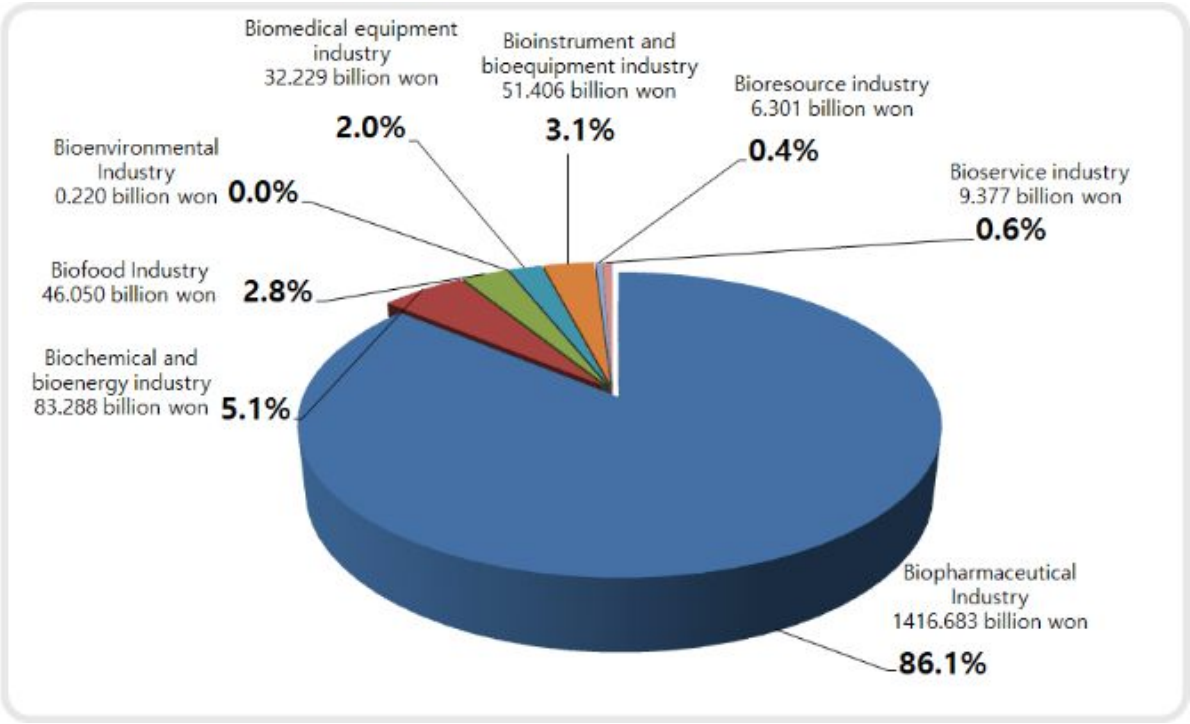
8 Import Status of Bioindustry

A. Import Status of 2017

○ The size of bioindustry's import in 2017 reached 1 trillion and 645.6 billion won.

○ Biopharmaceutical industry showed the highest proportion of 86.1% among the total import.

<Figure 2-36> 2017 Bioindustry's Size of Import by Category



○ Among domestic bioproducts and bioservices, there are 11 products that have more than 1.0% import amount.

○ Among bioproducts, Therapeutic antibodies and cytokines ranked the highest import amount among the total imports with 547.3 billion won(33.3%) and then the following highest products were Vaccines with 364.0 billion won(22.1%), Hormones with 195.6 billion won(11.9%), Hemotherapeutics with 181.3 billion won(11.0%) and Other biopharmaceuticals with 108.6 billion won(6.6%).

○ 5 top ranked products belonged to biopharmaceutical industry according to the size of imports, and it took 84.9% among the total import amount.

<Table 2-46> 2017 Main Bioproduct's Import (Unit : million Won, %)

Ranking	Code	Product Name	Domestic Sales	Distribution Ratio
1	1050	Therapeutic antibodies and cytokines	547,334	33.3
2	1030	Vaccines	364,041	22.1
3	1040	Hormones	195,586	11.9
4	1060	Hemotherapeutics	181,346	11.0
5	1000	Other biopharmaceuticals	108,562	6.6
6	6030	Multi-functional and other bioanalysis instruments	49,940	3.0
7	2030	Enzymes and reagents for research	44,650	2.7
8	5020	In-vitro Diagnostics	31,089	1.9
9	3010	Functional health foods	22,129	1.3
10	2020	Industrial enzymes and reagents	16,975	1.0
11	2000	Other biological chemistry and energy products	16,922	1.0

B. Recent Trend of Import Status

1) 2015~2017 Bioindustry's Trend of Import

○ The amount of bioindustry's import in 2017 increased by 185.9 billion won(12.7%) with 1 trillion and 645.6 billion won compared to 1 trillion and 459.7 billion won in 2016.

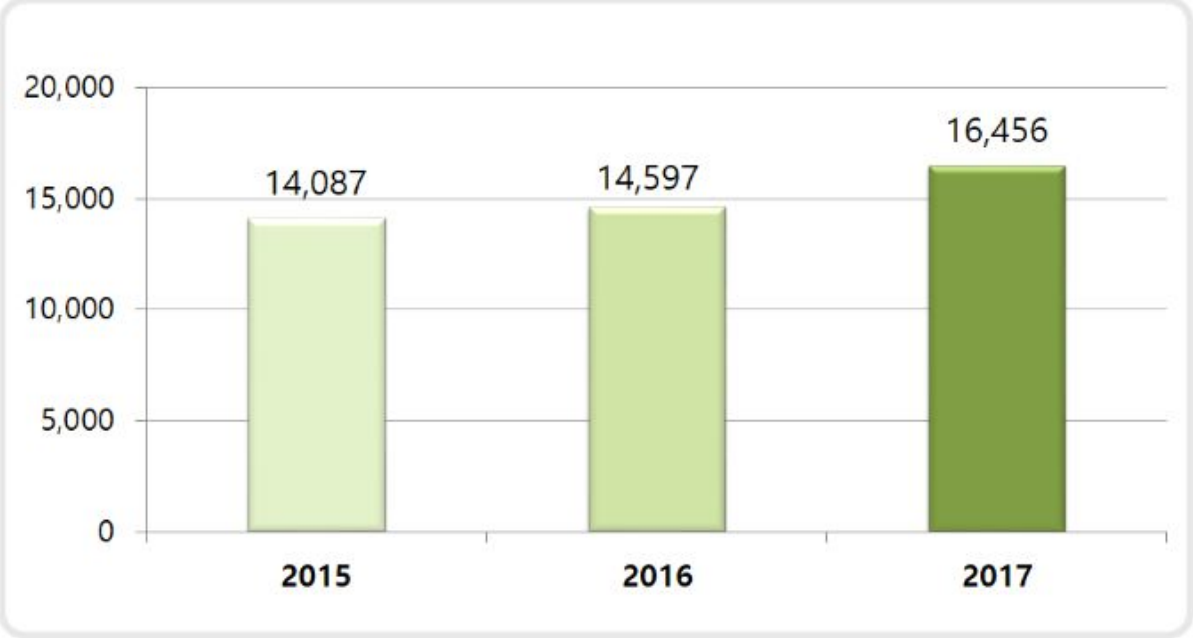
○ The average variation rate per year for 2015~2017 is 8.1%.

<Table 2-47> 2015~2017 Bioindustry's Trend of Import

(Unit : one hundred million Won, %)

Classification		2015	2016	2017	Annual Average Rate of Change
Import	Amount	14,087	14,597	16,456	8.1
	Rate of Change	0.6	3.6	12.7	

<Figure 2-37> 2015~2017 Bioindustry's Trend of Import (Unit : one hundred million Won)



<Table 2-48> 2015~2017 Bioindustry's Trend of Import by Category

(Unit : million Won, %)

Industrial Category	2015		2016		2017		Variation from the year before		Annual Average Rate of Change
	Amount of Import	Distribution Ratio	Amount of Import	Distribution Ratio	Amount of Import	Distribution Ratio	Amount of Import	Rate of Change	
Total	**1,408,699**	**100.0**	**1,459,669**	**100**	**1,645,554**	**100**	**185,885**	**12.7**	**8.1**
Biopharmaceutical Industry	1,220,247	86.6	1,238,512	84.8	1,416,683	86.1	178,171	14.4	7.7
Biochemical and bioenergy industry	87,710	6.2	88,629	6.1	83,288	5.1	-5,341	-6.0	-2.6
Biofood Industry	36,514	2.6	41,187	2.8	46,050	2.8	4,863	11.8	12.3
Bioenvironmental Industry	119	0.0	225	0.0	220	0.0	-5	-2.4	35.8
Biomedical equipment industry	770	0.1	32,279	2.2	32,229	2.0	-50	-0.2	547.0
Bioinstrument and bioequipment industry	53,781	3.8	52,484	3.6	51,406	3.1	-1,077	-2.1	-2.2
Bioresource industry	8,194	0.6	5,481	0.4	6,301	0.4	820	15.0	-12.3
Bioservice industry	1,364	0.1	872	0.1	9,377	0.6	8,505	975.4	162.2

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

2) 2013~2017 Bioindustry's Trend of Import

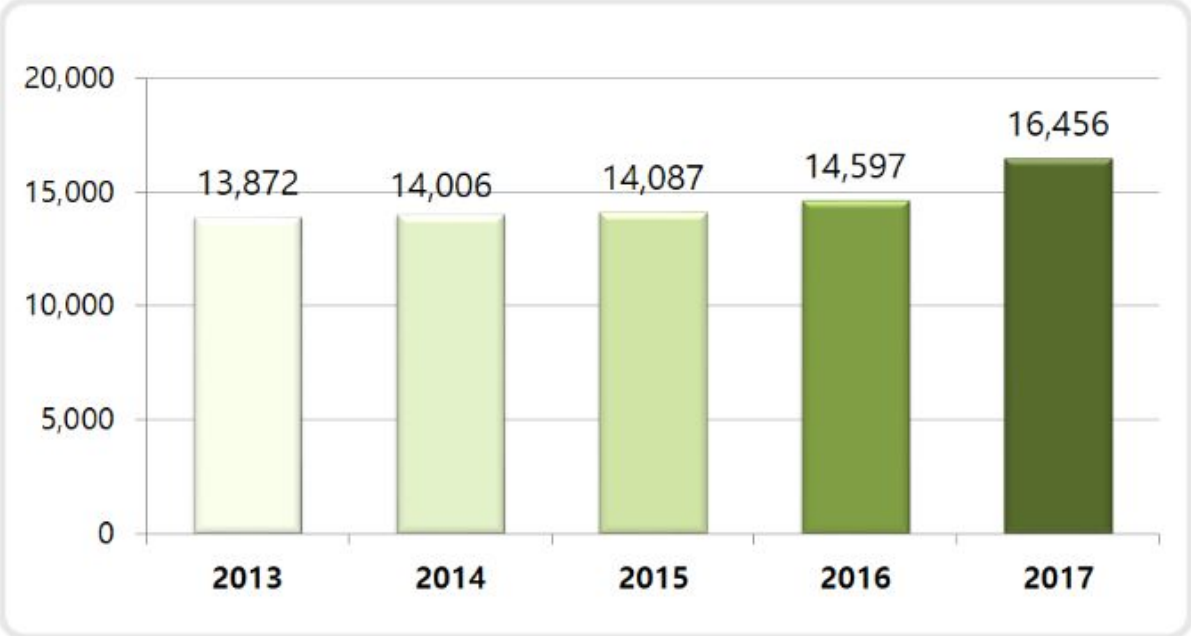
○ Domestic bioindustry's import continuously increased for the past 5 years with 4.4% annual average rate of change.

<Table 2-49> 2013~2017 Bioindustry's Trend of Import (Unit : one hundred million Won, %)

Classification		2013	2014	2015	2016	2017	Annual Average Rate of Change
Import	Amount	13,872	14,006	14,087	14,597	16,456	4.4
	Rate of Change	-3.1	1.0	0.6	3.6	12.7	

<Figure 2-38> 2013~2017 Bioindustry's Trend of Import

(Unit : one hundred million Won)



<Table 2-50> 2013~2017 Bioindustry's Trend of Import by Category

(Unit : one hundred million Won, %)

Industrial Category	2013		2014		2015		2016		2017		Variation from the year before		Annual Average Rate of Change
	Amount of Import	Distribution Ratio	Amount of Import	Distribution Ratio	Amount of Import	Distribution Ratio	Amount of Import	Distribution Ratio	Amount of Import	Distribution Ratio	Domestic Sales	Rate of Change	
Total	**1,387,198**	**100**	**1,400,645**	**100**	**1,408,699**	**100**	**1,459,669**	**100**	**1,645,554**	**100**	**185,885**	**12.7**	**4.4**
Biopharmaceutical Industry	1,221,854	88.1	1,222,661	87.3	1,220,247	86.6	1,238,512	84.8	1,416,683	86.1	178,171	14.4	3.8
Biochemical and bioenergy industry	63,609	4.6	81,114	5.8	87,710	6.2	88,629	6.1	83,288	5.1	-5,341	-6.0	7.0
Biofood Industry	27,639	2	31,140	2.2	36,514	2.6	41,187	2.8	46,050	2.8	4,863	11.8	13.6
Bioenvironmental Industry	226	0	226	0	119	0	225	0.0	220	0.0	-5	-2.4	-0.7
Biomedical equipment industry	1,471	0.1	760	0.1	770	0.1	32,279	2.2	32,229	2.0	-50	-0.2	116.4
Bioinstrument and bioequipment industry	57,026	4.1	54,737	3.9	53,781	3.8	52,484	3.6	51,406	3.1	-1,077	-2.1	-2.6
Bioresource industry	13,142	0.9	8,525	0.6	8,194	0.6	5,481	0.4	6,301	0.4	820	15.0	-16.8
Bioservice industry	2,231	0.2	1,482	0.1	1,364	0.1	872	0.1	9,377	0.6	8,505	975.4	43.2

* Due to changes in classification in 2016, some of the time series data in certain industries needs attention.

III. Statistical Tables

Content

< Table 1 > General Status of Company

< Table 1-1 > Distribution by Geography(Ⅰ-7)

	Total	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan	Sejong	Gyeonggi	Gangwon	Chungbuk	Chungnam	Jeonbuk	Jeonnam	Gyeongbuk	Gyeongnam	Jeju
Number of companies	984	207	16	22	23	12	76	7	6	320	53	78	47	23	23	30	28	13
▣ Sales Situations																		
No sales	245	45	5	6	10	4	16	1	2	95	11	16	11	4	7	3	6	3
Sales below break-even - 1 year	11	5	-	-	-	-	1	-	-	3	-	2	-	-	-	-	-	-
Sales below break-even - 2~3 years	56	10	2	2	2	2	6	-	-	14	3	6	1	2	2	3	1	-
Sales below break-even - 4~5 years	84	13	-	5	2	1	9	-	1	22	6	4	9	4	1	4	2	1
Sales below break-even - 6~9 years	99	20	2	3	2	1	12	-	-	28	8	6	1	2	3	6	5	-
Sales below break-even - 10 or more years	94	10	4	-	-	1	6	-	2	36	8	11	6	4	1	2	1	2
Sales above break-even - 1 year	2	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Sales above break-even - 2~3 years	11	1	-	1	-	1	-	-	-	5	1	1	-	-	-	-	-	1
Sales above break-even - 4~5 years	25	4	-	1	1	-	-	1	-	3	2	1	4	-	2	3	1	2
Sales above break-even - 6~9 years	58	7	1	2	3	-	6	-	1	12	2	7	3	1	4	3	5	1
Sales above break-even - 10 or more years	204	44	1	2	2	1	13	5	-	79	8	20	11	4	3	4	4	3
Sales - Unknown	95	48	1	-	1	1	7	-	-	23	3	3	1	2	-	2	3	-
▣ Main type of industry																		
Biopharmaceutical industry	322	97	4	6	11	1	17	-	1	126	8	28	14	3	-	3	2	1
Biochemical and Bioenergy Industry	201	26	3	2	3	2	29	3	3	55	10	14	12	6	10	13	7	3
Biofood Industry	189	19	7	5	3	2	7	-	2	46	17	23	14	7	9	9	12	7
Bioenvironmental Industry	75	5	1	6	3	4	4	3	-	24	8	4	1	4	2	2	4	-
Biomedical equipment Industry	66	19	-	2	1	1	4	-	-	20	9	2	4	1	-	2	1	-
Bioinstrument and Bioequipment Industry	57	14	-	1	-	1	8	-	-	28	-	1	2	-	2	-	-	-
Bioresource Industry	20	2	1	-	-	-	2	1	-	5	1	3	-	1	-	1	2	1
Bioservice Industry	54	25	-	-	2	1	5	-	-	16	-	3	-	1	-	-	-	1
☐ No sales																		
Biopharmaceutical industry	92	23	1	1	6	-	2	-	-	44	1	8	4	1	-	-	1	-
Biochemical and Bioenergy Industry	41	6	-	1	-	-	9	-	1	11	1	3	2	3	2	1	1	-
Biofood Industry	57	9	2	2	2	-	1	-	1	17	6	5	3	-	3	1	3	2
Bioenvironmental Industry	15	-	1	2	2	1	1	-	-	5	2	-	-	-	-	1	-	-
Biomedical equipment Industry	8	4	-	-	-	1	-	-	-	2	1	-	-	-	-	-	-	-
Bioinstrument and Bioequipment Industry	17	3	-	-	-	1	-	-	-	9	-	-	2	-	2	-	-	-
Bioresource Industry	7	-	1	-	-	-	1	1	-	3	-	-	-	-	-	-	1	-
Bioservice Industry	8	-	-	-	-	1	2	-	-	4	-	-	-	-	-	-	-	1
☐ Sales below break-even - 1 year																		
Biopharmaceutical industry	3	1	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Biofood Industry	2	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Bioenvironmental Industry	2	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Biomedical equipment Industry	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Bioservice Industry	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
☐ Sales below break-even - 2~3 years																		
Biopharmaceutical industry	19	6	-	-	1	-	-	-	-	9	1	2	-	-	-	-	-	-
Biochemical and Bioenergy Industry	15	2	1	-	-	2	3	-	-	3	1	-	-	-	1	2	-	-
Biofood Industry	7	-	1	-	-	-	1	-	-	-	1	2	-	-	1	-	1	-
Bioenvironmental Industry	4	-	-	1	1	-	-	-	-	-	-	1	-	1	-	-	-	-
Biomedical equipment Industry	5	-	-	1	-	-	-	-	-	2	-	-	1	-	-	1	-	-
Bioinstrument and Bioequipment Industry	3	1	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Bioresource Industry	2	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-
Bioservice Industry	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
☐ Sales below break-even - 4~5 years																		
Biopharmaceutical industry	22	4	-	1	1	1	1	-	-	7	3	2	2	-	-	-	-	-
Biochemical and Bioenergy Industry	18	2	-	1	-	-	4	-	1	2	1	1	2	1	-	3	-	-
Biofood Industry	17	2	-	-	-	-	-	-	-	6	1	-	4	2	-	1	-	1
Bioenvironmental Industry	8	-	-	2	-	-	-	-	-	1	-	1	-	1	1	-	2	-
Biomedical equipment Industry	3	-	-	-	-	-	1	-	-	-	1	-	1	-	-	-	-	-
Bioinstrument and Bioequipment Industry	10	3	-	1	-	-	2	-	-	4	-	-	-	-	-	-	-	-
Bioresource Industry	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Bioservice Industry	5	2	-	-	1	-	-	-	-	2	-	-	-	-	-	-	-	-

	Total	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan	Sejong	Gyeonggi	Gangwon	Chungbuk	Chungnam	Jeonbuk	Jeonnam	Gyeongbuk	Gyeongnam	Jeju
Number of companies	984	207	16	22	23	12	76	7	6	320	53	78	47	23	23	30	28	13
☐ Sales below break-even - 6~9 years																		
Biopharmaceutical industry	27	6	-	-	-	-	6	-	-	9	2	3	-	-	-	1	-	-
Biochemical and Bioenergy Industry	21	2	1	-	-	-	3	-	-	6	2	1	-	-	2	3	1	-
Biofood Industry	23	3	1	2	1	-	2	-	-	4	2	1	1	1	1	1	3	-
Bioenvironmental Industry	9	2	-	-	-	1	1	-	-	4	-	-	-	-	-	-	1	-
Biomedical equipment Industry	6	2	-	1	-	-	-	-	-	1	2	-	-	-	-	-	-	-
Bioinstrument and Bioequipment Industry	2	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Bioresource Industry	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-
Bioservice Industry	9	4	-	-	1	-	-	-	-	3	-	-	-	1	-	-	-	-
☐ Sales below break-even - 10 or more years																		
Biopharmaceutical industry	28	4	2	-	-	-	2	-	1	13	-	2	3	1	-	-	-	-
Biochemical and Bioenergy Industry	13	1	1	-	-	-	2	-	-	5	-	2	-	-	-	1	1	-
Biofood Industry	24	-	1	-	-	1	-	-	1	4	4	4	3	2	1	1	-	2
Bioenvironmental Industry	6	-	-	-	-	-	-	-	-	2	3	-	-	1	-	-	-	-
Biomedical equipment Industry	9	2	-	-	-	-	-	-	-	5	1	1	-	-	-	-	-	-
Bioinstrument and Bioequipment Industry	5	-	-	-	-	-	1	-	-	4	-	-	-	-	-	-	-	-
Bioservice Industry	9	3	-	-	-	-	1	-	-	3	-	2	-	-	-	-	-	-
☐ Sales above break-even - 1 year																		
Biofood Industry	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Bioenvironmental Industry	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
☐ Sales above break-even - 2~3 years																		
Biopharmaceutical industry	4	-	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	1
Biochemical and Bioenergy Industry	3	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-
Biofood Industry	3	1	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-
Bioinstrument and Bioequipment Industry	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
☐ Sales above break-even - 4~5 years																		
Biopharmaceutical industry	5	1	-	1	-	-	-	-	-	2	-	-	1	-	-	-	-	-
Biochemical and Bioenergy Industry	11	1	-	-	1	-	-	-	-	-	1	1	3	-	2	2	-	-
Biofood Industry	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Bioenvironmental Industry	3	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	1	-
Bioresource Industry	2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
Bioservice Industry	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
☐ Sales above break-even - 6~9 years																		
Biopharmaceutical industry	11	2	-	-	1	-	2	-	-	3	1	1	-	-	-	1	-	-
Biochemical and Bioenergy Industry	20	2	-	-	2	-	2	-	1	4	-	4	1	-	2	-	1	1
Biofood Industry	12	-	1	1	-	-	2	-	-	1	-	2	1	-	1	-	3	-
Bioenvironmental Industry	4	-	-	1	-	-	-	-	-	-	-	-	-	1	1	1	-	-
Biomedical equipment Industry	7	2	-	-	-	-	-	-	-	1	1	-	1	-	-	1	1	-
Bioinstrument and Bioequipment Industry	3	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Bioservice Industry	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
☐ Sales above break-even - 10 or more years																		
Biopharmaceutical industry	60	12	-	2	1	-	2	-	-	31	-	7	4	-	-	1	-	-
Biochemical and Bioenergy Industry	41	7	-	-	-	-	4	3	-	12	2	2	4	2	1	-	2	2
Biofood Industry	39	4	1	-	-	-	1	-	-	12	3	6	2	2	2	3	2	1
Bioenvironmental Industry	16	-	-	-	-	1	1	2	-	9	-	2	1	-	-	-	-	-
Biomedical equipment Industry	18	6	-	-	1	-	-	-	-	7	3	1	-	-	-	-	-	-
Bioinstrument and Bioequipment Industry	13	5	-	-	-	-	3	-	-	4	-	1	-	-	-	-	-	-
Bioresource Industry	3	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-
Bioservice Industry	14	10	-	-	-	-	2	-	-	2	-	-	-	-	-	-	-	-
☐ Sales - Unknown																		
Biopharmaceutical industry	51	38	1	-	1	-	2	-	-	6	-	1	-	1	-	-	1	-
Biochemical and Bioenergy Industry	18	3	-	-	-	-	2	-	-	10	1	-	-	-	-	1	1	-
Biofood Industry	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-
Bioenvironmental Industry	7	2	-	-	-	1	1	-	-	1	2	-	-	-	-	-	-	-
Biomedical equipment Industry	8	2	-	-	-	-	2	-	-	2	-	-	1	1	-	-	-	-
Bioinstrument and Bioequipment Industry	3	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Bioresource Industry	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Bioservice Industry	3	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-

< Table 1-2 > Existence of other business within the company(Ⅱ-4-1)

(Unit : No. of companies)

	Total	Exclusive business	Plural businesses	Unknown
Number of companies	984	527	448	9
▣ Sales Situations				
No sales	245	111	132	2
Sales below break-even - 1 year	11	10	1	-
Sales below break-even - 2~3 years	56	32	24	-
Sales below break-even - 4~5 years	84	51	33	-
Sales below break-even - 6~9 years	99	60	39	-
Sales below break-even - 10 or more years	94	53	41	-
Sales above break-even - 1 year	2	2	-	-
Sales above break-even - 2~3 years	11	6	5	-
Sales above break-even - 4~5 years	25	12	13	-
Sales above break-even - 6~9 years	58	31	27	-
Sales above break-even - 10 or more years	204	87	117	-
Sales - Unknown	95	72	16	7
▣ Main type of industry				
Biopharmaceutical industry	322	143	171	8
Biochemical and Bioenergy Industry	201	107	94	-
Biofood Industry	189	98	90	1
Bioenvironmental Industry	75	48	27	-
Biomedical equipment Industry	66	46	20	-
Bioinstrument and Bioequipment Industry	57	39	18	-
Bioresource Industry	20	10	10	-
Bioservice Industry	54	36	18	-
□ No sales				
Biopharmaceutical industry	92	37	54	1
Biochemical and Bioenergy Industry	41	19	22	-
Biofood Industry	57	20	36	1
Bioenvironmental Industry	15	8	7	-
Biomedical equipment Industry	8	7	1	-
Bioinstrument and Bioequipment Industry	17	12	5	-
Bioresource Industry	7	3	4	-
Bioservice Industry	8	5	3	-
□ Sales below break-even - 1 year				
Biopharmaceutical industry	3	2	1	-
Biofood Industry	2	2	-	-
Bioenvironmental Industry	2	2	-	-
Biomedical equipment Industry	2	2	-	-
Bioservice Industry	2	2	-	-
□ Sales below break-even - 2~3 years				
Biopharmaceutical industry	19	11	8	-
Biochemical and Bioenergy Industry	15	10	5	-
Biofood Industry	7	4	3	-
Bioenvironmental Industry	4	2	2	-
Biomedical equipment Industry	5	2	3	-
Bioinstrument and Bioequipment Industry	3	1	2	-
Bioresource Industry	2	1	1	-
Bioservice Industry	1	1	-	-
□ Sales below break-even - 4~5 years				
Biopharmaceutical industry	22	11	11	-
Biochemical and Bioenergy Industry	18	11	7	-
Biofood Industry	17	11	6	-
Bioenvironmental Industry	8	5	3	-
Biomedical equipment Industry	3	2	1	-
Bioinstrument and Bioequipment Industry	10	7	3	-
Bioresource Industry	1	-	1	-
Bioservice Industry	5	4	1	-

	Total	Exclusive business	Plural businesses	Unknown
Number of companies	984	527	448	9
☐ Sales below break-even - 6~9 years				
Biopharmaceutical industry	27	14	13	-
Biochemical and Bioenergy Industry	21	13	8	-
Biofood Industry	23	16	7	-
Bioenvironmental Industry	9	7	2	-
Biomedical equipment Industry	6	3	3	-
Bioinstrument and Bioequipment Industry	2	2	-	-
Bioresource Industry	2	2	-	-
Bioservice Industry	9	3	6	-
☐ Sales below break-even - 10 or more years				
Biopharmaceutical industry	28	6	22	-
Biochemical and Bioenergy Industry	13	8	5	-
Biofood Industry	24	14	10	-
Bioenvironmental Industry	6	6	-	-
Biomedical equipment Industry	9	7	2	-
Bioinstrument and Bioequipment Industry	5	5	-	-
Bioservice Industry	9	7	2	-
☐ Sales above break-even - 1 year				
Biofood Industry	1	1	-	-
Bioenvironmental Industry	1	1	-	-
☐ Sales above break-even - 2~3 years				
Biopharmaceutical industry	4	1	3	-
Biochemical and Bioenergy Industry	3	1	2	-
Biofood Industry	3	3	-	-
Bioinstrument and Bioequipment Industry	1	1	-	-
☐ Sales above break-even - 4~5 years				
Biopharmaceutical industry	5	1	4	-
Biochemical and Bioenergy Industry	11	6	5	-
Biofood Industry	2	1	1	-
Bioenvironmental Industry	3	1	2	-
Bioresource Industry	2	1	1	-
Bioservice Industry	2	2	-	-
☐ Sales above break-even - 6~9 years				
Biopharmaceutical industry	11	5	6	-
Biochemical and Bioenergy Industry	20	10	10	-
Biofood Industry	12	7	5	-
Bioenvironmental Industry	4	1	3	-
Biomedical equipment Industry	7	5	2	-
Bioinstrument and Bioequipment Industry	3	2	1	-
Bioservice Industry	1	1	-	-
☐ Sales above break-even - 10 or more years				
Biopharmaceutical industry	60	18	42	-
Biochemical and Bioenergy Industry	41	18	23	-
Biofood Industry	39	17	22	-
Bioenvironmental Industry	16	8	8	-
Biomedical equipment Industry	18	10	8	-
Bioinstrument and Bioequipment Industry	13	8	5	-
Bioresource Industry	3	-	3	-
Bioservice Industry	14	8	6	-
☐ Sales - Unknown				
Biopharmaceutical industry	51	37	7	7
Biochemical and Bioenergy Industry	18	11	7	-
Biofood Industry	2	2	-	-
Bioenvironmental Industry	7	7	-	-
Biomedical equipment Industry	8	8	-	-
Bioinstrument and Bioequipment Industry	3	1	2	-
Bioresource Industry	3	3	-	-
Bioservice Industry	3	3	-	-

<Table 1-3 > Distribution by Type of Company[Multiple answer](Ⅱ-4-2)

(Unit : No. of companies)

	Total	Venture companies	INNO-BIZ	Konex-listed companies	Kosdaq-listed companies	Listed companies	Not applicable/ Unknown
Number of companies	984	344	313	26	124	84	411
▣ Sales Situations							
No sales	245	67	63	3	23	34	108
Sales below break-even - 1 year	11	4	3	2	1	-	5
Sales below break-even - 2~3 years	56	23	12	2	5	3	28
Sales below break-even - 4~5 years	84	35	32	7	7	3	34
Sales below break-even - 6~9 years	99	41	40	3	14	6	37
Sales below break-even - 10 or more years	94	39	40	3	19	5	27
Sales above break-even - 1 year	2	1	-	-	-	-	1
Sales above break-even - 2~3 years	11	3	2	1	1	1	6
Sales above break-even - 4~5 years	25	9	7	-	2	-	13
Sales above break-even - 6~9 years	58	27	23	-	8	5	18
Sales above break-even - 10 or more years	204	63	77	3	36	24	79
Sales - Unknown	95	32	14	2	8	3	55
▣ Main type of industry							
Biopharmaceutical industry	322	101	71	8	70	44	132
Biochemical and Bioenergy Industry	201	76	73	1	15	18	85
Biofood Industry	189	59	58	4	14	17	82
Bioenvironmental Industry	75	21	31	-	-	1	39
Biomedical equipment Industry	66	38	33	6	11	-	16
Bioinstrument and Bioequipment Industry	57	18	25	1	4	-	27
Bioresource Industry	20	5	5	-	2	3	10
Bioservice Industry	54	26	17	6	8	1	20
☐ No sales							
Biopharmaceutical industry	92	32	18	2	15	15	31
Biochemical and Bioenergy Industry	41	13	16	-	2	5	18
Biofood Industry	57	7	12	1	4	12	28
Bioenvironmental Industry	15	2	5	-	-	-	10
Biomedical equipment Industry	8	1	3	-	1	-	5
Bioinstrument and Bioequipment Industry	17	6	7	-	1	-	9
Bioresource Industry	7	1	1	-	-	2	4
Bioservice Industry	8	5	1	-	-	-	3
☐ Sales below break-even - 1 year							
Biopharmaceutical industry	3	-	-	-	1	-	2
Biofood Industry	2	-	-	-	-	-	2
Bioenvironmental Industry	2	1	1	-	-	-	1
Biomedical equipment Industry	2	2	1	2	-	-	-
Bioservice Industry	2	1	1	-	-	-	-
☐ Sales below break-even - 2~3 years							
Biopharmaceutical industry	19	8	5	1	4	3	6
Biochemical and Bioenergy Industry	15	5	1	-	1	-	10
Biofood Industry	7	4	2	-	-	-	3
Bioenvironmental Industry	4	2	2	-	-	-	2
Biomedical equipment Industry	5	2	-	-	-	-	3
Bioinstrument and Bioequipment Industry	3	1	1	-	-	-	2
Bioresource Industry	2	-	-	-	-	-	2
Bioservice Industry	1	1	1	1	-	-	-
☐ Sales below break-even - 4~5 years							
Biopharmaceutical industry	22	9	9	3	5	1	8
Biochemical and Bioenergy Industry	18	6	6	-	1	1	9
Biofood Industry	17	8	5	1	-	-	8
Bioenvironmental Industry	8	2	4	-	-	-	4
Biomedical equipment Industry	3	2	-	-	1	-	1
Bioinstrument and Bioequipment Industry	10	5	6	1	-	-	2
Bioresource Industry	1	1	1	-	-	-	-
Bioservice Industry	5	2	1	2	-	1	2